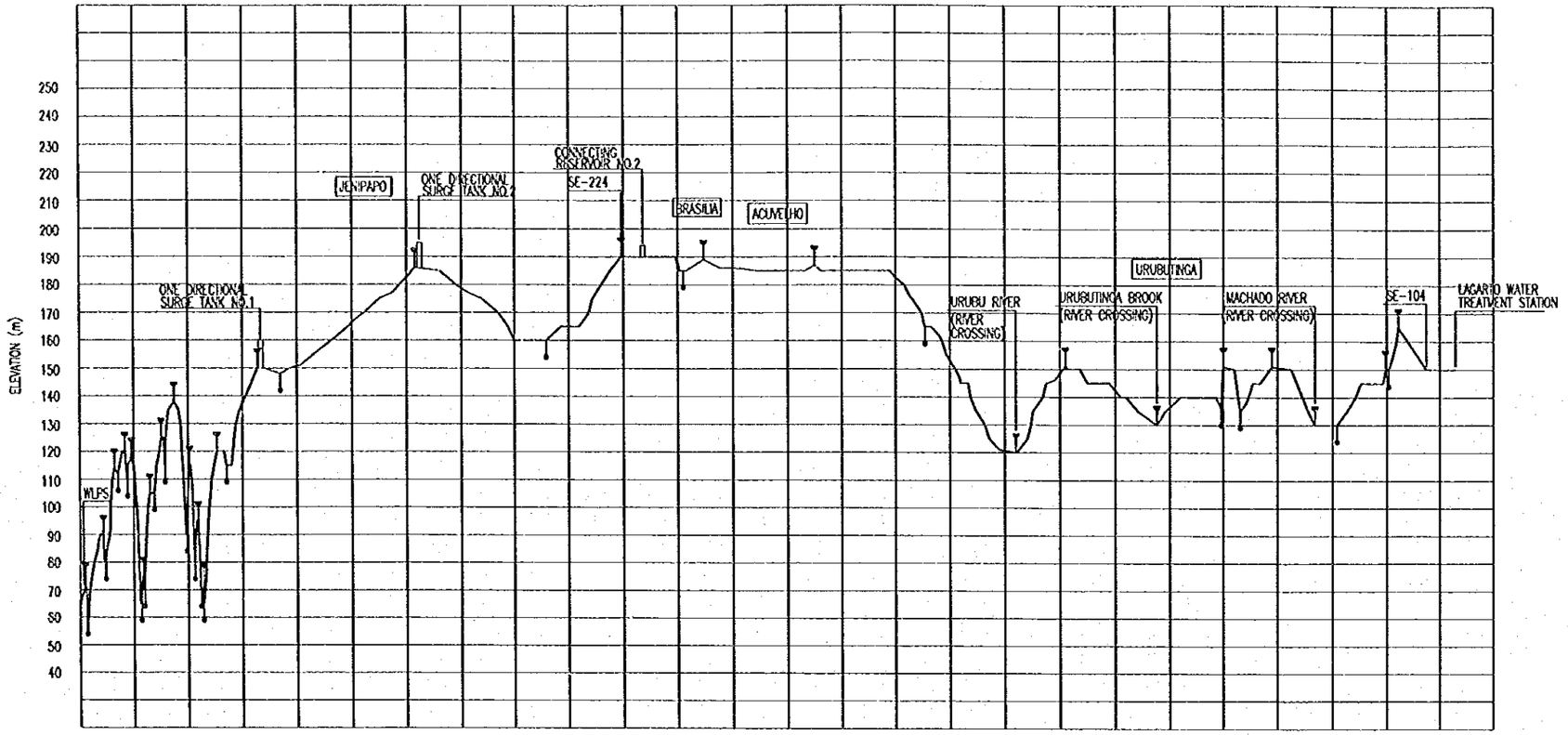


STATION NO.	0	164	3074+10	516	905	1265
TOTAL DISTANCE (M)	0	3280	6150	10320	18100	25300
PARTIAL DISTANCE (M)	0	3280	2870	4170	7780	7200
GROUND ELEVATION (M)	65.0	150.0	186.0	190.0	151.0	150.0
INVERT ELEVAION (M)	63.7	146.3	184.3	188.3	149.4	148.5
PIPE		ϕ700 PRESSURE			ϕ600 GRAVITY	ϕ500 GRAVITY

Figure-4.18 Vertical Profile of Piauitinga Pipeline

4.4.2 Auxiliary Structures

(1) Connecting Reservoir, CR4

(a) General

Connecting reservoir is required for smooth conveyance of water from pressurized pipeline of diameter 700mm to the pipeline of diameter 600 by gravity.

(b) Design Conditions

1) Finished Ground Level
   - F.G.L. : EL. 190.0 m
2) Water Level in the Reservoir
   - H.W.L. : EL. 194.0 m
   - L.W.L. : EL. 189.0 m
3) Required storage capacity
   As same as CR2.

(c) Design of Connecting Reservoir

The dimensions of CR4 are the same as CR1 and CR2 as shown in Figure-4.5.

(d) Sequence of Construction

One basin of CR4 with the storage capacity of 1,500m^3 is constructed in Phase 1 and the other basin with the same capacity is constructed in Phase 2.

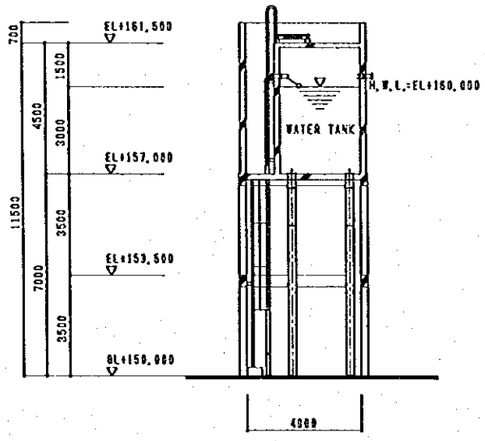
(2) One Way Surge Tank

(a) Design Conditions

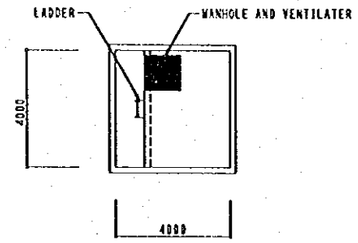
No.	Location(m)	Ground Elevation(EL. m)	W.L.(EL. m)	Cross section Area (m^2)	Height(m)
1	3,300	150.0	> 160.0	10	> 3.0
2	6,200	186.0	> 195.0	10	> 5.0

(b) Design of Surge Tank

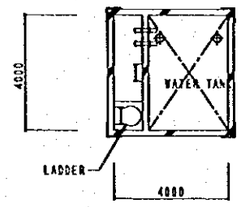
One way surge tank is elevated reinforced concrete tank as shown in Figure-4.19 and is constructed in Phase 1.



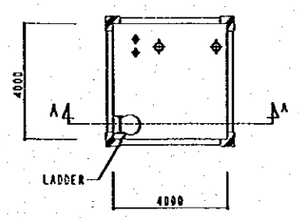
A-A SECTION 1/100



EL+161,000 PLAN 1/100



EL+157,000 PLAN 1/100



EL+153,500 PLAN 1/100

Figure-4.19 Surge Tank

4.5 Agreste Water Conveyance Pipeline

4.5.1 Characteristics of Pipeline

Characteristics of Pipeline route determined based on the water conveyance plan in CHAPTER 3 are as follows:

(1) Design Conditions

Service Pressure in the Pipeline

- Permissible Service Pressure : 2.10Mpa
- Maximum Service Pressure : 2.88Mpa

(2) Materials

Unless otherwise specified, all pipe materials are ductile cast iron.
Class of Push-on Joint Type pipe will be K7 in accordance with the Service pressure in the pipeline.

(3) Length

ϕ 700 : 8,784 m
ϕ 500 : 7,659 m per Phase (total length in two phases 15,318 m)
ϕ 600 : 7,529 m per Phase (total length in two phases 15,058 m)

(4) Ground Elevation

Vertical profile of the pipeline is shown in Figure-4.20.

Lowest elevation : MSL+40m
Highest elevation: MSL+240m

(5) Conditions of Ground Surface in Pipeline Route

Type of ground surface and its length is as follows:

Pasture : 19,055 m
Bare land : 4,138 m
Pavement : 160 m
Over-pass : 610 m

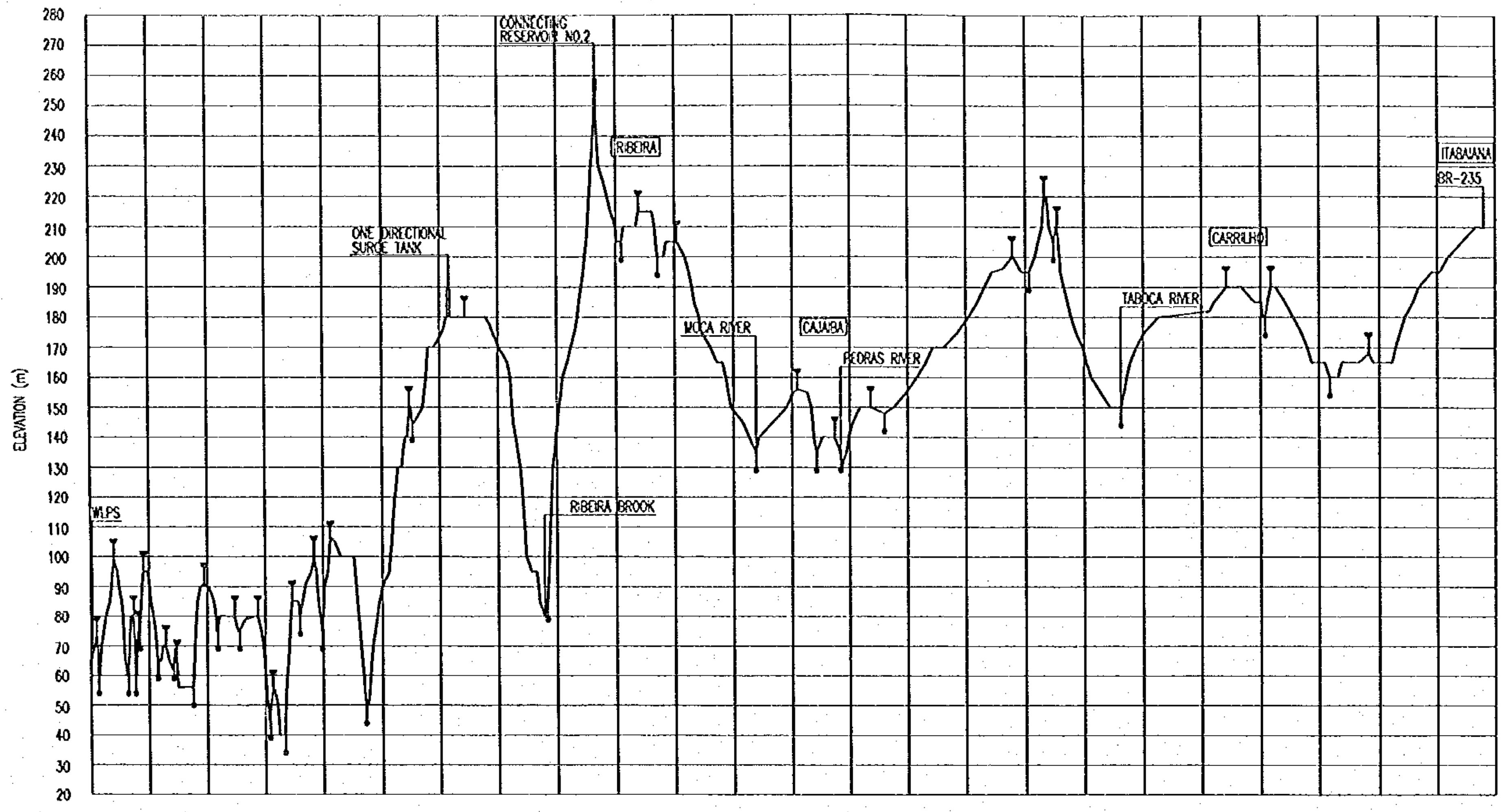
(6) Details of Over-pass

(a) Vaza Barris Dam Crossing

- Pipe runs on the crest of dam in non-overflow portion with length of 280m
- Pipe runs on the support bridge over spillway with length of 150m. The bridge is supported by piers constructed in the spillway.
- Materials of pipe are carbon steel.

(b) Ribeira River Crossing

- 40m of river crossing
- Pipes to cross over the river with reinforced concrete pier constructed at 6m interval



STATION NO.	0	306	433	815	1191
TOTAL DISTANCE (M)	0	6120	8660	16300	23820
PARTIAL DISTANCE (M)	0	6120	2540	7640	7520
GROUND ELEVATION (M)	65.0	180.0	255.0	220.0	210.0
INVERT ELEVAION (M)	63.3	178.3	253.3	218.5	208.4
PIPE	ϕ700 PRESSURE		ϕ500 GRAVITY	ϕ600 GRAVITY	

Figure-4.20 Vertical Profile of Agreste Pipeline

(c) Small River Crossings

- 20m and 40m of river crossings
- Pipes to cross over the river with reinforced concrete pier constructed at 6m interval

(d) Moca River Crossing

- 20m of river crossing
- Pipes to cross over the river with reinforced concrete pier constructed at 6m interval

(e) Pedras River Crossing

- 50m of river crossing
- Pipes to cross over the river with reinforced concrete pier constructed at the center of the river
- Materials of pipe are carbon steel.

(f) Marsh Crossing

- 110m of marsh crossing
- Pipes to cross over the marsh with reinforced concrete support constructed at 6m interval

(g) Taboca River Crossing

- 50m of river crossing
- Pipes to cross over the river with reinforced concrete pier constructed at 6m interval

(7) Road Crossings

Major road crossings are as follows:

(a) BR-235

Crossing with BR-235 coming from Aracaju at the intersection of SE-104 from Lagarto. Crossing width is 120m.

(b) Itabaiana Water Treatment Station

Crossing with branch road from BR-235 just before Itabaiana Water Treatment Station. Crossing width is 40m.

4.5.2 Auxiliary Structures

(1) Connecting Reservoir, CR3

(a) General

Connecting reservoir is required for smooth conveyance of water from pressurized pipeline of diameter 700mm to the pipeline of diameter 500 by gravity.

(b) Design Conditions

1) Finished Ground Level
   - F.G.L. : EL. 255.0 m

2) Water Level in the Reservoir
   - H.W.L. : EL. 259.0 m
   - L.W.L. : EL. 254.0 m

3) Required storage capacity
   As same as CR2.

(c) Design of Connecting Reservoir

The dimensions of CR3 are the same as CR1 and CR2 as shown in Figure-4.5.

(d) Sequence of Construction

One basin of CR3 with the storage capacity of 1,500m^3 are constructed in Phase 1 and the other basin with the same capacity is constructed in Phase 2.

(2) One Way Surge Tank

(a) Design Conditions

No.	Location(m)	Ground Elevation(EL. m)	W.L.(EL. m)	Cross section Area (m^2)	Height(m)
1	6,000	180.0	> 188.0	20	> 2.0

(b) Design of Surge Tank

One way surge tank is elevated reinforced concrete tank as shown in Figure-4.19 and is constructed in Phase 1.

4.6 Electric Power Supply

4.6.1 Existing Electric Power Supply System

(1) Cajaiba Substation

The existing electric power supply facility near the Project site is Cajaiba Substation (S/S). Cajaiba S/S, operated by ENERGIPE, is located in Cajaiba Village, was constructed for the electric power supply to Cajaiba Village as well as to the Raw Water Pump Station, which supplies drinking water to Itabaiana City and irrigation water for farms near the Dam.
The electric power for Cajaiba S/S is supplied from Itabaiana S/S, located at Queimadas near Itabaiana City, via 69kV transmission line.

The technical data of main transformer in Cajaiba S/S is as follows:

Type	: Outdoor use
Number of phase	: 3
Rated frequency	: 60Hz
Rated Primary Voltage	: 69kV
Rated Secondary Voltage	: 13.8kV
Rated Capacity	: 5MVA

(2) 69 kV Outgoing Switchgear Bay

69 kV outgoing switchgear bay is constructed in the existing Cajaiba S/S to supply electric power to the new Vaza Barris S/S. Specification of equipment and structures is in

accordance with ENERGIPE Standard.

Composition of equipment	:Lightning arresters, disconnecting switches, gas circuit breakers, current transformers, post insulators, potential transformers and cable heads
RC Structures	:Gantry towers and pedestals
Others	:Insulators, hardwares, conductors, etc.

(3) Electric Power Failure

The duration and stoppage of electric power in Cajaiba S/S in the past four years is shown in Table-4.8.

Table-4.8 Electric Power Failure in Cajaiba S/S

	1996	1997	1998	1999
EDPC	94.91	76.67	24.29	10.24
EFPC	80.45	54.87	14.87	7.67
AEDPC	1.18	1.40	1.63	1.34
AIESPC	4.5	6.7	24.5	24.6

Notes : Source of information : ENERGIPE
EDPC : Equivalent duration per consumer, hours
EFPC : Equivalent frequency per consumer, times
AEDPC : Averaged equivalent duration per consumer per stoppage, hours
AIESPC : Averaged interval of effective stoppage per consumer, days
(*) : Information accumulated in the first semester of 1999

Table-4.8 shows that the electrical stoppage at Cajaiba S/S is occurred in every 25 days and its duration is 1.5 hour in 1998 and 1999 on average.

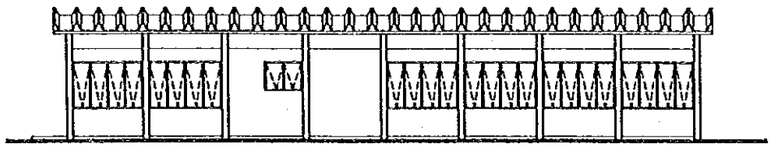
4.6.2 Vaza Barris Substation

(1) General

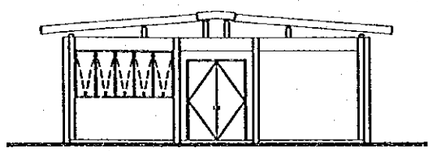
The new substation, called Vaza Barris S/S, is constructed for electric power supply to Water Intake Pump Station for the Water Supply Projects to Itabaiana and Lagarto Cities and Vaza Barris Irrigation Area. The electric power is received from Cajaiba S/S.

(2) Electric Power Demand

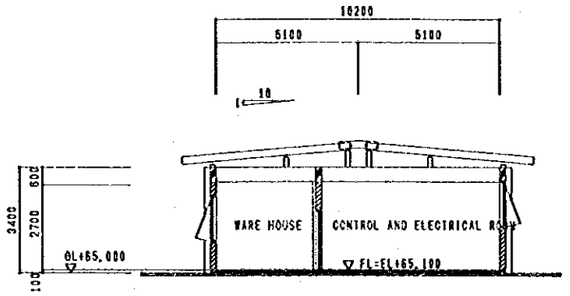
Domestic and Industrial Water Supply		
Water Intake Pumps	110 kW x 3 x 2	= 660 kW
Conveyance Pumps	300 kW x 2 x 2	= 1,200 kW
	300 kW x 2 x 2	= 1,200 kW
Subtotal		3,060 kW
Irrigation Water Supply	2,200 kW x 4	= 8,800 kW
Building facility, etc.		1,000 kW
Total		12,860 kW



ELEVATION 1/100



ELEVATION 1/100



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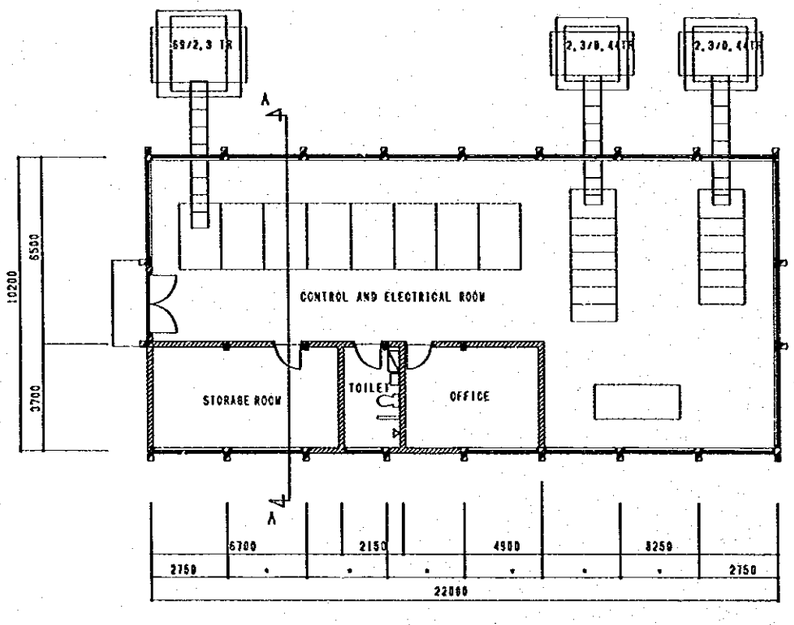

