

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 REPORT
(VOLUME I)
MASTER PLAN STUDY**

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)



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Exchange Rate

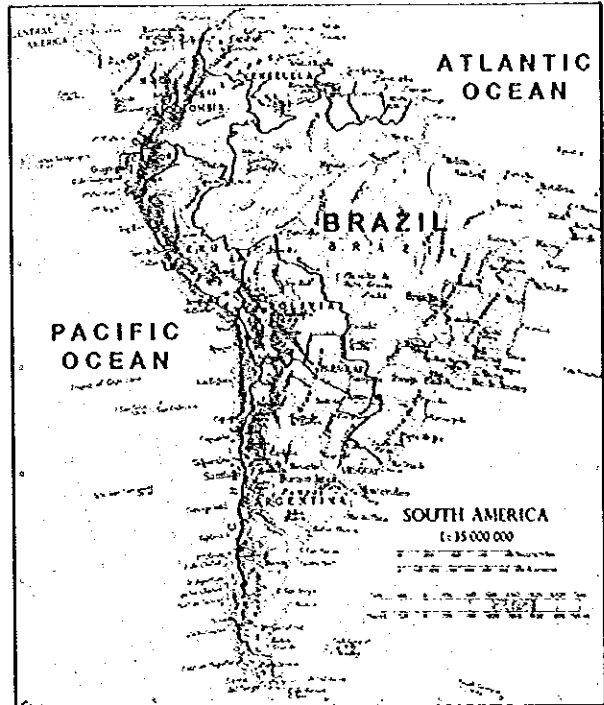
Part I Master Plan Study :

US\$ 1.00 = R\$ 1.18 = ¥ 141.40 as of August 1998

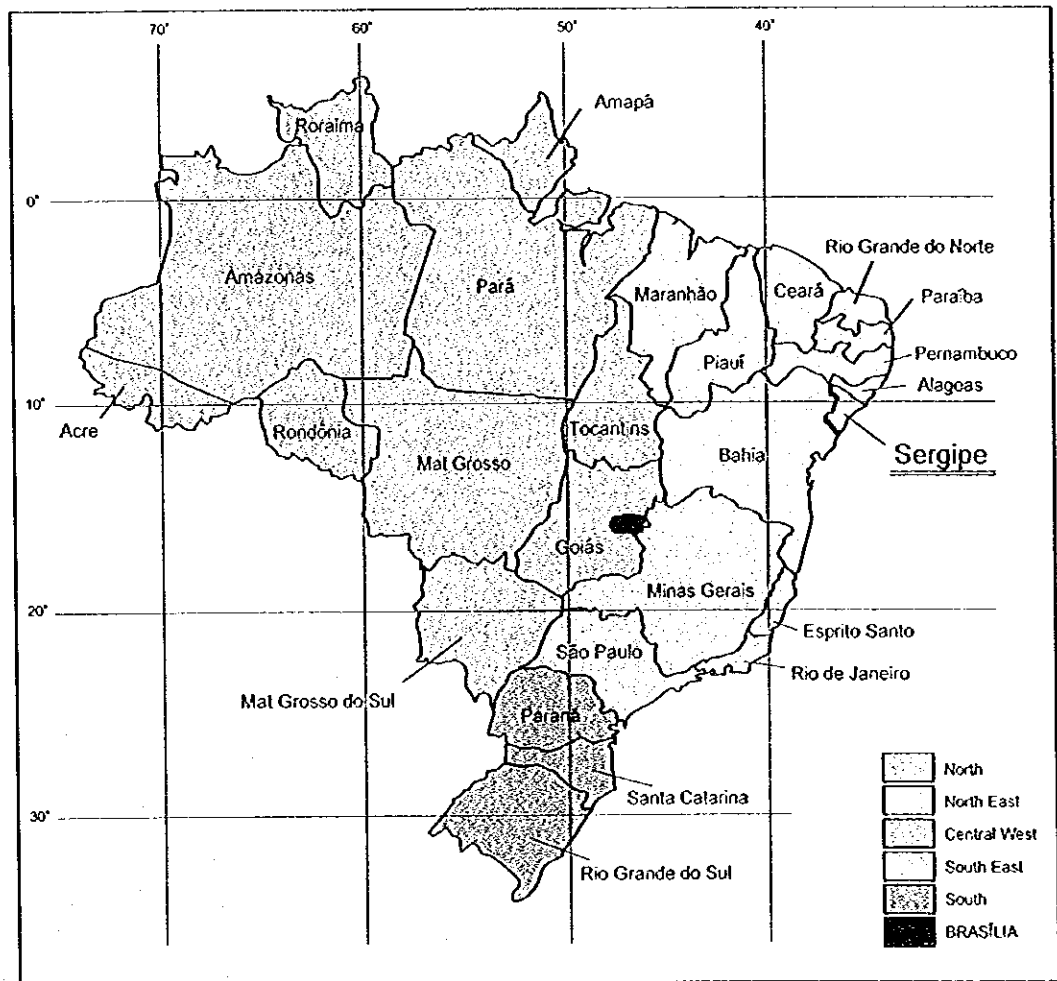
Part II Feasibility Study :

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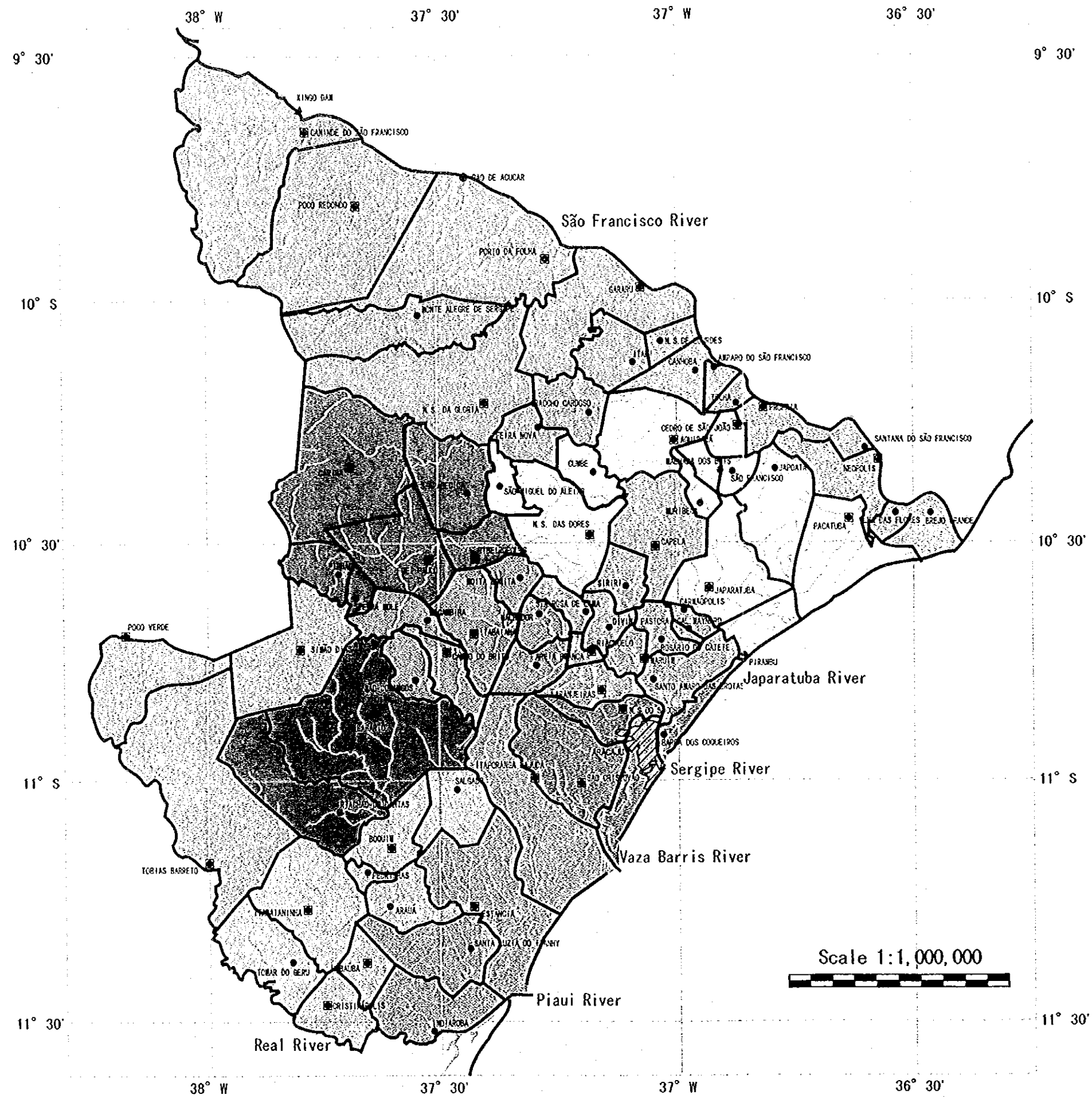
Location of Brazil
