GROUND FLOOR PLAN 1/100

EXTERIOR FINISH SCHEDULE		INTERIOR FINISH SCHEDULE		
ROOF	FIBERCEMENT ROOFING CANALETE 49 TYPE OR EQUIVALENT		OFFICE , STORAGE ROOM , CONTROL AND ELECTRICAL ROOM	TOILET AND SHOWER ROOM
WALL	PLASTER WITH LATEX PAINT	FLOOR	CONCRETE STEEL TROWEL WITH SILICON PAINT	CERAMIC TILE
		WALL	PLASTER WITH LATEX PAINT	CERAMIC TILE
		COLUMN	SILICON PAINT	SILICON PAINT
		BEAM	DITTO	DITTO

Figure-4.21 Control and Electical Building

(3) Components to be constructed and/or installed

(a) Control and Electrical Building

Type	: Concrete masonry, one-story
Total floor area	: 220 m^2
Air conditioning	: Natural Ventilation
Accessories	: Lighting, outlet, telephone and lightning arrester
Design	: Refer to Figure-4.21

(b) Main Transformer

- High voltage

Quantity	: 1
Type	: Outdoor use
Number of phase	: 3
Rated frequency	: 60Hz
Rated Primary Voltage	: 69kV
Rated Secondary Voltage	: 2.3kV
Rated Capacity	: 18MVA

- Low voltage

Quantity	: 2
Type	: Outdoor use
Number of phase	: 3
Rated frequency	: 60Hz
Rated Primary Voltage	: 2.3kV
Rated Secondary Voltage	: 440V
Rated Capacity	: 2,500kVA

(c) 69kV Outdoor Switchgear

- Composition of equipment	:Lightning arresters, disconnecting switches, gas circuit breakers, current transformers, post insulators, potential transformers and cable heads
- RC Structures	:Gantry towers and pedestals
- Others	:Insulators, hardwares, conductors, etc.

(d) Distribution Board

- High voltage distribution board

Purpose	: Electric power supply for high voltage motors
Type	: Indoor use, metal-enclosed and self-standing type
Rate voltage	: 2.3kV
Power Distribution	: Unit method composed of VCB, metering and protective relays, etc.

- Low voltage distribution board

Purpose	: Electric power supply for low voltage motors and building facilities
Type	: Indoor use, metal-enclosed and self-standing type
Rate voltage	: 440V
Power Distribution	: Unit method composed of MCCB, magnetic conductor, thermal relay, etc.

(e) DC Power Supply Equipment

Composition of equipment : Battery, battery charger and distribution board
Rated voltage : 110V DC

(f) Control and Protection Panel for 69kV Outdoor Switchgear

Composition of equipment : On-off switch for GCB, position indicator for GCB and DS, alarm indicator, metering and protective relays, etc.
Type : Indoor use, metal-enclosed and self-standing type

4.6.3 Layout Plan

The substation equipment for the Project is installed on the land near the Water Intake Pump Station and the following equipment configuration is adopted.

(1) Outdoor Equipment

The 69kV switchgear and the main transformers are installed outdoor.

(2) Indoor Equipment

A control building is constructed to install the indoor equipment mentioned above.

4.6.4 Transmission Line

The route for the 69kV transmission line from Cajaiba S/S to Vaza Barris S/S has been selected based on the existing 1:5,000 map and the electrical network map supplied by ENERGIPE. The type of electric poles, bare conductor for overhead transmission lines and other required materials and equipment for transmission lines are in conformity with ENERGIPE standard.

JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME II)
FEASIBILITY STUDY

[H] OPERATION AND MAINTENANCE PLAN

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (H)
OPERATION AND MAINTENANCE PLAN

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CHAPTER 1 PREPARATION OF ORGANIZATION

1.1 Operating Entities

After completion of the construction works of the Project, the following entities would be in charge of operation. Completed facilities should be handed over to each entity for operation and maintenance.

1) Vaza Barris Multipurpose Dam: A project office under a water agency
2) Domestic Water Supply in Urban and Large Rural Areas: DESO
3) Irrigation Water Supply: COHIDRO
   (or the autarchy as proposed in the Master Plan)

Since DESO and COHIDRO are currently operate similar schemes, preparation of operating organization is discussed only for the operation of the multi-purpose facilities.

1.2 Establishing Operating Entity for Multi-purpose Facilities

Possible entity in charge of operation and maintenance of the multi-purpose facility would be DESO or COHIDRO, both of which have experience in operation and maintenance of water facilities. However, the project has a characteristic of multi-purpose, and equitable operation and maintenance can not be fully expected by a single-purpose operator such as DESO or COHIDRO, although they are the public entities, in case some conflicts between domestic water supply and irrigation arise. SEPLANTEC should promote establishment of a water agency in coordination with Bahia State under permission of federal organs, allocating capable staff with similar experiences, and preparation of operation rules/ manuals and training in cooperation with DESO and COHIDRO.

Since the Vaza Barris river, which runs in Sergipe and Bahia states, is of federal domain, the competent water agency is the agency for Vaza Barris basin under the National Water Agency (ANA). In case of delay of establishment of the agency, SEPLANTEC can ask ANA to delegate the operation and maintenance in the area of the State to the State Government. Current draft of the law establishing ANA (Art. 2), shows high possibility of the delegation. In case ANA approves the delegation, the functions of operation and maintenance can be placed under SEPLANTEC with the inspection by ANA. SEPLANTEC can conclude an agreement for outsourcing to DESO or COHIDRO for day-to-day operation, as far as equitable management is assured, using their capability of operation of water facility.

A site office should be established with one full-time employee responsible for daily operation and maintenance, according to the operation and maintenance activities as mentioned below. Some inspection, observation and daily operation can be carried out by persons working for intake operation hired by DESO or COHIDRO, concluding a contract with one of these companies. Water quality monitoring can be contracted out to DESO, ADEMA or ITPS. Sounding survey should be conducted by a survey company with a contract.

CHAPTER 2 RECOMMENDED PLANS

2.1 Vaza Barris Dam Facilities

Principles to be applied in operation and maintenance are a) safety, b) efficient water use and equitable water resources allocation, and c) environmental conservation. In order to realize these principles, 1) reporting and communication, 2) operation/inspection/ observation/monitoring, and 3) accounting will be carried out. Operation rules should be determined before completion of the facilities. Regarding 3), a draft of the operation rule should be prepared with the consultant for design and construction supervision. Since accounting should just follow the rules of cost allocation as described in Section 5.1 of Part 1, items of 1) and 2) of the above are discussed below.

2.1.1 Reporting and Communication

Results of the operation/inspection/observation/monitoring and accounting should be recorded and periodically reported to the organs in charge of inspection of the operation and maintenance by the site office. Methods and frequency of the reporting should be determined before the operation. Forms for reporting should also be prepared.

Communication system in emergent cases, such as drought or deterioration of water quality, should be established before the commencement of the operation. Required communication facilities should also be installed. Periodical check, at least once a year in the beginning of dry season, should be conducted on the system (command-operation lines) and communication facilities.

2.1.2 Operation/Inspection/Observation/Monitoring

Detailed manner of operation and inspection should be discussed after detail specifications of facilities are determined. Operation and inspection of dams of similar type and scale to the Vaza Barris Dam facilities are generally discussed below.

(1) Low Flow Control

Assurance of maintenance discharge is inevitable for conservation of river environment of the downstream. Operation of valves for control of the discharge from the outlets of by-pass pipeline and low flow discharge pipe should be carried out in a frequency of once in a day to once in a week, corresponding to the water level (discharge) of the reservoir of the check dam. A reliable system for the operation should be established.

(2) Inspection and Maintenance

Safety of the dam and dam facilities are fatally important for the residents along the downstream and users of the reservoir water. Inspection as shown in Table-2.1 below should certainly be carried out.

Since the frequency of inspection at the stage 1 is high and the results of the inspection of this stage is important for operation and the inspection of the latter stage, the inspection of this stage should be conducted by or with a specialist.

In case extraordinary values are measured in the inspection, more precise and detail inspection should be carried out. Depending on the results of detail inspection some rehabilitation and immediate counter-measures might be required.

Table-2.1 Inspection and Maintenance of Dam Facilities

Inspection Items	Frequency		
	Stage 1: from the start to filling to a certain period of time after bankfull stage	Stage 2: up to the stable condition of the Dam	Stage 3: later stage
Water Leakage	daily	weekly	monthly
Displacement	weekly	monthly	one in three month
Uplift Pressure	weekly	monthly	one in three month
Valve Facilities	monthly	monthly	monthly

(3) Observation and Monitoring

(a) Rainfall and Meteorological Observation

Accumulation of rainfall and meteorological data and subsequent analysis is important for operation improvement for efficient use of water. Regarding rainfall and meteorological observation, data of the stations in the catchment area and the area near the dam should periodically be collected. Communication system should be established to obtain these data.

(b) Water Level (Discharge)

Discharge data is very important for operation and inspection as well as for understanding flow regime of the river. Measurement of the water level should be measured every day at the point of the main dam and the check dam.

(c) Reservoir Sediment

Sediment data is also important to know the available volume of water and to use the water efficiently. Sounding survey should be conducted once in several years (around five years) in the main reservoir.

(d) Water Quality

Vaza Barris Reservoir will be the source of water for the two integrated domestic water supply systems, namely Itabaiana and Piauitinga Integrated system and will serve to 539,000 persons in 2020. Water quality of the reservoir is extremely important. The water quality monitoring at the intake point and at a point of the check dam reservoir should preferably be made once in a month, more frequently than that of monitoring of ordinary Class 1 waters. In order to understand conditions of density strata of the reservoir, water quality at different depth (3 points) of the intake point should preferably be monitored twice a year.

2.1.3 Control of Intake

Intake operation should be controlled under the initiative of SEPLANTEC (SRH) since the Vaza Barris Dam should be destined to the most effective and efficient water use among the sectors. Regarding control of intake, a) restriction at the times of droughts and other critical hydrological events, and b) integrated intake management at the times of ordinary conditions and critical conditions are discussed below.