Location of Sergipe




LOCATION MAP



LEGEND (Micro-region)

-  SERGIPANA DO SERTÃO DO SÃO FRANCISCO
-  CARIRA
-  NOSSA SENHORA DAS DORES
-  AGRESTE DE ITABAIANA
-  TOBIAS BARRETO
-  AGRESTE DE LAGARTO
-  PROPRIA
-  COTINGUIBA
-  JAPARUTUBA
-  BAIXO COTINGUIBA
-  ARACAJU
-  BOQUIM
-  ESTANCIA

Scale 1:1,000,000

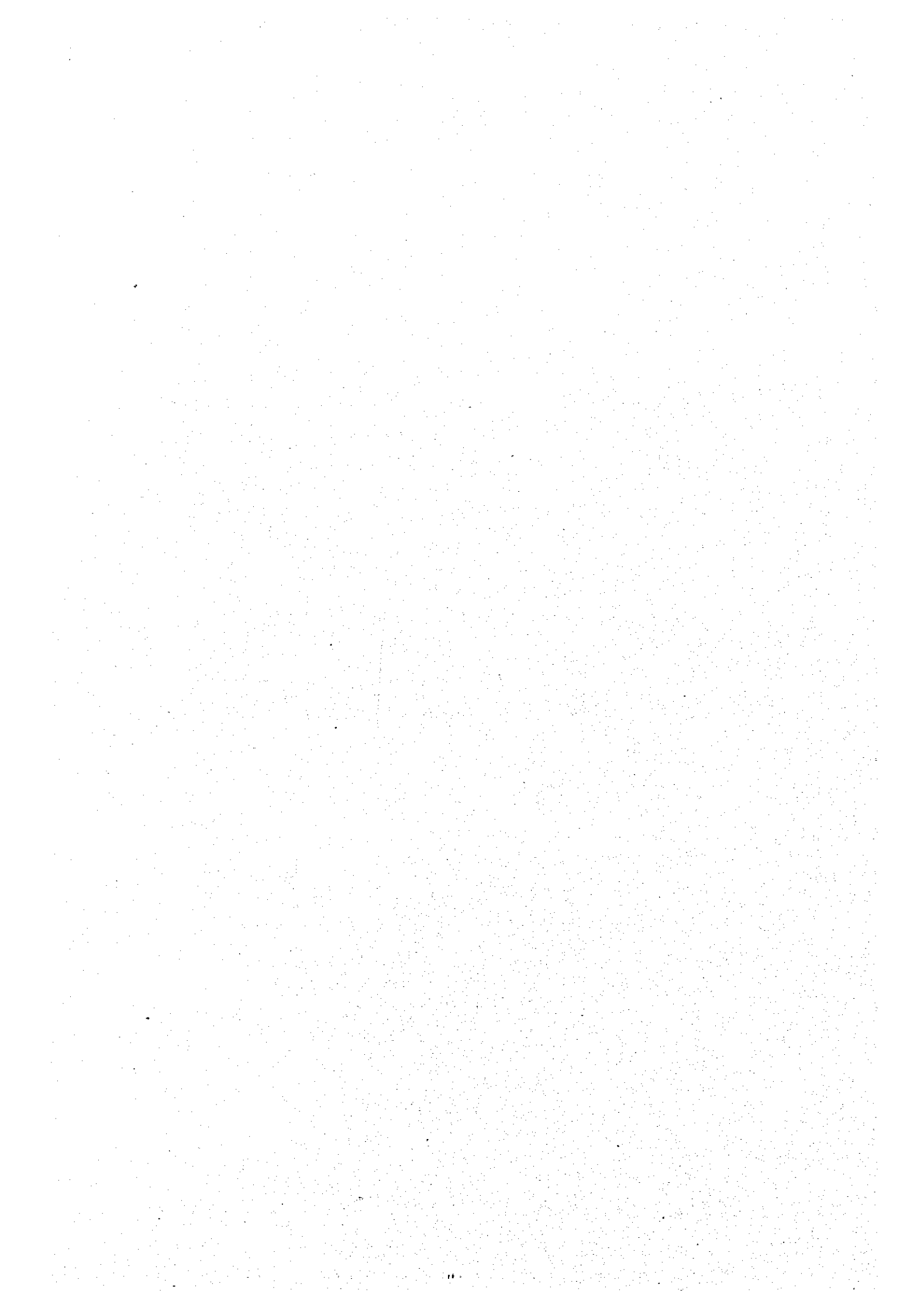


Map of the Study Area



- LEGEND (Micro-region)
- SERGIPANA DO SERTÃO DO SÃO FRANCISCO
 - CARIRA
 - NOSSA SENHORA DAS DORES
 - AGRESTE DE ITABAIANA
 - TOBIAS BARRETO
 - AGRESTE DE LAGARTO
 - PROPRIA
 - COTINGUIBA
 - JAPARUTUBA
 - BAIXO COTINGUIBA
 - ARACAJU
 - BOGUIM
 - ESTANCIA

Map of the Study Area



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LIST OF ABBREVIATIONS

Abbreviation	Official Name in Brazil	Name Translated in English
ADEMA	Administração Estadual do Meio Ambiente	State Department of Environment
ANA	Agência Nacional de Água	National Water Agency
ANEEL	Agência Nacional de Energia Elétrica	National Agency of Electric Energy
ASES	Agência Reguladora de Serviços Concedidos	Agency for Public Services Inspection
CEMIG	Companhia Energética de Minas Gerais	Minas Gerais Power Company
CECMA	Conselho Estadual de Controle do Meio Ambiente	State Council of Environmental Control
CEHOP	Companhia Estadual de Habitação e Obras Públicas	State Company of Housing and Public Works
CEPEL	Centro de Pesquisa de Energia Elétrica	Electric Power Research Center
CEPES	Central de Pesquisas Espaciais de Sergipe	Sergipe Space Research Center
CHESF	Companhia Hidroelétrica do São Francisco	São Francisco Hydropower Electricity Corporation
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico	National Council of Science and Technology Development
CNRH	Conselho Nacional de Recursos Hídricos	National Council of Water Resources
CNRNR	Conselho Nacional dos Recursos Naturais Renováveis	National Council of Renewal Natural Resources
CODEVASF	Companhia de Desenvolvimento do Vale do São Francisco	São Francisco Valley Development Corporation
CODISE	Companhia de Desenvolvimento Industrial e de Recursos Minerais de Sergipe	Industry and Mineral Resources Development Corporation of Sergipe State
COFIEIX	Comissão de Financiamentos Externos	Commission of International Finance
COHIDRO	Companhia de Desenvolvimento de Recursos Hídricos e Irrigação de Sergipe	Sergipe Water Resources and Irrigation Development Corporation
CONAMA	Conselho Nacional do Meio Ambiente	National Council of Environment
CONDESE	Conselho do Desenvolvimento Econômico de Sergipe	Sergipe Economic Development Council
CONERH/SE	Conselho Estadual de Recursos Hídricos	State Council of Water Resources
CVRD	Companhia Vale do Rio Doce	Council of Doce River Valley
DC	Defesa Civil	Civil Defense
DESO	Companhia de Saneamento de Sergipe	Sergipe Sanitation Corporation
DNAEE	Departamento Nacional de Águas e Energia Elétrica	National Department of Water and Electric Energy
DNER	Departamento Nacional de Estados e Rodagens	National Department of Roads and Highways
DNOCS	Departamento Nacional de Obras Contra as Secas	National Department of Drought Countermeasure
ELETRORBRAS	Centrais Elétricas Brasileiras S.A.	Brazilian Central Electric Joint-stock Company
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária	Brazilian Agriculture and Livestock Research Company
EMDAGRO	Empresa de Desenvolvimento Agropecuário de Sergipe	Sergipe Agriculture and Livestock Development Company
FAO	Fundo das Nações Unidas para Alimentação e Agricultura	Food and Agriculture Organization
FIDA	Fundo Internacional de Desenvolvimento Agrícola	International Fund of Agriculture Development
FNS	Fundação Nacional de Saúde	National Foundation Health
FUNERH	Fundo Estadual de Recursos Hídricos	State Fund of Water Resources
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis	Brazilian Institute of Environment and Renewable Natural Resources
IBGE	Instituto Brasileiro de Geografia e Estatística	Brazilian Institute of Geography and Statistics
IICA	Instituto Interamericano de Cooperação para a Agricultura	Interamerican Institute of Agricultural Cooperation
INCRA	Instituto de Nacional de Colonização e Reforma Agrária	National Institute of Colonization and Agricultural Reform