(1) Intake Restriction

In order to optimize the use of limited water in case of drought and other hydrological events, phased intake restriction should be conducted; 1) to secure water for the late stage of a drought with moderate restriction at the early stage of the drought, 2) to avoid damage

of a sudden restriction with giving some period for preparation to more severe restriction.

Rules for water allocation and the restriction of intake in the critical conditions should be decided by the River Basin Committee and the National Council of Water Resources after submission of a draft by SEPLANTEC (SRH) through ANA. Conflicts between domestic water supply and irrigation water supply should be settled in the Committee and the Council. Introduction of drought charge or seasonal charge into water right charging might give an incentive for efficient allocation at times of droughts.

Three methods for phased intake restriction are possible: a) to predict the future available volume of water in the reservoir according to the long-term weather forecast and determine the rate of intake restriction, b) to determine the rate of the restriction by available volume of water at times, c) to estimate probable discharge to reservoir as expected value according to probability of rainfall in the catchment calculated with the past rainfall records.

Results of a simulation in Japan shows; that Method c) worked most effective the reduction of 40% of drought damage compared to the case without any restriction (use water as much as available at times even in the period of drought), that Method c) also substantially reduced the drought damage as much as 15% to 20% compared to the cases without any restriction. Effectiveness of Method a) would heavily depends on the preciseness and reliability of available long-term weather forecast.

Since many data on rainfall, river discharge and drought damage are required to apply Method c), and easiness to apply Method c), Method c) is recommendable at present. With the development of information system on water resources potential and water use, including those on drought damage, Method b) is also recommendable as a future method.

(2) Integrated Intake Management

The Vaza Barris reservoir will provide water to Itabaiana Integrated Water Supply System and Piauitinga Integrated Water Supply System, as well as irrigation perimeters near the dam. Both integrated water supply system has water sources of dam/reservoir, weirs for direct intake from rivers and wells for groundwater pumping.

The integrated intake management consists of a) to precisely analyze water resource potential in terms of quantity and quality at every sources at ordinary times and drought times and to calculate load factors of the current intake, b) to analyze social and economic losses in every types of water use caused by various level of droughts, and c) to control intake operation for overall efficiency of water use in cases of ordinary situations and droughts. Cooperation with DESO and COHIDRO is inevitable to formulate an operation plan.

A criterion for the optimal intake operation at ordinary times is variable costs for intake and water conveyance to water treatment plants. In case treatment costs vary depending on the water sources, variable costs for the treatments should also be taken into consideration. The optimal operation at ordinary times is that to minimize the variable costs. In drought cases, optimal operation can be made by full use of the potential of all water sources and to minimize economic and social losses caused by intake restriction or to make the level of losses by the restriction same in all sectors of water use.

2.2 Domestic Water Supply

Since DESO has been supplying water in the target areas and has enough experiences for domestic water supply, expansion of operation and maintenance in these areas would not be difficult for DESO. As proposed in the Master Plan, however, DESO should expand the operation and maintenance not by increasing its staff but by shifting its staff from the administrative sector as far as possible. Training for the shift should be conducted.

2.3 Irrigation Water Supply

Although COHIDRO has enough experiences in operation and maintenance of irrigation schemes, its management seems to have to be improved, as recommended in the Master Plan. A management reform is discussed below, since well-organized irrigation management is essential for the sound management of the Project.

2.3.1 Integrated Approach with Close Coordination

Integrated management is necessary to achieve higher objectives without leaving uncontrollable management factors outside of the operating entities. Brazilian irrigation management, especially those developed in settlement programs, seems to be oriented to integrated management. In some cases irrigation perimeter management includes building social facilities. However, this type of management requires excessive duties on government organs as well as duplications of functions in the same level of the governments, and often causes financial burdens heavier than those levels of the government can afford.

In proposed irrigation management, the role of the government operating entity will be limited to management of water facility. In order not to lose the merits of integrated management, a mechanism of close coordination with supporting entities in charge of agricultural extension, research, and crediting should be established. Periodical meetings among the operating entity of irrigation management, supporting entities and the farmers' association should be encouraged. The merger of COHIDRO and EMDAGRO and increased farmers' participation as described below might help promoting the required close coordination.

2.3.2 Increased Role of Farmer's Associations

For equitable, efficient and flexible water management, role of farmers themselves should be enhanced, although role of government entity is very important at the construction stage and the initial stage of operation. Establishment of water users' association or irrigation association should be promoted with assistance through mobilization and education/ training activities. Increased capability will allow less government involvement in the future. Farmers' participation in water management will often cause not only better efficiency of irrigation management but also better cost recovery, resulting less financial burdens on the government.

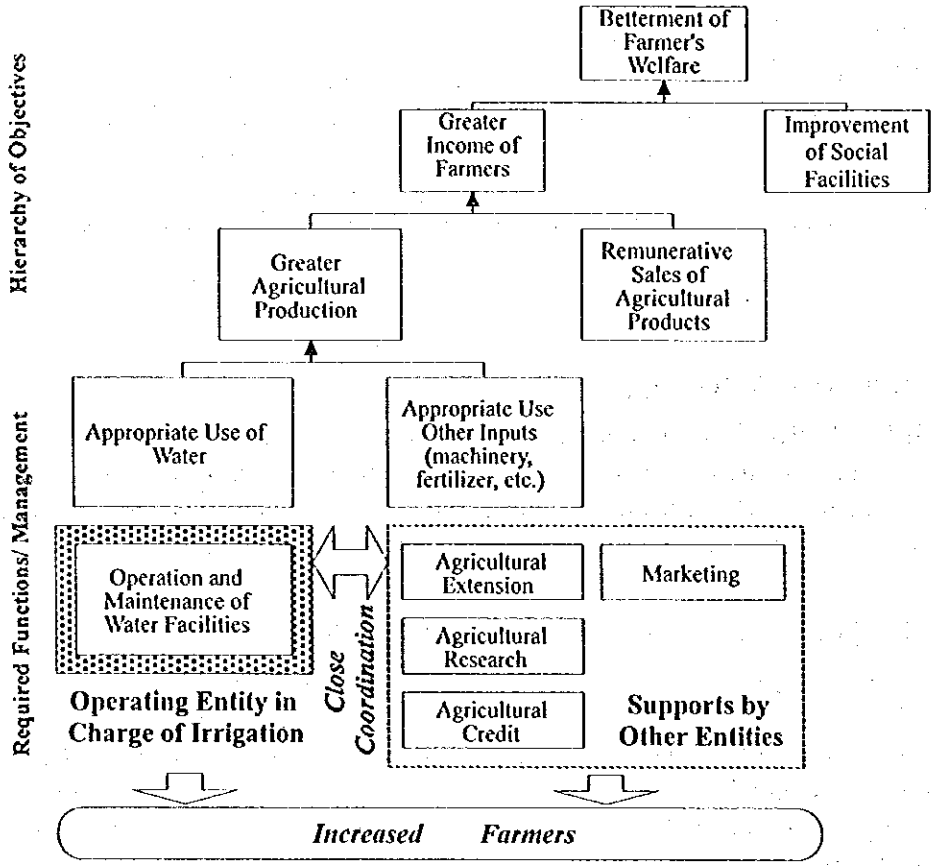

Figure-2.1 Recommended Management of Irrigation

However, farmers of the target area do not have any experience in irrigation and water management. Mobilization activities would be examined, referring successful cases in other parts of Brazil and other countries. The establishment of "Irrigation Districts" by CODEVASF, such as that in Petrolina perimeter would be a good example. Consultation with or supports by CODEVASF help organizing sustainable perimeter management.

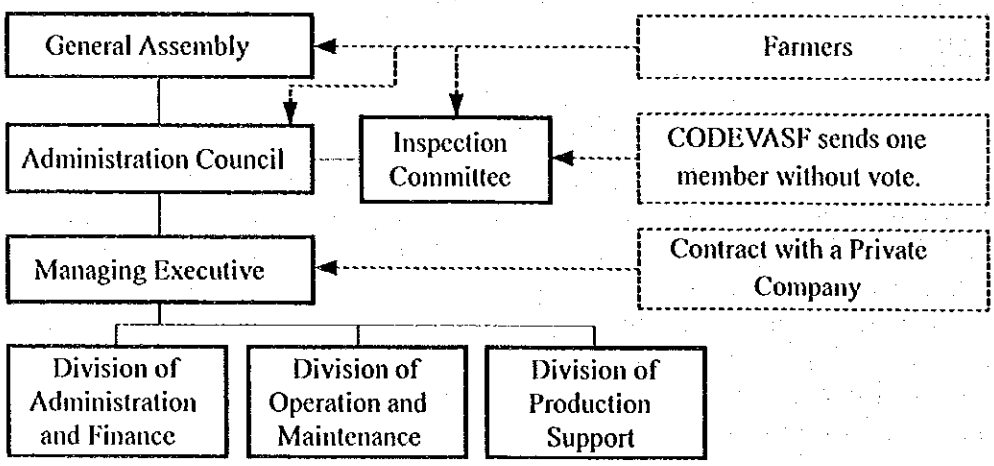

Figure-2.2 Organization of the District in Petrolina Perimeter

JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME II)
FEASIBILITY STUDY

[I] COST ESTIMATE

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (I)
COST ESTIMATE

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CHAPTER 1 INTRODUCTION

This report covers the details of estimation of the Project cost for the construction of the facilities included in the Feasibility Study.

CHAPTER 2 CONDITIONS OF COST ESTIMATION

2.1 Price Level

Cost estimation for the Study is based on the costs and prices in Brazilian "Real", R$, at the time of September 1999, namely 1 US$ = 1.92R$ and 1 US$ = 106.95 yen.

2.2 Unit Price

2.2.1 General

In principal, unit prices used for cost estimation of the Projects in the Feasibility Study are determined based on the data base for cost estimation of public works in the Sergipe State provided by CEHOP.
Unit prices not covered by the CEHOP data base are obtained by quotations from manufacturers, suppliers or distributors of products required for the Projects or estimation from the prices of the similar projects in the past.

2.2.2 CEHOP Data Base

The data base was developed by CEHOP in order to achieve the efficient preparation of documents required in the budgeting and tendering process for the Public Works in the State of Sergipe.

The data base includes:

- List of approximately 9,000 possible materials to be used
- Grouped description and listing of approximately 8,000 service items
- Price compositions more than 6,000
- Approximately 230 specifications concerning main basic services

The data base can provide preparation of the following reports:

- Budget Table
- Physical-financial work schedule
- Material curve
- Presentation of the specific price compositions
- List of all materials with identical information
- Suppliers list of materials and prices

The software including data base is supplied by CEHOP in the form of CD ROM. The software is developed in a client-server base in a way to make possible also the access through Internet.