Abbreviation	Official Name in Brazil	Name Translated in English
ITPS	Instituto de Tecnologia e Pesquisas de Sergipe	Sergipe Institute of Technology and Research
JBIC	Banco de Cooperação Internacional do Japão	Japan Bank for International Cooperation
JICA	Agência de Cooperação Técnica Internacional do Japão	Japan International Cooperation Agency
JIS	Padrão Industrial do Japão	Japan Industrial Standard
MMARHAL	Ministério do Meio Ambiente, dos Recursos Hídricos e da Amazônia Legal	Ministry of Environment, Water Resources and Legal Amazon
MPO (change to MP)	Ministério de Planejamento e de Orçamento	Ministry of Planning and Budget
MP (change from MPO)	Ministério do Planejamento, Orçamento e Gestão	Ministry of Planning, Budget and Management
OECE	Fundo Cooperação e Económica Ultramarino	Overseas Economic Cooperation Fund
PERH	Plano Estadual de Recursos Hídricos	State Plan of Water Resources
PROÁGUA/ Semi-Árido	Sub-Programa de Desenvolvimento Sustentável de Recursos Hídricos para o Semi-Árido Brasileiro	Water Resources Development Program for Brazilian Semi-Arid Areas
PRÓ-SERTÃO	Projeto de Apoio às Famílias de Baixa Renda da Região Semi-Árida de Sergipe	Low Income Family Supporting Project in Semi-Arid Region of Sergipe
PROVABASE	Projeto do Desenvolvimento dos Recursos Hídricos e Abastecimento de Água com Aproveitamento do Rio Vaza Barris em Sergipe	Project of Water Resources Development and Supply in Vaza Barris River - Sergipe
RBC		River Basin Committee
SAGRI	Secretaria de Estado da Agricultura, do Abastecimento e da Irrigação	State Secretariat of Agriculture, Supply and Irrigation
SEAIN	Secretaria Assuntos Internacionais	Secretariat of International Affairs
SEEC	Secretaria de Estado de Educação e Cultura	State Secretariat of Education and Culture
SEED	Secretaria de Estado de Educação e do Desporto	State Secretariat of Education and Sports
SEFAZ	Secretaria de Estado da Fazenda	State Secretariat of Finance
SEICT	Secretaria de Estado da Indústria, do Comércio e do Turismo	State Secretariat of Industry, Commercial and Tourism
SEMA	Secretaria de Estado do Meio Ambiente	State Secretariat of Environment
SESP	Secretaria de Estado de Serviços Públicos	State Secretariat of Public Services
SEPLAN	Secretaria de Estado do Planejamento	State Secretariat of Planning
SEPLANTEC	Secretaria de Estado do Planejamento e da Ciência e Tecnologia	State Secretariat of Planning, Science and Technology
SES	Secretaria de Estado da Saúde	Secretariat of Health
SOE	Empresas possuídas pelo Estado	State owned Enterprise
SPEO	Superintendência de Planejamento e Orçamento	Superintendency of Planning and Budget
SRH	Superintendência de Recursos Hídricos	Superintendency of Water Resources
SRHII	Secretaria de Recursos Hídricos	Secretariat of Water Resources
SSP	Secretaria de Estado da Segurança Pública	State Secretariat of Public Security
SUDENE	Superintendência de Desenvolvimento do Nordeste	Superintendency of Northeast Brazil Development
SUPES	Superintendência de Estudos e Pesquisas	Superintendency of Study and Research
UEGP	Unidade Estadual de Gestão do PROÁGUA	State Unit of PROÁGUA Management
UFS	Universidade Federal de Sergipe	Federal University of Sergipe
UGP	Unidade de Gestão do PROÁGUA	Project Management Unit
UNDP	Programa da Nações Unidas para o Desenvolvimento	United Nation Development Program
USBR	Departamento de Interior dos Estados Unidos	United States Department of Interior, Bureau of Reclamation
USCE	Exército dos Estados Unidos, Corpo de Engenheiros	United States Army, Corps of Engineers
WA		Water Agency
WHO	Organização Mundial de Saúde	World Health Organization

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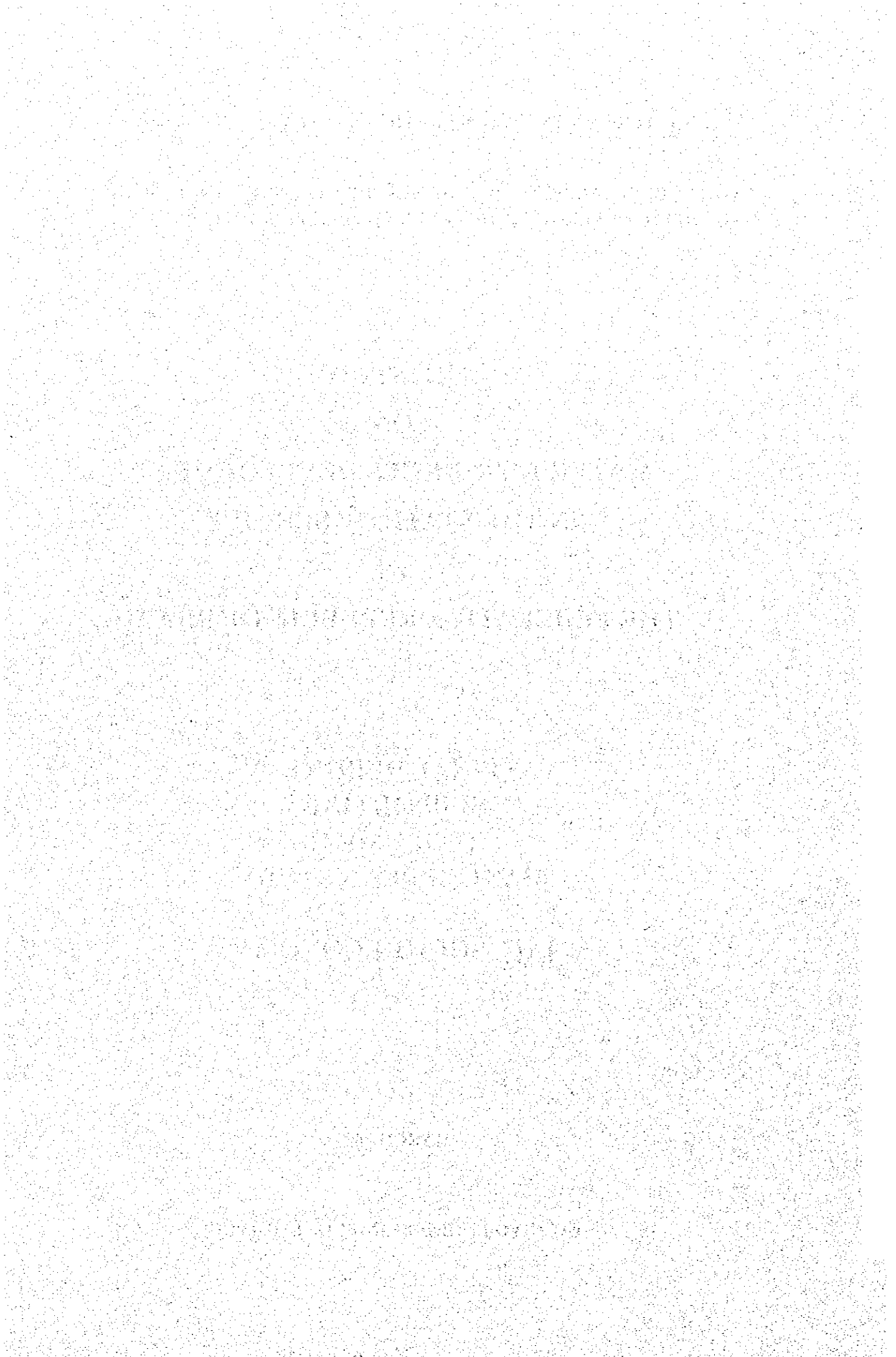
**THE STUDY
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**FINAL REPORT
SUPPORTING
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MASTER PLAN STUDY**

[A] SOCIO-ECONOMY

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**THE STUDY ON WATER RESOURCES DEVELOPMENT
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**SUPPORTING REPORT (A)
SOCIO-ECONOMY**

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CHAPTER 1 PRESENT SOCIO-ECONOMY

The socio-economic study aims at presenting two aspects for planning sections in this master plan: (1) present socio-economic structures in sectors concerned to water resources development; and (2) future socio-economic framework in the sectors. These two aspects are not only essential for planning but also fundamental for estimation of water requirement in water consumers such as domestic, industrial and agriculture sectors.

The present socio-economy is presented in Chapter 1 and the future socio-economy is presented in Chapter 2.

1.1 Administrative Units

1.1.1 Central Government

Presently, according to the Constitution of the Federative Republic of Brazil and the Constitution of the State of Sergipe, the state's central government is divided into two types of organs: (1) the organs of the direct administration; and (2) those of the indirect administration.

(1) Organs of the Direct Administration

The responsible of the state administration is the Governor (Governador). The state has 17 secretariats with their attribution under his control, for example: Secretariat of Finance, Secretariat of Planning, Science and Technology. In addition to these secretariats, the state has some assistant organs for Governor such as Cabinet of Governor, Vice Governor & his Cabinet and Cabinet of State Police.

(2) Organs of the Indirect Administration

The state has 8 autarchies, 10 public enterprises and companies, and 3 foundations under the administration of the secretariats, for example: State Administration of Environment (ADEMA), Sanitation Company (DESO), State Company of Housing and Public Works (CEHOP), and Company of Water Resources Development and Irrigation (COHIDRO).

1.1.2 Local Government

The State of Sergipe is composed of 75 municipalities presently. Each municipality has the administration organ under the control of the Mayor (Prefeito) and has the City Hall & City Council.

1.2 River Basin Area

Sergipe State can be divided into six river systems as shown in Table-1.1.

River basin boundaries were determined from the SUDENE 1:100,000 scale maps and the basin areas were measured by a planimeter – the measured areas are also shown above. The basin boundaries were then copied to the map showing the local government (municipality) boundaries. The location and area of each municipality could then be determined in relation to the six river basins. The distribution of basin area by municipality is given in Appendix-1.

Table-1.1 Distribution of Basin Area

Unit: km²

Micro-Region	River Basin						
	Sao Francisco	Japarutuba	Sergipe	Vaza Barris	Piaui	Real	Total
Total	7,276.3	1,722.0	3,673.0	2,559.0	4,262.0	2,558.0	22,050.3
Sergipana do S. do S. F	4,899.6	120.7	435.8	—	—	—	5,456.0
Carira	—	—	974.7	908.5	—	—	1,883.2
N. S. das Dores	320.4	376.7	571.7	—	—	—	1,268.8
Agreste de Itabaiana	—	—	439.4	666.4	—	—	1,105.8
Tobias Barreto	—	—	—	135.8	474.6	1,450.3	2,060.6
Agreste de Lagarto	—	—	—	208.8	1,145.6	136.5	1,490.9
Propria	1,014.9	—	—	—	—	—	1,014.9
Cotinguiba	—	570.1	188.1	—	—	—	758.2
Japarutuba	1,041.4	423.3	—	—	—	—	1,464.7
Baixo Cotinguiba	—	220.1	516.9	—	—	—	737.0
Aracaju	—	11.2	513.5	334.6	—	—	859.3
Boquim	—	—	—	—	1,079.6	816.8	1,896.4
Estancia	—	—	32.9	304.9	1,562.2	154.5	2,054.5

1.3 Census Population

1.3.1 State Population

Population distribution is one of the most fundamental information to formulate a water resources development plan. Although the latest population census was worked out in 1991, the provisional population census, so called "Contagem da Populacao", was made by IBGE in 1996. Thus, the population distribution was principally based on the 1996 census in this study.

Table-1.2 Census Population and Annual Growth

Unit: 1,000 persons

Item	1970	1980		1991		1996	
	Population	Population	Growth	Population	Growth	Population	Growth
Brazil	93,139.0	119,002.7	2.48	146,825.5	1.93	157,079.6	1.36
Sergipe	901.6	1,140.1	2.37	1,491.9	2.47	1,624.2	1.71
Urban	420.0	623.0	4.02	1,002.4	4.42	1,140.6	2.62
Rural	481.6	517.1	0.71	489.5	-0.50	483.6	-0.24
By Micro-region							
Sergipana S. do SF	74.4	101.0	3.11	113.1	1.03	115.9	0.50
Carira	44.0	51.1	1.50	54.9	0.65	57.4	0.91
N. S. das Dores	47.1	48.6	0.33	51.6	0.53	53.9	0.89
A. de Itabaiana	80.8	98.5	2.00	120.7	1.87	135.6	2.36
Tobias Barreto	63.8	72.2	1.24	87.4	1.76	92.1	1.04
A. de Lagarto	67.9	75.8	1.11	89.1	1.48	93.1	0.88
Propria	70.3	70.5	0.03	78.1	0.93	81.7	0.90
Cotinguiba	30.8	33.5	0.84	37.4	1.00	38.7	0.69
Japarutuba	30.6	33.5	0.89	42.1	2.11	43.7	0.75
B. Cotinguiba	41.1	48.7	1.71	66.4	2.85	70.5	1.20
Aracaju	219.2	338.9	4.45	530.2	4.15	607.6	2.76
Boquim	75.9	98.6	2.64	125.2	2.20	134.2	1.40
Estancia	55.8	69.2	2.18	95.7	2.99	99.7	0.84

Source: Censo Demografico-1970, 1980 and 1991 - IBGE

Contagem da Populacao - IBGE

Note: Growth in %

According to the 1996 census by IBGE, Brazil has a population of 157 million. This population increased by 10 million as compared to the 1991 census. During the 1990s, the average growth rate was 1.36% per annum. It slowed down from 1.93% per annum during 1980s.

In Sergipe State, the 1996 census population was 1.62 million or 1.03% of the national population. The average growth rate during the 1990s was 1.71% per annum. This growth rate was larger than that of the country.

The population in the urban area of Sergipe State was 1.14 million in the 1996 census or shared 70% of the state population, still less concentrated compared with that of Brazil which shared 78% in the census. The average growth rate during the 1990s was 2.62% per annum, which, though slowed down from 4.42% per annum during the previous decades, showed more accelerated rate than that of Brazil, 2.09% per annum.

Meanwhile, the population in the rural area of the state in the 1996 census has moved downward continuously to 0.48 million or shared only 30% in the state.

Among the 75 municipalities in the state, Aracaju City, the capital of the state, has the largest population and a function of not only politics but also economic center of the state. Its census population was 428,194 or 26% of the state population in 1996. The growth rate during the 1990s was 1.25% per annum on average, which was smaller than that of the state and the country. The second and third largest municipality in the same census was Nossa Senhora do Socorro with population of 105,728 or share of 6.5% and Lagarto with that of 75,316 or share of 4.6%, respectively. Nossa Senhora do Socorro is urban city around Aracaju City and gained the most accelerated growth rate of 9.4% among all during 1990s. Census population by municipality is given in Appendix-2.

1.3.2 River Basin Population

There is no statistical information regarding river basin population in the state. So the distribution of population by each river basin was conducted by the Study Team as shown in Table-1.3. The distribution to each river basin was made on the municipality basis. The municipalities located in two or more river basins are calculated as follows. In general, rural population was distributed by the percentage of each river basin area in the municipality. Urban population of each municipality was totally allocated to the river basin in which town is located. For the few cases where the town is located on the boundary between two river basins, the urban population is divided equally to each basin. The distribution percentage of those urban populations is given in Appendix-1.