2.3 Composition of Project Cost

2.3.1 General

Project cost is composed of the following cost items:

- Administration Cost, AC
- Consulting Services Cost, CSC
- Construction Cost, CC
- Compensation Cost, LCC
- Land Acquisition Cost, LAC
- Contingency, CT

2.3.2 Administration Cost, AC

Administration cost of the Government covers the cost for supervision and management of the project implementation by the Government staff and is taken as 1% of CSC, CC, LCC, LAC and CT.

2.3.3 Consulting Services Cost, CSC

The cost covers the cost for consulting engineering services required in the whole period of the project implementation and is taken as 10% of CC, LCC and LAC. This rate is estimated as the average of rates for all CSC required in the Project.

2.3.4 Construction Cost, CC

The cost required for the construction of facilities and other related works including the preparatory works. The cost includes material and equipment cost and labor cost including installation and erection of equipment, etc. as a direct cost and the direct and indirect benefit, BDI, as an indirect cost.

2.3.5 Compensation Cost, LCC

This cost covers the cost associated with the compensation for properties such as resettlement of residents, permanent and temporary use of land, etc.

(1) Evaluation Method of House Compensation

(a) Cost Reproduction Method

The current cost for the construction of a new house is estimated, considering details such as type of floor, doors, etc. The depreciation is calculated to reach a final value for compensation as 2% per year and durability in years of the house.

(b) Comparison Method

The house to be resettled is compared to a similar house sold recently in the region, and the price paid for this house is the parameter for the calculation of the compensation for the dispossessed house.

(2) Evaluation Method of Land Compensation

The compensation for land along the pipeline is necessary only when the pipe crosses or is in a private area. In case the pipeline is along the existing road or pathway, there is no need for compensation but an authorization from DNER to install the pipeline. Regarding the pipeline from Ribeira to Itabaiana, it can be implemented along the existing pipeline with small compensation, since the area was already compensated at the time of the execution of existing work and the compensated area is larger than the required for the existing pipeline considering the possibility of future expansion. Unit cost of land for compensation is as same as for land acquisition.

2.3.6 Land Acquisition Cost, LAC

This cost covers the cost associated with the acquisition of land for construction of the facilities and their influence area.

(1) Land to be inundated in the Reservoir

Inundated area in the reservoir is measured based on 1:5000 scale map. Unit cost of land is 520 R$/ha established in the Master Plan Study for the region based on the information from INCRA. The same unit rate is applied for the acquisition of land required for the construction of Water Intake and Lift Pump Stations.

(2) Land for Water Supply Facility

The land acquisition in the urban areas is done considering the region and it is calculated by a lot in size of 8m x 25m called "chao de casa", informal popular measuring unit of land with an average unit cost of 3,000 R$/lot.

2.3.7 Contingency, CT

Contingency includes the physical contingency.
5% of the sum of CSC, CC, LCC and LAC is taken as the physical contingency of the Project cost.

2.4 Price Escalation

The index for variation of construction cost is the civil construction cost per square meters of buildings published by IBGE in their annual and monthly statistical reports. The period of index to be analyzed is between July 1994 and May 1999.
The following indexes have been analyzed:

- National Consumer Price Indes – NCPI in Brazil
- Average civil construction cost per m^2, ACCC in Brazil, Sao Paulo and Sergipe in R$ and US$
- Foreign exchange rate from Brazilian Reals to U.S. dollars

Figure-2.1 indicates the variation of the indexes between July 1994 and May 1999. It is noted that IBGE started to adopt a new series of ACCC from January 1999 to suit the updated technical reference of SINAPI, National Research System of costs and rates of the civil construction, promoted by the "Caixa Economica Federal", Federal Financial Organ.

In this analysis, ACCC in 1998 base is used by multiplying increase rate of new ACCC in 1999, which is also shown in IBGE Report, to ACCC in December 1998.

Figure-2.1 shows that the increase rate of ACCC Sergipe R$ is very small and is less than those of NCPI and ACCC Brazil R$. On the contrary, ACCC US$ is decreasing month by month and is oscillated drastically at the beginning of 1999 due to the sharp decline of exchange rate of Brazilian "Real" to US dollar caused by the economic crisis in Brazil. The current exchange rate is still regarded as unstable. Therefore, the Project cost is evaluated in Brazilian Real basis. The annual price escalation rate of ACCC R$ in Sergipe and Sao Paulo between July 1995 and June 1999 is calculated as 1.8% and 5.0%, respectively. Since the prices of most of the construction equipment and materials are strongly affected by the prices in Sao Paulo, the annual rate of price escalation for the Project cost is taken as 5.0%.

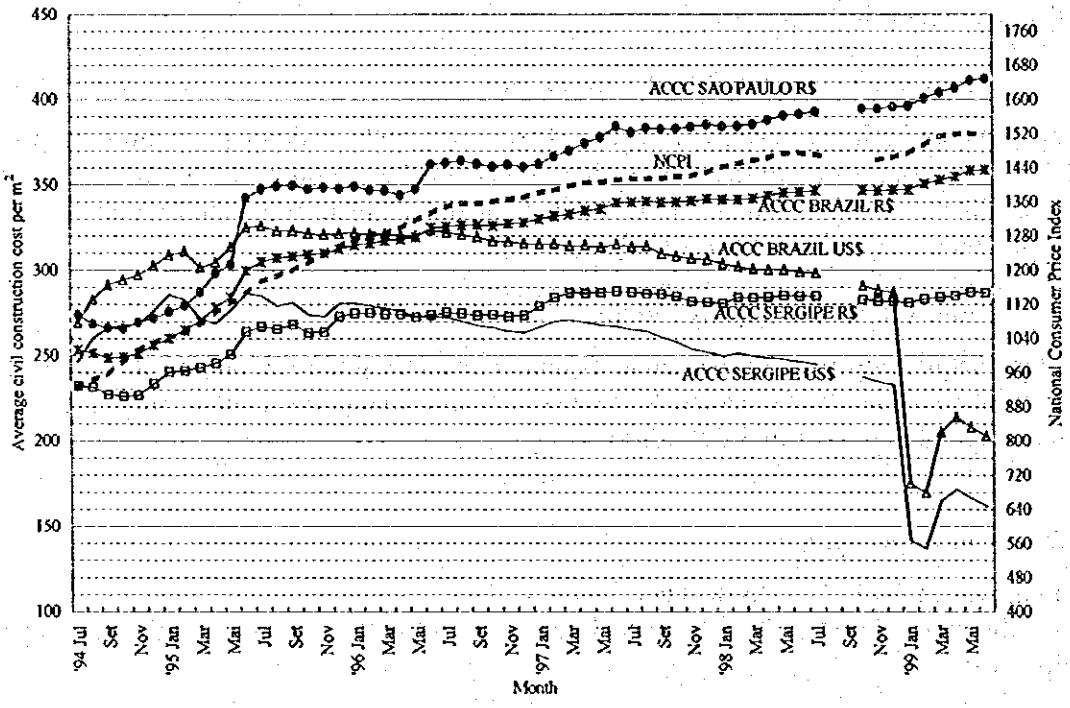

Figure-2.1 Monthly Variation of Construction Cost

2.5 Method of Estimation of the Project Cost

2.5.1 Cost Estimation based on the Result of Facility Design

The cost estimation for the following construction works was made based on the quantities of equipment, materials, labor and other related items calculated from the design drawings of facilities:

(1) Facilities related to Dam

- Vaza Barris Dam
- Check Dam
- Low Flow Bypass

(2) Facilities related to Water Conveyance

Facilities related to water conveyance from Vaza Barris Reservoir to Agreste and Piauitinga Regions were included in this category.

- Water Intake Pump Station
- Water Lift Pump Stations
- Connecting Reservoirs
- Water Conveyance Pipelines
- Surge Tanks
- Control and Electrical Building
- Substation

2.5.2 Cost Estimation based on the Result in the Master Plan Study

The cost estimation of the Water treatment stations, treated water pump stations and distribution networks for the following municipalities included in Agreste and Piauitinga Integrated Water Supply Systems was made by adjusting the result of cost estimation in the Master Plan Study:

(1) Agreste Integrated Water Supply System

- Areia Branca
- Campo do Brito
- Itabaiana
- Macambira
- Sao Domingos

(2) Piauitinga Integrated Water Supply System

- Poco Verde
- Simao Dias
- Lagarto
- Richao do Dantas

(3) Method of Adjustment of Construction Cost

The price escalation from September 1998 to September 1999 is considered in the adjustment of the construction cost estimated in the Master Plan Study.

CHAPTER 3 PROJECT COST

3.1 Total Project Cost

Table-3.1 shows the Total Project Cost included in the Feasibility Study.

Table-3.1 Summary of Project Cost

Unit: R$ thousand

Cost Item	Phase 1	Phase 2	Total
1. Administration Cost	2,065	563	2,628
2. Consulting Service Cost	17,877	4,876	22,753
3. Construction Cost	176,253	48,759	225,012
(1) Dam	67,280	0	67,280
(2) Urban water supply facility to Agreste	34,597	23,993	58,590
(3) Urban water supply facility to Piauitinga	36,716	24,766	61,482
(4) Reforestation	719	0	719
(5) Irrigation water supply facilities	36,941	0	36,941
4. Land Acquisition Cost	2,536	0	2,536
5. Contingency	9,833	2,682	12,515
Total	208,564	56,880	265,444

3.2 Dam Project

Table-3.2 shows the Dam Project Cost included in the Feasibility Study.

Table-3.2 Summary of Dam Project Cost

Unit: R$ thousand

Cost Item	Phase 1	Phase 2	Total
1. Administration Cost	806	0	806
2. Consulting Service Cost	6,980	0	6,980
3. Construction Cost	67,280	0	67,280
(1) Dam	30,189	0	30,189
(2) Check Dam	4,260	0	4,260
(3) Low Flow Bypass	32,830	0	32,830
4. Land Acquisition Cost	2,523	0	2,523
5. Contingency	3,839	0	3,839
Total	81,428	0	81,428

3.3 Water Supply Project

3.3.1 Agreste Water Supply Project

Table-3.3 shows the summary of Agreste Water Supply Project Cost included in the Feasibility Study.