Table-1.3 River Basin Population and Annual Growth

Unit: 1,000 persons

River Basin	1970		1980		1991		1996	
	Population	Population	Growth (%)	Population	Growth (%)	Population	Growth (%)	
S. Francisco	168.1	193.4	1.41	217.3	1.06	224.2	0.63	
Japarátuba	65.1	71.6	0.95	84.5	1.52	90.8	1.44	
Sergipe	333.7	478.3	3.67	677.3	3.21	759.2	2.31	
V. Barris	99.6	104.0	0.43	141.5	2.84	165.2	3.15	
Piauí	166.1	208.7	2.31	267.6	2.29	273.5	0.44	
Real	68.9	84.1	2.01	103.7	1.92	111.3	1.43	
Total	901.6	1,140.1	2.37	1,491.9	2.47	1,624.2	1.71	

1.3.3 Population Density and Family Size

According to the 1991 census, a population density of the state was 68 persons/km². The density of the respective micro-regions were ranged from the largest one of 617 persons/km² in Aracaju Micro-region to the smallest of 21 persons/km² in Sergipana do Sertao do Sao Francisco Micro-region.

An average family size was 4.23 in the state according to the 1991 census. Among the 13 micro-regions, the largest family size was Sergipana do Sertao do Sao Francisco Micro-region of 4.80. The smallest one was Agreste de Itabaiana Micro-region of 4.11.

1.4 Labor Force

In 1991, the labor force in Sergipe State registered 530,700. Of this number, 513,100 or 96.7% were employed. Thus, an unemployment rate was only 3.3% in the state. This rate was somewhat larger than that in the 1980 census year.

In the past, the agricultural sector, so called as the primary sector, used to absorb the greatest portion of manpower resources in the state. In the 1991 census this sector accounted for only 149,200 or 29.7% of the total labor force. It recorded a drastic decrease to 149,700 or 42.3% in the 1980 census from 161,000 or 60.9% in the previous census 1970.

The industrial sector, or the secondary sector, employed the smallest share of the labor force among the three major economic sectors. Its share was 17.4% in the state in 1991. It increased only 0.1% from the previous census 1980. In the manufacturing sub-sector, its share of labor force kept the same percentage of 7.4% in the 1980s. Thus, the industrial contribution for the state economy has stayed almost unchanged since 1980.

On the other hand, the number of workers in the service sector, or the tertiary sector, expanded at an annual rate of 6.5% in the state during 1980s. In particular, the public service sub-sector registered the highest rate of 7.6% per annum among all sectors and sub-sectors. Then, the share of the services sector increased from 37.2% in 1980 to 49.6% in 1991 in the state.

Table-1.4 Number of Labor Force (over 10 years old)

Item	Gainful Workers (1,000 Persons)			Percentage Distribution(%)			Ave. Growth Rate(%)	
	1970	1980	1991	1970	1980	1991	'70-'80	'80-'90
1. Agriculture	161.0	149.7	149.2	60.7	42.3	28.2	-0.7	0.0
2. Industry	31.1	61.4	100.5	11.7	17.3	18.9	7.0	4.6
-Manufacturing	15.2	26.3	39.2	5.7	7.4	7.4	5.7	3.7
3. Services	68.6	131.4	263.5	25.8	37.2	49.6	6.7	6.5
-Commerce	15.1	28.5	56.1	5.7	8.1	10.6	6.5	6.3
-Social Services	10.3	25.1	53.7	3.9	7.1	10.1	9.3	7.2
-Public Services	9.0	14.2	31.6	3.4	4.0	6.0	4.7	7.6
4. No Jobs	4.8	11.2	17.6	1.8	3.2	3.3	8.8	4.2
	265.5	353.7	530.8	100.0	100.0	100.0	2.9	3.8

Source: Censo Demografico 1991, Mao-de Obra, No. 16 Sergipe, IBGE
 Recenseamento Geral do Brasil 1980, Censo Demografico, Mao-de Obra, Sergipe, 1983, IBGE
 Censo Demografico, Sergipe, Recenseamento Geral 1970, Dec. 1972, IBGE

1.5 Gross Regional Domestic Product

Gross domestic product (GDP) in Brazil was R\$658 billion at market prices in 1995. It was broken down into gross value added (GVA) of main economic sectors as shown in Table-1.5. They were summarized as follows: R\$68 billion at factor cost in the agricultural sector or 12.2% of GDP, R\$189 billion in the industrial sector or 33.6%, and R\$344 billion in the services sector or 54.2%. Per capita GDP was R\$4,250 as shown in Table-1.8.

Gross regional domestic product (GRDP) of Sergipe State in 1995 was R\$3.60 billion, accounting for 0.55% of GDP. GVA share to GRDP of main three economic sectors in the state was tabulated in Table-1.6. They are broken down R\$0.42 billion or 12.6% of GRDP for agriculture, R\$1.00 billion or 30.2% for industry, and R\$1.90 billion or 57.3% for services. Per capita GRDP in 1995 was R\$2,260 as shown in Table-1.8. It was only 53% of the national per capita GDP. Incidentally, GRDP of state level was estimated by SUDENE.

Table-1.5 GDP & GRDP at 1995 Constant Prices

Unit: R\$ billion						
Economic Sector	1990	1991	1992	1993	1994	1995
Gross Domestic Product in Brazil						
1. Agriculture	55.5	57.0	60.1	59.5	65.0	68.3
2. Industry	173.8	170.1	162.9	173.7	185.7	189.0
-Manufacturing	111.5	108.9	104.5	112.9	121.7	123.8
3. Services	333.2	330.2	327.5	331.9	338.1	343.8
-Commerce	31.8	31.8	31.0	33.1	35.1	38.0
4. Sub-total	562.5	557.3	550.4	565.1	588.8	601.1
5. GDP at Factor Cost	511.5	510.4	505.7	521.4	546.3	561.8
6. GDP at Market Price	601.8	584.8	574.3	597.0	638.8	658.1
Gross Regional Domestic Product in Sergipe						
1. Agriculture	0.55	0.62	0.51	0.31	0.41	0.42
2. Industry	1.01	0.91	0.95	0.98	0.98	1.00
3. Services	1.60	1.67	1.66	1.72	1.80	1.90
4. GRDP at Factor Cost	3.16	3.21	3.12	3.01	3.19	3.31
5. GRDP at Market Price	3.37	3.40	3.31	3.20	3.47	3.60

Source: Anuário Estatístico do Brasil 1996,1997, IBGE

Agregados Econômicos Regionais, Nordeste do Brasil, 1965-95, 1996, MPO, SUDENE

Note: Value added of the respective sectors was calculated applying the economic indices in the references above.

Table-1.6 Percentage Distribution of G(R)DP by Economic Sector

Unit: %						
Economic Sector	1990	1991	1992	1993	1994	1995
Brazil						
1. Agriculture	11.8	11.5	12.2	12.4	14.2	12.2
2. Industry	41.3	38.4	38.3	37.9	36.1	33.6
Manufacturing	29.6	26.6	25.7	25.1	23.7	22.0
3. Services	46.9	50.1	49.5	49.7	49.7	54.2
Commerce	8.2	7.6	7.6	7.6	7.2	6.8
Total	100.0	100.0	100.0	100.0	100.0	100.0
Sergipe State						
1. Agriculture	16.6	16.3	16.8	7.8	12.7	12.6
2. Industry	38.9	42.4	37.1	40.2	33.2	30.2
Manufacturing	20.8	17.8	17.4	20.0	-	-
3. Services	44.6	41.4	46.1	52.0	54.1	57.3
Commerce	17.6	16.8	15.1	17.8	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Anuário Estatístico do Brasil, 1996, 1997, IBGE

Agregados Econômicos Regionais, Nordeste do Brasil, 1965-95, 1996, MPO, SUDENE

For six years, GDP increased from R\$602 billion to R\$658 billion in real terms, i.e., average growth rate of 1.3% per annum. GRDP in Sergipe State grew at a rate of 1.0% per annum on average for the same period, which was smaller than the growth rate of the country. Then, the share of the state in the country diminished for this period. The real growth rates of the main economic sectors on average per annum during 1990 to 1995 were shown in the Table-1.7.

Table-1.7 Real Growth of G(R)DP by Economic Sector

Economic Sector	Unit: %					
	1991	1992	1993	1994	1995	'90-'95
Brazil						
1. Agriculture	2.8	5.4	-1.0	9.3	5.1	4.2
2. Industry	-2.1	-4.3	6.7	6.9	1.8	1.7
Manufacturing	-2.4	-4.1	8.1	7.8	1.7	2.1
3. Services	-0.9	-0.8	1.4	1.9	1.7	0.6
Commerce	0.1	-2.5	6.6	6.0	8.5	3.7
Total	-0.9	-1.2	2.7	4.2	2.1	1.3
Sergipe State						
1. Agriculture	13.1	-18.2	-39.0	30.6	2.7	-5.4
2. Industry	-10.0	4.6	3.1	-0.3	2.2	-0.2
3. Services	4.7	-0.6	3.3	5.0	5.2	3.5
Total	1.4	-2.5	-3.6	5.9	4.0	1.0

Source: Anuario Estatístico do Brasil, 1996, 1997, IBGE

Agregados Economicos Regionais, Nordeste do Brasil, 1965-95, 1996, MPO, SUDENE

As shown in Table-1.8, in terms of average annual growth between 1990 and 1995, both per capita GDP and per capita GRDP of the state were calculated as of 0.4% and -0.5%, respectively. These figures imply that both economic conditions have kept almost the same level for the past six years, although the economy has fluctuated for the period. These in 1991 and 1992 were resulted in serious negative growth in particular. In 1995, these barely recovered to the 1990 level in consequence of the recent real growth.

Table-1.8 Real Growth of G(R)DP per Capita

Economic Sector	1990	1991	1992	1993	1994	1995
G(R)DP per Capita at 1995 Constant Prices (R\$)						
Brazil	4,168	3,980	3,857	3,956	4,177	4,246
Sergipe	2,312	2,282	2,184	2,073	2,210	2,256
	1991	1992	1993	1994	1995	'90-'95
Annual Growth Rate (%)						
Brazil	-4.5	-3.1	2.6	5.6	1.7	0.4
Sergipe	-1.3	-4.3	-5.1	6.6	2.1	-0.5

Source: Anuario Estatístico do Brasil 1996, 1997, IBGE

Agregados Economicos Regionais, Nordeste do Brasil, 1965-95, 1996, MPO, SUDENE

1.6 Economic Sector Profile

1.6.1 Agricultural Sector

Value added (VA) of agriculture sector accounted for 13.8% of GRDP on average during 6 years from 1990 to 1995, which fluctuated between 9.7% in 1993 and 18.2% in 1991. The real growth of agriculture sector during the same period was a decline of 5.4% per annum, as shown in Table-1.7, which was far greater than 0.24% decline per annum of the rural population between 1991 and 1996 census.

Production tendency changed so much during this decade. The crop area of cotton, sugarcane and maize declined between 1985 and 1996 as shown in Table-1.9. Particularly, the area of cotton declined dramatically. Adversely, the production of coco and orange increased remarkably. Orange production in particular increased more than 40% during the same period and shared substantial portion in the agriculture sector of the state.

Table-1.9 Main Agriculture Products

Item	Production (1,000 ton)			Crop Area (1,000 ha)		
	1985	1996	Changes (%)	1985	1996	Changes (%)
Cotton	13.5	0.8	-99.9	33.8	1.9	-94.4
Sugarcane	1,605.9	1,341.8	-16.4	26.5	22.4	-15.5
Cassava	461.1	597.0	29.5	35.2	39.8	13.1
Maize	98.5	114.2	15.9	98.5	81.6	-17.1
Coco (1000 fruits)	80.9	95.4	17.9	42.6	50.2	17.8
Orange (1000 fruits)	2,920.6	4,173.1	42.8	28.3	41.4	46.3

Source: "Municipal Agriculture Production, 1981-1996" (IBGE) and EMDAGRO for Modification

As to the livestock, pig and poultry population increased slightly but cattle population and the production of milk and eggs decreased remarkably between 1990 and 1995 as shown in Table-1.10.

Table-1.10 Main Livestock Population and the related Production

Item	Number (1,000 heads)		
	1990	1995	Changes (%)
Cattle	1,030	797	-22.6
Pig	96	99	3.1
Poultry	2,925	3,041	4.0
Milk (1000 liters)	99,862	66,013	-33.9
Eggs (1000 dozens)	10,325	6,719	-34.9

Source: "Municipality Livestock Population, 1976 to 1995" (IBGE) and EMDAGRO for Modification

1.6.2 Mining and Industrial Sector

VA of mining and industrial sector accounted for 28.3% of GRDP on average during 6 years from 1990 to 1995. The real growth of the sector during the same period declined 0.2% per annum.

According to the economic census by IBGE in 1985 and Official Registration of Industries in Sergipe 1991/92 (Cadastro Industrial Sergipe 1991/92) by CODISE, in the terms of distribution of gross production value, manufacturing sector shared 56% in 1991/92, but decreased dramatically from almost 100% during the preceding decade. Light industries such as textiles and food industries accounted for dominant shares in the state. On the other hand, mining sector, especially crude oil extraction industry, surged to 44% from almost nothing. Number of establishment decreased from 1,918 in 1980 to 1,458 in 1991/92, mainly due to non-metallic sector, which declined from 826 to 143 in the same period.

Both number of establishments and distribution of gross production value were concentrated in large cities such as Aracaju, Estancia, Itabaiana and Laranjeiras that shared respectively 53.2% in 1991/92 and 73.5% in 1985.

Table-1.11 Mining and Industrial Aspect

Item	Number of Establishments			Distribution of Gross Production Value (%)		
	1980	1985	1991/92	1980	1985	1991/92
Sergipe	1,918	1,989	1,458	100.0	100.0	100.0
Mining	43	35	4	0.3	0.3	44.4
Manufacturing	1,875	1,954	1,454	99.7	99.7	55.6
Textile	121	94	122	40.8	37.3	14.1
Food & Beverage	479	511	570	26.9	26.8	11.8
Non-Metallic	826	837	143	13.3	10.2	3.2
Chemical	15	21	23	1.3	16.7	4.9
Others	434	491	596	17.4	8.7	21.6
Aracaju	383	409	627	50.7	35.8	-
Estancia	66	56	57	13.8	14.0	-
Itabaiana	126	132	86	2.0	1.4	-
Laranjeiras	14	38	6	4.2	22.3	-

Source: Censo Economico de 1985, Industria, Comercio e Service, Volume 2, IBGE
Cadastro Industrial Sergipe, 1991/92, SEICT, CODISE and SEBRAE

1.6.3 Services Sector

VA of services sector accounted for 50.9% of GRDP on average during 6 years from 1990 to 1995. The real growth of the sector increased 0.9% per annum, in spite of decline in other sectors.

According to the economic census by IBGE in 1985, the wholesale and retail sector amounted to dominant share of 90% both in 1980 and 1985, as shown in Table-1.12. Aracaju City also took a predominant position of the sector in the same years.

Table-1.12 Aspect of Services Sector

Item	Number of establishments		Contribution of Sales Amount (%)	
	1980	1985	1980	1985
Sergipe	5,609	7,439	100.0	100.0
Wholesale & retail	3,805	4,766	89.9	90.7
Others	1,804	2,673	10.1	9.3
Aracaju	2,424	2,979	66.3	59.8

Source: Censo Economico de 1985, Industria, Comercio e Service, Volume 2, IBGE

1.7 Inflation

In Brazil, consumer price index is widely used as one of instrument to measure inflation. The consumer price index of Brazil moved moderately downwards during these years, as shown in Table-1.13. In Sergipe, the index declined also moderately till 1997 but upward movement has taken place in 1998 though moderate. According to SUPES survey, the price advances in 1998 were concentrated largely in the durable goods and food /beverage sector. The rest of items are showing moderately 2 to 5%.