Table-3.3 Summary of Agreste Water Supply Project Cost

Unit: R$ thousand

Cost Item	Phase 1	Phase 2	Total
1. Administration Cost	400	277	677
2. Consulting Service Cost	3,459	2,399	5,858
3. Construction Cost	34,597	23,993	58,590
(1) Conveyance	17,500	12,137	29,637
(2) Distribution	17,097	11,856	28,953
4. Land Acquisition Cost	5	0	5
5. Contingency	1,903	1,320	3,223
Total	40,364	27,989	68,353

3.3.2 Piauitinga Water Supply Project

Table-3.4 shows the Piauitinga Water Conveyance Project Cost included in the Feasibility Study.

Table-3.4 Summary of Piauitinga Water Supply Project Cost

Unit: R$ thousand

Cost Item	Phase 1	Phase 2	Total
1. Administration Cost	424	286	710
2. Consulting Service Cost	3,671	2,477	6,148
3. Construction Cost	36,716	24,766	61,482
(1) Conveyance	17,723	11,955	29,678
(2) Distribution	18,993	12,811	31,804
4. Land Acquisition Cost	8	0	8
5. Contingency	2,020	1,362	3,382
Total	42,839	28,891	71,730

3.4 Reforestation

Table-3.5 shows the Reforestation Cost included in the Feasibility Study.

Table-3.5 Summary of Reforestation Cost

Unit: R$ thousand

Cost Item	Phase 1	Phase 2	Total
1. Administration Cost	8	0	8
2. Consulting Service Cost	72	0	72
3. Reforestation	719	0	719
4. Land Acquisition Cost	0	0	0
5. Contingency	40	0	40
Total	839	0	839

3.5 Irrigation Water Supply Facilities

Table-3.6 shows the Irrigation Water Supply Facilities Cost included in the Feasibility Study. The cost for Irrigation Water Supply Facilities is referred from the Technical Report of Pre-Feasibility Study of Vaza Barris Irrigation Project, proposed by SRH with same modification on CSC.

Table-3.6 Summary of Irrigation Water Supply Facilities Cost

Unit: R$ thousand

Cost Item	Phase 1	Phase 2	Total
1. Administration Cost	427	0	427
2. Engineering	3,694	0	3,694
3. Supply Facilities	36,941	0	36,941
4. Contingency	2,032	0	2,032
Total	43,094	0	43,094

APPENDIX-1

Current Supply Conditions of Construction Materials in the State of Sergipe

APPENDICES

Appendix-1 Current Supply Conditions of Construction Materials in the State of Sergipe

(1) General

Common construction materials required for the Priority Projects can be procured in the State of Sergipe. Current supply condition of construction materials in the State of Sergipe is as follows:

(2) Ready-mixed Concrete

There are only three commercial concrete producers that are equipped with concrete mixing plant and agitator trucks in their own plants in the State of Sergipe. All of their plants are located at boundary area of Aracaju city. These producers are nation wide company which own their branches in major capitals of the States in Brazil. They can provide concrete mixing plant in the dam construction site as well. The production capacity of concrete producers is shown in Table-1.1.

Table- 1.1 Production Capacity of Concrete Producers

Company Name	Address	Production Capacity (m^3/month)	Strength of Concrete (MPA)
Concrete Redimix do Brasil S/A	Rodovia BR235 KM 4.2	Max. 10,000 Average 5,000	9, 11,13, 15, 18, 20, 22, 25 and 30
Supermix Concreto S/A	S/N Faz. Itacanema	-	-
Polimix Concreto Ltda.	Rod. BR235 Km 04 – S/N Nossa Senhora Do Socorro	Average 5,000	9 ~35, max 60

(3) Crushed Stone

There are four crushed stone producers in the State of Sergipe. Quarries of three producers are located in the so-called Itabaiana dome region near to the Vaza Barris Dam construction site. The production capacity of the producers is shown in Table-1.2.

Table- 1.2 Production Capacity of Crushed Stone Producers

Company Name	Place of Production	Production Capacity (m^3/month)	Size (mm)
Pedreira Dinanica Ltda.	Povoado Sao Jose, Itabaiana	Average 14,000	16, 25, 32, 50
Pedreira Cajaiba Ltda.	Povoado Cajaiba, Itabaiana	Average 12,000 23,000 (From Sep. 99)	
Pedreira Anhanguera S/A	Itabaiana	Average 6,000	16, 19, 25, 38

All of these producers can also supply rock-fill materials for dam construction. Their production capacities of rock-fill materials are around 5,000 m^3 per month on average.

(4) Sand

Sand for fine aggregate is excavated in the margin of Poxim River near to the cities of Itaporanga and Riachuelo by a large number of persons, like self-employed excavators. Some crushed stone producers also supply crushed stone powder as fine aggregate in stead. The production capacity of the producers is shown in Table-1.3.

Table- 1.3 Production Capacity of Fine Aggregate Producers

Company Name	Place of Production	Production Capacity (m^3/month)	Remarks
Pedreira Dinanica Ltda.	Povoado Sao Jose, Itabaiana	Average 3,000	Powder of crushed stone
Morais	Laranjeiras	Average 4,000	Sand
Jazida do Poxim	Pacatuba	Average 6,000	Sand

APPENDIX-2

Cost Estimation Sheet

Appendix-2 Cost Estimation Sheet

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA				YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project				LOCATION :			
WORK : Dam				UNIT : FIRST PHASE			PAGE 1/8
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works	lot	1		2,025,364		
2.	Temporary works	lot	1		3,148,415		
3.	Civil works	lot	1		25,015,561		
	Grand Total					30,189,340	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris Dam Project			LOCATION :			
WORK : Dam			UNIT : FIRST PHASE			PAGE 2/8
				Prices (R$)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works					2,025,364	
1.1	Mobilization and demobilization	lot	1		300,000	300,000	
1.2	Site office, work spaces and camps	lot	1		800,000	800,000	
1.3	Access Road					917,216	
1.3.1	Access road from Ribeira to Dam Site Total distance = 9500 m, Road Width = 5 m and Waiting Area per 500m					518,069	
1.3.1.1	Regularization of sub-base	m^2	48,450	0.42	20,349		
1.3.1.2	Reinforcement (Distance = 3000 m, Thk = 0.5 m)	m^3	7,500	3.94	29,550		
1.3.1.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	14,535	9.85	143,170		
1.3.1.4	Excavation	m^3	20,000	2.09	41,800		
1.3.1.5	Embankment	m^3	30,000	9.44	283,200		
1.3.2	Access road from Jenipapo to Dam Site Total distance = 1500 m, Road Width = 5 m and Waiting Area per 500m Total distance = 3500 m, Exp. Width = 2 m and Waiting Area per 500m					399,147	
1.3.2.1	Regularization of sub-base	m^2	15,000	0.42	6,300		
1.3.2.2	Reinforcement (Thk = 0.5 m)	m^3	5,970	3.94	23,522		
1.3.2.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	4,500	9.85	44,325		
1.3.2.4	Excavation	m^3	20,000	2.09	41,800		
1.3.2.5	Embankment	m^3	30,000	9.44	283,200		
1.4	Deforestation and stripping of construction site	m^2	67,900	0.12	8,148	8,148	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. : YEC | DATE: 30/9/99

PROJECT : Vaza Barris Dam Project | LOCATION :