Table-1.13 Consumer Price Index

Year	Unit: %				
	1994	1995	1996	1997	1998*
Brazil ⁽¹⁾	1,238.0	25.9	11.3	7.2	1.8
Sergipe ⁽²⁾	995.5	13.9	9.2	5.6	6.8

Source: (1) Precos ao Consumidor, Brasil Total, FGV, Conjuntura Economica, 1998 October
(2) Indice de Vida - Aracaju, SEPLANTEC/SUPES, 1998 September

* as of September, 1998

1.8 State Finances

1.8.1 Financial Composition

The state government recorded a deficit balance for three consecutive fiscal years from 1994 till 1996. In fiscal year of 1997, the huge amount of surplus was realized due to privatization of a state owned electric enterprise, ENERGIPE. According to government official, this surplus will be carried over mainly for coming investment expenditure. In fiscal 1998, the government estimated a balanced budget.

As shown in Table-1.14, some 40 to 50% of total revenue were derived from transfers from Federal Government, some 30 to 35% from taxes, mainly ICMS (a kind of value added tax) and the rest from loans.

The major item among expenditures was personnel expenditure. The Law No. 82/95 requires the state government that total personnel expenditures of not only the state government officials but also of the state owned enterprises' employees whose salaries are paid from the state account shall not exceed, since 1998, 60% of the net current revenue that means total current revenue of the state excluding an amount transferred to municipalities. The percentage of proceeding 3 years was 85% in 1995, 73% in 1996 and 66% in 1997. Sergipe State government estimates possibility to achieve the requirement of this 60% in 1998 fiscal budget.

Table-1.14 Financial Composition of Sergipe State

Unit: R\$ million

Year	1994	1995	1996	1997	1998
Revenues	429.3	733.9	934.1	1,575.9	893.6
1. Current	326.2	643.7	729.8	861.9	802.6
1) Tax	139.6	262.2	313.3	372.5	330.0
2) Transfers from Federal Gov.	166.2	355.6	396.9	441.7	452.7
2. Capital*	103.1	90.2	204.3	714.0	91.0
1) Credit Operations	83.8	48.6	118.1	169.3	55.1
Expenditures	453.3	770.4	938.0	1,253.0	893.6
1. Current	312.0	700.4	719.2	843.8	687.3
1) Personnel	155.2	456.1	443.5	469.8	368.8
2) Financial	27.3	34.5	40.7	43.7	35.1
2. Capital	141.3	70.0	218.8	409.2	206.3
1) Investment	119.7	60.8	136.2	236.8	185.6
2) Repayment	14.6	9.0	82.4	172.4	20.5
Deficit/Surplus	-24.0	-36.5	-3.9	322.9	0.0
(% of Revenues)	-5.6%	-5.0%	-0.4%	20.5%	0.0%

Source: Balanco Geral, Governo de Sergipe, 1994,1995,1996 and 1997

Orcamento-Programa, Governo de Sergipe, 1998 (Original Budget)

* The amount of 1997 was mostly derived from the privatization of ENERGIPE, formerly owned by the state.

Investment, including financial investment, in total expenditures was 18% on average during the 5 years, fluctuating from 8.9% in 1995 to 26.5 in 1994.

1.8.2 Debt Situation

The state government finances were sustained by loans around 11% on average during the years from 1994 to 1998. The debts in Table-1.15 mean such accumulated amount of loan payable. In general, the debt amount is compared with net current revenue to measure its financial burden (Debt Ratio), as shown in Table-1.15. Although the debt ratio has been declining obviously, the state has still owed loans equivalent to one year's net current revenue.

Table-1.15 Debt-to-Net Current Revenue Ratio

Unit: R\$ 1,000 (1990-1992), R\$ million (1993-1998)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
A. Net Current Revenues	11.0	48.1	502.1	11.8	291.2	576.1	646.1	762.2	716.5
B. Debts	20.7	122.1	1613.1	44.7	383.8	569.0	684.2	746.4	737.8
C. Ratio (B/A)	188%	254%	321%	380%	132%	99%	106%	98%	103%

Source: Balanco Geral, Governo de Sergipe, 1994,1995,1996 and 1997
Orcamento-Programa, Governo de Sergipe, 1998 (Original Budget)

Note: Debts in 1998 is as of September.

Incidentally, loan is a negotiable matter. So loan period varies depending on the loan agreement. The state raised long-term funds in large part, which means financially less burdensome because of smaller annual repayment for the state. The debt payment, which means a total amount of repayment of loan and interest payment, is compared with net current revenue to measure its payment affordability (Debt Service Coverage Ratio), as shown in Table-1.16. In general, 25% of the ratio are considered a financial upper limit. The Sergipe state government has maintained constantly lower level of the ratio, except in 1997 when state owned enterprise was privatized and provisional repayment especially to BNDES was made from the fund of the stock release. It means that the state government financial condition is currently healthy in terms of debt service coverage ratio.

Table-1.16 Debt Service Coverage Ratio

Unit: R\$ 1,000 (1990-1992), R\$ million (1993-1998)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
A. Net Current Revenues	11.0	48.1	502.1	11.8	291.2	576.1	646.1	762.2	716.5
B. Debt Payment	2.0	3.1	23.5	1.4	41.9	43.5	123.1	216.1	55.5
C. Ratio (B/A)	18.2%	6.4%	4.7%	11.9%	14.4%	7.6%	19.1%	28.4%	7.7%

Source: Balanco Geral, Governo de Sergipe, 1994,1995,1996 and 1997
Orcamento-Programa, Governo de Sergipe, 1998 (Original Budget)

CHAPTER 2 FUTURE SOCIO-ECONOMIC FRAMEWORK

2.1 Population Projection

The long-term projection of population is indispensable for formulating the future framework of socio-economic structure in the project areas.

The population of Brazil was estimated up to the year 2020 by IBGE in the Annually Statistic Book in 1996 as shown in Table-2.1. Its annual growth rate was 1.0% between 1996 and 2020.

As to the population of Sergipe State, the SUPES provides population projections for the state with a breakdown of its municipality level during the period from 1990 to 2010 in the annual publication called "Anuario Estatístico de Sergipe 1996". These projections were based on the results of the 1991 census.

In this study, the future population is projected on the basis of the 1996 census results, applying the method of the SUPES projection. Table-2.1 shows the population projected up to the year 2020 at 10-year intervals. The projected population by municipality is given in Appendix-2. The state population in 2020 was projected at 2.78 million. Its growth rate is 2.3% on average between 1996 and 2020. It is smaller than that (2.47%) between the 1980 and 1991 censuses, but almost the same rate as the growth during 1970 to 1996.

Table-2.1 Projected Population in Sergipe: 1997 – 2020

Unit: 1000 persons

Item	Census 1996	Projected Population					
		1997	1998	2000	2010	2020	% (*)
Brazil	157,079	159,060	161,247	165,715	184,157	200,306	1.0
Sergipe	1,624	1,654	1,685	1,750	2,163	2,778	2.3
Urban	1,141	1,171	1,202	1,267	1,668	2,237	2.8
Rural	483	483	483	483	495	541	0.5
By Micro-region							
Sergip. do SF	116	117	117	119	131	154	1.2
Carira	57	58	59	60	70	85	1.7
N. S. das Dores	54	54	55	56	63	73	1.3
A. de Itabaiana	136	139	143	150	215	297	3.3
Tobias Barreto	92	93	94	97	110	132	1.5
A. de Lagarto	93	94	95	97	106	118	1.0
Propria	82	83	84	86	110	152	2.6
Cotinguiba	39	39	39	40	43	47	0.8
Japaratuba	44	44	44	45	51	59	1.3
B. Cotinguiba	70	71	72	75	91	115	2.1
Aracaju	608	625	643	680	891	1,212	2.9
Boquim	134	136	138	142	167	204	1.8
Estancia	100	101	102	103	115	130	1.1
By River Basin							
Sao Francisco	225	226	228	232	266	332	1.6
Japaratuba	91	95	95	97	116	147	1.4
Sergipe	759	776	798	841	1,016	1,494	2.9
Vaza Barris	165	160	163	168	203	253	1.8
Piauí	273	284	287	294	331	380	1.8
Real	111	113	114	118	141	172	2.0

Source: Anuario Estatístico do Brazil 1996, IBGE
 Contagem da População 1996, IBGE
 Anuario Estatístico de Sergipe 1996, SEPLANTEC/SUPES

* Annual growth rate between 1996 and 2020

2.2 GRDP Projection

The long-term projection of GRDP is also indispensable for formulating the future framework of the socio-economic structure in the project areas. Official GRDP projection is not available, even though the report of "Plano plurianual 1996-1999, Governo de Sergipe" tried to give the projection. Only the national development plan named "Perennial-Year Plan 1996-1999, Message from National Congress" proposed the target growth of 4.6% per annum on average during the planning period. The plan, however, presents the projections only until the year 1999. After that, no projection scenarios were suggested in any of the development plans, at present. Therefore, GDP and GRDP in the future are estimated on the following assumptions.