WORK : Dam | UNIT : FIRST PHASE | PAGE 3/8

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$) Unit Price	Sub-total	Total	REMARKS
2.	Temporary works					3,148,415	
2.1	Construction and Installation of Concrete Casting Facility					1,721,783	
2.1.1	Crane					969,600	
2.1.1.1	Rental fee, operation and maintenance cost of crane Tecnotra BR-200 or equivalent including operator, etc., 2 units	unit-mth	60	16,000.00	960,000		
2.1.1.2	Transportation	lot	1		9,600		
2.1.2	Platform					752,183	
2.1.2.1	Pre-fabricated Concrete Slab and Beam					308,914	
2.1.2.1.1	Pre-fabrication					299,677	
	Concrete	m^3	658	137.33	90,363		
	Reinforcing bars	kg	72,389	1.69	122,337		
	Form	m^2	5,048	17.23	86,977		
2.1.2.1.2	Transportation and installation					9,257	
	Loading and Transportation (0.5km)	t	1,612	2.35	3,788		
	Unloading and installation	t	1,612	3.38	5,449		
2.1.2.2	Prefabricated concrete pile					443,269	
2.1.2.2.1	Pre-fabrication					85,427	
	Concrete	m^3	161	137.33	22,110		
	Reinforcing bars	kg	17,738	1.69	29,977		
	Form	m^2	1,935	17.23	33,340		
2.1.2.2.2	Transportation and installation					5,187	
	Loading and Transportation (0.5km)	t	395	2.35	928		
	Manual Ground perforation, Dia.0.25m	m	688	4.25	2,924		
	Unloading and installation	t	395	3.38	1,335		
2.1.2.2.3	Support Foundations					352,655	
	Concrete	m^3	1,376	137.33	188,966		
	Reinforcing bars	kg	68,800	1.69	116,272		
	Form	m^2	2,752	17.23	47,417		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Dam		UNIT : FIRST PHASE					PAGE 4/8
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2.2	Diversion of river					426,632	
2.2.1	Excavation of 1st category of soil	m^3	61,863	2.09	129,294		
2.2.2	Loading and transportation of 1at category of soil(.0.5km)	m^3	61,863	2.37	146,615		
2.2.3	Embankment	m^3	84,676	1.78	150,723		
2.3.	Waste Water Treatment Facility					1,000,000	
	Waste Water Treatment Facility	lot	1		1,000,000		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Dam		UNIT : FIRST PHASE					PAGE 5/8
ITEM	DESCRIPTION	UNIT	Q'TY	Prices (R$)			REMARKS
				Unit Price	Sub-total	Total	
3.	Civil works					25,015,561	
3.1	Earth work					218,842	
3.1.1	Excavation of 1st category of soil	m^3	342,000	2.09	714,780		
3.1.2	Excavation of 2nd category of soil	m^3	38,000	1.89	71,820		
3.1.3	Loading and transportation of 1at category of soil(0.8km)	m^3	34,200	2.69	91,998		
3.1.4	Loading and transportation of 2nd category of soil(0.8km)	m^3	3,800	2.69	10,222		
3.1.5	Compaction of soil to NP 95%	m^3	34,200	1.11	37,962		
3.2	Concrete Production					21,037,141	
3.2.1	Dam Concrete Type-1 Production, transportation and casting	m^3	216,100	80.11	17,311,771		
3.2.2	Dam Concrete Type-2 Production, transportation and casting	m^3	42,600	71.85	3,060,810		
3.3.3	Form	m^2	36,000	18.46	664,560		
3.3.4	Construction Joint and Water-stop (3% of concrete work)	lot			630,000		
3.3	Grouting					1,370,000	
	Curtain Grouting and Consolidation Grouting (6.5% of concrete work)	lot	1		1,370,000		
3.4	Monitoring Instrument					420,000	
	Monitoring Instrument (2% of concrete work)	lot	1		420,000		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Concrete Production for Dam Body		UNIT : FIRST PHASE					PAGE 6/8
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-1	Dam Concrete Type-1 Production for Dam Body per m^3					80.11	
1	Plant and Equipment					20.21	
1.1	Mixing Plant					20.12	
	Supply and Operation of mixing plant	m^3	1	18.00	18.00		
	Diesel oil	liters	4	0.53	2.12		
1.2	Water Pumping Facility					0.09	
	Facility for water pumping	m^3	1	0.07	0.07		
	Diesel oil	liters	0.036	0.53	0.02		
2	Material					59.90	
2.1	Cement					32.00	
	Supply of cement	kg	200	0.16	32.00		
2.2	Crushed stone					27.90	
	Supply of crushed stone 15cm - 50cm	m^3	0.90	15.00	13.50		Quotation
	Supply of crushed stone < 2cm	m^3	0.60	15.00	9.00		Quotation
	Transportation of crushed stone	m^3	1.50	3.60	5.40		Quotation
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :				
WORK : Concrete Production for Dam Body		UNIT : FIRST PHASE				PAGE 7/8
				Prices (R$)		
ITEM	DESCRIPTION	UNIT	QTY	Unit Price	Sub-total	Total	REMARKS
S-2	Dam Concrete Type-2 Production for Dam Body per m^3					71.85	
1	Plant and Equipment					20.21	
1.1	Mixing Plant					20.12	
	Supply and Operation of mixing plant	m^3	1	18.00	18.00		
	Diesel oil	liters	4	0.53	2.12		
1.2	Water Pumping Facility					0.09	
	Facility for water pumping	m^3	1	0.07	0.07		
	Diesel oil	liters	0.036	0.53	0.02		
2	Material					51.64	
2.1	Cement					25.60	
	Supply of cement	kg	160	0.16	25.60		
2.2	Crushed stone					26.04	
	Supply of crushed stone 15cm - 50cm	m^3	0.80	15.00	12.00		Quotation
	Supply of crushed stone < 2cm	m^3	0.60	15.00	9.00		Quotation
	Transportation of crushed stone	m^3	1.40	3.60	5.04		Quotation
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Water Pumping Facility		UNIT : FIRST PHASE					PAGE 8/8
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-3	Facility for water pumping from nearest perennial brook					17,508	
1.	Earth work					4,552	
	Deforestation and stripping	m^3	14,000	0.12	1,680		
	Excavation	m^3	742	2.09	1,551		
	Embankment	m^3	742	1.78	1,321		
2.	Steel Pipes					10,840	
	Supply and Installation of pipe dia 75mm	m	510	20.22	10,312		
	Supply and Installation of check valve dia 75mm	unit	2	264.24	528		
3.	Submersible Pump					2,116	
	Supply of pump unit 20HP 125mca	unit	1	1560.00	1,560		
	Installation of pump	unit	1	555.85	556		
	Facility for water pumping per m^3					0.07	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Check Dam		UNIT : FIRST PHASE					PAGE 1/6
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works	lot	1		382,544		
2.	Temporary works	lot	1		172,950		
3.	Civil works	lot	1		3,704,700		
	Grand Total					4,260,194	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Check Dam		UNIT : FIRST PHASE					PAGE 2/6
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works					382,544	
1.1	Mobilization and demobilization	lot	1		50,000	50,000	
1.2	Site office, work spaces and camps	lot	1		50,000	50,000	
1.3	Access Road						
	Access road from Jenipapo to Dam Site					281,644	
	Total distance = 1500 m, Road Width = 5 m and Waiting Area per 500m						
1.3.1	Regularization of sub-base	m^2	7,650	0.42	3,213		
1.3.2	Reinforcement (Thk = 0.5 m)	m^3	3,750	3.94	14,775		
1.3.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	2,295	9.85	22,606		
1.3.4	Excavation	m^3	25,000	2.09	52,250		
1.3.5	Embankment	m^3	20,000	9.44	188,800		
1.4	Deforestation and stripping of construction site	m^2	7,500	0.12	900	900	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA				YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Dam Project				LOCATION :				
WORK : Check Dam				UNIT : FIRST PHASE				PAGE 3/6
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)				REMARKS
				Unit Price	Sub-total	Total		
2.	Temporary works					172,950		
2.1	Diversion of river					172,950		
2.1.1	Excavation of 1st category of soil	m^3	15,000	2.09	31,350			
2.1.3	Embankment	m^3	15,000	9.44	141,600			
	(BDI = 0.3)							

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Check Dam		UNIT : FIRST PHASE					PAGE 4/6
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
3.	Civil works					3,704,700	
3.1	Earth work					366,912	
3.1.1	Excavation of 1st category of soil	m^3	20,800	2.09	43,472		
3.1.3	Loading and transportation of 1at category of soil(0.4km)	m^3	20,800	6.11	127,088		
3.1.5	Embankment	m^3	20,800	9.44	196,352		
3.2	Concrete Production					3,337,788	
3.2.1	Concrete - Production, transportation and casting	m^3	28,400	97.31	2,763,604		
3.2.2	Reinforcing bars	kg	262,200	1.69	443,118		
3.3.3	Form	m^2	7,100	18.46	131,066		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Dam Project		LOCATION :					
WORK : Check Dam		UNIT : FIRST PHASE					PAGE 5/6
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-1	Concrete Production for Dam Body per m^3					97.31	
1	Plant and Equipment					36.12	
1.1	Mixing Plant					36.12	
	Supply and Operation of mixing plant	m^3	1	34.00	34.00		
	Diesel oil	liters	4	0.53	2.12		
2	Material					61.19	
2.1	Cement					32.00	
	Supply of cement	kg	200	0.16	32.00		
2.2	Water					0.69	
	Water produced by desalination plant	m^3	0.25	2.75	0.69		
2.3	Crushed stone					28.50	
	Supply of crushed stone 15cm - 50cm	m^3	0.90	15.00	13.50		Quotation
	Supply of crushed stone < 2cm	m^3	0.60	15.00	9.00		Quotation
	Transportation of crushed stone	m^3	1.50	4.00	6.00		Quotation
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA				YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Dam Project				LOCATION :				
WORK : Check Dam				UNIT : FIRST PHASE				PAGE 6/6
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)				REMARKS
				Unit Price	Sub-total	Total		
S-2	Water Production by Desalination Plant per m^3							
1	Plant and Equipment					50,500.00		
1.1	Desalination Plant					50,500.00		
	Supply of desalination plant with production capacity of $50m^3$/day	unit	1	32500.00	32,500.00			
	House for desalination plant 3m x 5m	unit	1	13000.00	13,000.00			
	Generator	unit	1	5000.00	5,000.00			
	Operating Period 20 months							
	Cost of desalination plant per m^3					2.35		
	Operation cost per m^3					0.40		
	Water Production Cost by desalination plant per m^3 of water					2.75		
	(BDI = 0.3)							

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050			UNIT : FIRST PHASE				PAGE 1/7
					Prices (R$)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works	lot	1		2,916,208	32,829,990	
2.	Civil works	lot	1		29,913,782		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :			
WORK : Low Flow Bypass - Box Culvert 1,050 x 1,050			UNIT : FIRST PHASE			PAGE 2/7
			Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works					2,916,208	
1.1	Mobilization and demobilization	lot	1		300,000	300,000	
1.2	Site office, work spaces and camps	lot	1		900,000	900,000	
1.3	Access road					1,683,870	
1.3.1	Access Road (New construction) Total Distance = 1500 m x 3 routes Road Width = 5 m Waiting Area Per 500 m					844,931	
1.3.1.1	Regularization Of Sub-Base	m^2	22,950	0.42	9,639		20301001
1.3.1.2	Reinforcement Of Sub-Base (Distance = 1500 m, Thk = 0.5 m)	m^3	11,250	3.94	44,325		20302001
1.3.1.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,885	9.85	67,817		20307003
1.3.1.4	Excavation	m^3	75,000	2.09	156,750		20307003
1.3.1.5	Embankment	m^3	60,000	9.44	566,400		20307003
1.3.2	Access Road (Expansion of existing pathway) Total Distance = 3500 m x 3 routes Expansion of Road Width = 2 m Waiting Area Per 500 m					838,939	
1.3.2.1	Regularization Of Sub-Base	m^2	22,050	0.42	9,261		20301001
1.3.2.2	Reinforcement Of Sub-Base (Distance = 3500 m, Thk = 0.5 m)	m^3	10,500	3.94	41,370		20302001
1.3.2.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,615	9.85	65,158		20307003
1.3.2.4	Excavation	m^3	75,000	2.09	156,750		20307003
1.3.2.5	Embankment	m^3	60,000	9.44	566,400		20307003
1.4	Deforestation (BDI = 0.3)	m^2	269,485.00	0.12	32,338	32,338	

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050			UNIT : FIRST PHASE				PAGE 3/7
ITEM	DESCRIPTION	UNIT	QTY	Prices (RS)			REMARKS
				Unit Price	Sub-total	Total	
2.	Civil works					29,913,782	
2.1	Box Culvert					27,237,672	
2.1.1	Box Culvert 1,050 x 1,050	m	27,720.00	982.60	27,237,672		
2.2	Earth work					2,676,110	
2.2.1	Mechanical Soil Excavation	m^3	239,509.00	3.38	809,540		
2.2.2	Embankment w/ excavated soil, 95% Proctor	m^3	205,796.00	9.07	1,866,570		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050			UNIT ; FIRST PHASE				PAGE 4/7
					Prices (R$)		
ITEM	DESCRIPTION	UNIT	QTY	Unit Price	Sub-total	Total	REMARKS
S-1	Box Culvert per meter					982.60	
	Leveling Concrete	m^3	0.205	111.6	22.88		10303006
	Concrete Fck=21Mpa	m^3	2.320	150.28	348.65		10303006
	Form	m^2	5.800	19.59	113.62		10301003
	Reinforcement 120kg/m^3	kg	278.40	1.69	470.50		10305004
	Water-Stop	m	0.390	46.67	18.20		10301003
	Scaffolding	m	1.103	7.94	8.75		10304005
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :					
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050		UNIT : FIRST PHASE					PAGE 5/7
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-2	Concrete 21Mpa Production for Box Culvert per m^3					150.28	
1	Plant and Equipment					26.12	
1.1	Mixing Plant					26.12	
	Supply and Operation of mixing plant	m^3	1	24.00	24.00		
	Diesel oil	liters	4	0.53	2.12		
2	Material					85.19	
2.1	Cement					56.00	
	Supply of cement	kg	350	0.16	56.00		
2.2	Water					0.69	
	Water produced by desalination plant	m^3	0.25	2.75	0.69		
2.2	Crushed stone					28.50	
	Supply of crushed stone < 2cm	m^3	0.90	15.00	13.50		
	Supply of sand	m^3	0.60	15.00	9.00		
	Transportation of crushed stone	m^3	1.50	4.00	6.00		
3	Transportation					4.58	
	Concrete	m^3	1.00	4.58	4.58		
4	Casting of concrete					34.39	
	Casting of concrete for structure	m^3	1.00	34.39	34.39		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050			UNIT : FIRST PHASE				PAGE 6/7
					Prices (R$)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-3	Concrete Production for leveling concrete per m^3					111.60	
1	Plant and Equipment					26.12	
1.1	Mixing Plant					26.12	
	Supply and Operation of mixing plant	m^3	1	24.00	24.00		
	Diesel oil	liters	4	0.53	2.12		
2	Material					61.19	
2.1	Cement					32.00	
	Supply of cement	kg	200	0.16	32.00		
2.2	Water					0.69	
	Water produced by desalination plant	m^3	0.25	2.75	0.69		
2.2	Crushed stone					28.50	
	Supply of crushed stone < 2cm	m^3	0.90	15.00	13.50		
	Supply of sand	m^3	0.60	15.00	9.00		
	Transportation of crushed stone	m^3	1.50	4.00	6.00		
3	Transportation					4.58	
	Concrete	m^3	1.00	4.58	4.58		
4	Casting of concrete					19.71	
	Casting of leveling concrete	m^3	1.00	19.71	19.71		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :					
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050		UNIT : FIRST PHASE					PAGE 7/7
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-4	Water Production by Desalination Plant per m^3						
1	Plant and Equipment					50,500.00	
1.1	Desalination Plant					50,500.00	
	Supply of desalination plant with production capacity of $50m^3$/day	unit	1	32500.00	32,500.00		
	House for desalination plant 3m x 5m	unit	1	13000.00	13,000.00		
	Generator	unit	1	5000.00	5,000.00		
	Operating Period 20 months						
	Cost of desalination plant per m^3					2.35	
	Operation cost per m^3					0.40	
	Water Production Cost by desalination plant per m^3 of water					2.75	
	(BDI = 0.3)						

Items		Phase1	Phase2	Total
Common (Agreste 51.3%, Piauitinga 48.7%)	Site Preparation	1,601,874	0	
	S/S	1,618,902	0	
	Control Building	24,579	0	
	Water Intake Pump Station	2,600,522	0	
	Water Intake Pump Station	0	688,857	
	Pipeline from WIPS to CR1	182,744	0	
	Pipeline from WIPS to CR2	0	127,192	
	Connecting Reservoir No.1 Capacity 3,000m³	653,230	0	
	Connecting Reservoir No.2 Capacity 3,000m³	0	554,285	
	Pipeline from CR1 to WLPS1and CR2 to WLPS2	52,788	0	
Common Total		6,734,639	1,370,334	8,104,973
Agreste	Water Lift Pump Station No.1 to Itabaiana	690,860	0	
	Water Lift Pump Station No.1 to Itabaiana	0	451,667	
	Pipeline from WLPS1 to CR3	15,481,862	0	
	Pipeline from WLPS1 to CR3	0	8,176,107	
	One Direction Surge Tank	77,311	0	
	Connecting Reservoir No.3 Capacity 3,000m³	0	603,758	
Agreste Total		16,250,033	9,231,532	25,481,565
Piauitinga	Water Lift Pump Station No.2 to Lagarto	690,860	0	
	Water Lift Pump Station No.2 to Lagarto	0	451,667	
	Pipeline from WLPS2 to CR4	15,587,606	0	
	Pipeline from WLPS2 to CR4	0	8,222,062	
	One Direction Surge Tank No.1	82,126	0	
	One Direction Surge Tank No.2	90,150	0	
	Connecting Reservoir No.4 Capacity 3,000m³	0	603,757	
Piauitinga Total		16,450,742	9,277,486	25,728,228
Total		39,435,414	19,879,352	59,314,766

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Preparation work (Common)		UNIT : FIRST PHASE					PAGE 1/3
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Preliminary works	lot	1		1,401,848		
2	Civil works	lot	1		200,026		
	Grand Total					1,601,874	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :					
WORK : Preparation work (Common)			UNIT : FIRST PHASE					PAGE 2/3
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)				REMARKS
				Unit Price	Sub-total	Total		
1	Preliminary Works					1,401,848		
1.1	Mobilization and demobilization	lot	1		400,000			
1.2	Site office, work space and camp	lot	1		1,000,000			
1.3	Deforestation and stripping	m^2	15,397	0.12	1,848			
	(BDI = 0.3)							

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :				
WORK : Preparation work (Common)		UNIT : FIRST PHASE				PAGE 3/3
				Prices (R$)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2	Civil Works					200,026	
2.1	Earthworks					155,860	
2.1.1	Mechanical excavation, loading and transportation (0.4km) of soil	m^3	76,778	2.03	155,860		
2.2	Others					44,166	
2.2.1	Fence and Gates						
2.2.1.1	Fence H=2.1 with concrete post	m	420	24.84	10,433		
2.2.1.2	Double Swing Gate, W = 4.0m x 2	m^2	16.8	137.4	2,308		
2.2.2	Concrete pavement t=10cm	m^2	1,717	15.39	26,425		
2.2.3	Outdoor lighting	lot	1		5,000		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : 69kV Substation Yard (Common)		UNIT : FIRST PHASE					PAGE 1/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Civil works	lot	1		19,773		
2	Electrical works	lot	1		6,020,906		
	Grand Total					6,040,679	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. : YEC | DATE: 30/9/99

PROJECT : Vaza Barris Multi-purpose Dam Project | LOCATION :

WORK : 69kV Substation Yard (Common) | UNIT : FIRST PHASE | PAGE 2/3

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$) Unit Price	Sub-total	Total	REMARKS
1	Civil works					19,773	
1.1	Earthworks					1,146	
1.1.1	Mechanical excavation of soil	m^3	51	2.09	107		
1.1.2	Disposal of excavated material	m^3	30	2.37	71		
1.1.3	Compacted backfill	m^3	21	1.78	37		
1.1.4	Compacted Gravel for fdn	m^3	4	18.88	76		
1.1.5	Gravel for yard	m^3	50	17.1	855		
1.2	Concrete works					14,206	
1.2.1	Structural concrete, fck=25Mpa	m^3	45	142.38	6,407		
1.2.2	Reinforcing steel	kg	3,210	1.69	5,425		
1.2.3	Form - structure	m^2	108	19.59	2,116		
1.2.1	Leveling concrete, fck=15Mpa	m^3	2	129.1	258		
1.3	Fence and Gates					4,421	
1.3.1	Barbed wire fence H=2.5	m	55	27.92	1,536		
1.3.2	Double swing gate	Set	21	137.4	2,885		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : 69kV Substation Yard (Common)		UNIT : FIRST PHASE					PAGE 3/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2	Electrical Works					6,020,906	
2.1	Supply and erection of electrical out-going and out-door switchgear facilities at the Existing Cajaiba S/S (Including the cost for related civil works)	lot	1		272,470	272,470	Quotation
2.2	Supply and construction of transmission line from Cajaiba S/S to the New S/S (Including the cost for related civil works)	km	11.5	48,500	557,750	557,750	Quotation
2.3	Supply and erection of electrical in-coming and outdoor switchgear facilities at New S/S (Including the cost for related civil works)	lot	1		272,470	272,470	Quotation
2.4	Main transformers, distribution boards, DC power supply equipment, control and protection panels and cables					4,917,216	
2.4.1	Equipment and material supply	lot	1		3,335,002		Quotation
2.4.2	Insurance and Freight	lot	1		238,214		Quotation
2.4.3	Erection and commissioning	lot	1		1,344,000		Quotation
2.5	Grounding	lot	1		1,000.00	1,000	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Control and Electrical Building (Common)		UNIT : FIRST PHASE					PAGE 1/4
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Execution of civil works	lot	1		86,714		
2	Electrical erections	lot	1		5,000		
	Grand Total					91,714	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :				
WORK : Control and Electrical Building (Common)			UNIT : FIRST PHASE				PAGE 2/4
					Prices (RS)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Execution of civil works					86,714	
1.1	Preliminary works					372	
	Location of the building	m^2	231	1.61	372		
1.2	Earthworks					1,501	
1.2.1	Mechanical excavation of soil H<=2	m^3	151	2.09	316		
1.2.2	Disposal of excavated material	m^3	34	2.37	81		
1.2.3	Compacted backfill	m^3	117	9.44	1,104		
1.3	Concrete works					42,515	
1.3.1	Plain concrete, fck=15Mpa	m^3	32	129.1	4,131		
1.3.2	Structural concrete, fck=21Mpa	m^3	85	148.59	12,630		
1.3.3	Reinforcing steel	kg	9,350	1.69	15,802		
1.3.4	Form	m^2	508	19.59	9,952		
1.4	Scaffolding and Stage					12,117	
	Scaffolding	m^3	108	7.94	858		
	Stage	m^2	130	86.61	11,259		
1.5	Closure					24,023	
1.5.1	Brick masonry, Ceramic brick 8 holes	m^2	143	29.41	4,206		
1.5.2	Roofing, including wood works, hardware, fibercement roof Canalete 49 type or equivalent	m^2	288	32.7	9,418		
1.5.3	Metallic frames						
1.5.3.1	Aluminum tilting window	m^2	58	122.03	7,078		
1.5.3.2	Aluminum door	m^2	10	109.03	1,090		
1.5.3.3	Wooden door	unit	3	39.94	120		
1.5.4	Plain transparent glass with 4mm thk	m^2	58	36.4	2,111		
	(BDI = 0.3)						