(1) GDP

- 1) Until the year 1999, GDP will increase at the growth rates predicted in the national plan, and continue to grow at the same rate of 5% as proposed in the plan to the year 2000.
- 2) Beyond the year 2000, the growth rates were assumed to slow down to the followings: three-quarters (3.75%) of the growth (5.0%) at the end of 20 century for the first decade and two-quarter (2.5%) for the second decade.

(2) GRDP

- 1) Till the year 2000, GRDP of the state will increase at the same growth rates (5.0%) as GDP's growth after 1997.
- 2) Beyond the year 2000, GRDP is assumed to keep the same rate of 5.0%, in order to alleviate the economic disparity between the national average and state level.
- 3) Agriculture Sector will be assumed to grow at the rate of 1% per annum after 1997. The growth rate of Industrial Sector and Services Sector after 1997 was estimated as shown in Table-2.2.

Table-2.2 GDP and GRDP Projection at 1998 Constant Prices

Year	1995	1997	1998	2000	2010	2020
GDP and GRDP (R\$ billion at 1998 Constant Prices) by Data and References						
1) Brazil	799.39	868.78	912.21	1,005.71	1,453.30	1,860.35
2) Sergipe	4.43	4.89	5.13	5.66	9.22	15.02
Agriculture	0.55	0.57	0.57	0.58	0.64	0.71
Industry	1.34	1.49	1.57	1.75	2.95	4.93
Services	2.54	2.83	2.99	3.33	5.63	9.38
Average Growth Rate (% annum)						
1) Brazil	1.80*	4.50	5.00	5.00	3.75	2.50
2) Sergipe	1.33*	5.00	5.00	5.00	5.00	5.00
Agriculture	-4.88*	1.00	1.00	1.00	1.00	1.00
Industry	1.94*	5.57	5.55	5.55	5.38	5.25
Services	3.90*	5.57	5.55	5.55	5.38	5.25

Source: Plano Pluriannual 1996-1999, Mensagem ao Congresso Nacional, GOB, MPO
Anuario Estatistico do Brazil 1996, IBGE

* Annual growth rate between 1990 and 1995

Note: Based on Precos ao Consumidor, FGV and SUPES, in Table-1.13 for calculating 1998 constant price

By 2020, GRDP of the state will reach to R\$15.02 billion at 1998 constant prices as shown in Table-2.2. It was 3.4 times of that (R\$4.43 billion) in 1995. Thus, it accounted for 0.80% in Brazil, which become larger than the percentage (0.55%) in 1995.

GRDP per capita in 2020 was calculated at R\$5,400 at 1998 constant prices, as shown in Table-2.3. It was 1.95 times of that (R\$2,770) in 1995. It was 58% of the national average, which became larger than that (54%) in 1995. Thus, the regional disparity could shrink and the people's lives would get closer to the national level for this period.

Table-2.3 GRDP per Capita

Year	1995	1997	1998	2000	2010	2020
Population Projection (million)						
1) Brazil	154.97	159.06	161.07	165.72	184.16	200.31
2) Sergipe	1.60	1.65	1.68	1.75	2.16	2.78
Per Capita GDP and GRDP(R\$)						
1) Brazil	5,160	5,460	5,660	6,070	7,890	9,290
2) Sergipe	2,770	2,960	3,050	3,230	4,270	5,400
Indices of Per Capita G(R)DP to 1997 Value						
1) Brazil	—	1.00	1.04	1.11	1.44	1.70
2) Sergipe	—	1.00	1.03	1.10	1.44	1.83

Source: Plano Pluriannual 1996-1999, Mensagem ao Congresso Nacional, GOB, MPO
Anuario Estatistico do Brasil, 1996, IBGE

2.3 Regional Socio-economic Framework

2.3.1 Present Regional Socio-economic Framework

Sergipe State, which is composed of 75 municipalities, is divided into 13 Homogeneous Micro-Regions (Microrregioes Homogeneas-MRH). In this section, these MRHs are used as regional unit because these units are used for statistical work by federal level and state level (hereinafter described as MRH).

The MRH is regional unit that is composed of several municipalities with similar natural and socio-economic conditions. And using this unit, estimated present regional socio-economic framework is summarized as follows. And the detail is shown in Table-2.4 and Table-2.5.

- Concentration of the State's population for central region (Grande Aracaju) composed of MRH-Aracaju and MRH-Baixo Cotinguiba is high and reaches about 42% of the State's one. Moreover, concentration level of 2nd & 3rd economic sector's GRDP in the same region is very high and reaches about 75 % of the State's one.
- Difference of the GRDP per Capita among MRHs is very large. The GRDP per capita of four MRHs, namely MRH- Sergipana do Sertao do Sao Francisco, - Itabaiana, -Lagarto and -Estancia, which have regional core city, correspond to a level ranging approximately from 20% to 40% of GRDP per capita of the central region mentioned above. Other MRHs' GRDP per capita is estimated at a level of less than 20% of the central region's one.

Table-2.4 Estimated Population of Sergipe State in 1997

No. & Name of MRH	Urban Population		Rural Population		Total Population		Urban/Total (%)
	Persons	%	Persons	%	Persons	%	
01. Sergipana do Sertao do S.F.	54,047	4.6	62,418	12.9	116,465	7.0	46.4
02. Carira	29,899	2.5	28,135	5.8	58,035	3.5	51.5
03. Nossa Senhora das Dores	28,933	2.5	25,483	5.3	54,416	3.3	53.2
04. Agreste de Itabaiana	77,208	6.6	61,853	12.8	139,061	8.4	55.5
05. Tobias Barreto	50,575	4.3	42,533	8.8	93,108	5.6	54.3
06. Agreste de Lagarto	40,227	3.4	53,754	11.1	93,980	5.7	42.8
07. Propria	54,543	4.7	28,131	5.8	82,674	5.0	66.00
08. Cotinguiba	22,051	1.9	16,950	3.5	39,001	2.4	56.5
09. Japarutuba	18,239	1.6	25,839	5.4	44,079	2.7	41.4
10. Baixo Cotinguiba	58,553	5.0	12,923	2.7	71,457	4.3	81.9
11. Aracaju	613,690	52.4	11,044	2.3	624,734	37.8	98.2
12. Boquim	61,940	5.3	74,226	15.4	136,166	8.2	45.5
13. Estancia	60,898	5.2	39,731	8.2	100,629	6.1	60.5
Total or Average	1,170,784	100.0	483,022	100.0	1,653,806	100.0	70.8
River Basin							
Sao Francisco	114,768	9.8	111,050	23.0	225,818	13.7	50.8
Japarutuba	56,279	4.8	35,922	7.4	94,511	5.7	59.6
Sergipe	697,485	59.6	81,062	16.8	776,237	46.9	89.9
Vaza Barris	96,907	8.3	63,124	13.1	160,031	9.7	60.6
Piaui	149,958	12.8	134,232	27.8	284,190	17.2	52.8
Real	55,387	4.7	57,632	11.9	113,019	6.8	49.0

Source: Censo Demografico 1970,1980 & 1991 / IBGE
 Contagem da Populacao 1996 / IBGE
 Anuario Estatistico de Sergipe 1996 /SEPLANTEC, SUPES

Table-2.5 Estimated GRDP & GRDP per Capita in 1997 at 1998 Constant Prices

Unit: R\$ million for GRDP

No. & Name of MRH	1st Sector		2nd & 3rd Sector		Total of GRDP		GRDP per Capita (R\$)
	GRDP	(%)	GRDP	(%)	GRDP	(%)	
01. Sergipana do Sertao do S.F.	86	15.2	157	3.6	243	5.0	2,090
02. Carira	39	6.8	9	0.2	48	1.0	830
03. Nossa Senhora das Dores	24	4.2	8	0.2	32	0.6	580
04. Agreste de Itabaiana	69	12.1	93	2.2	162	3.3	1,160
05. Tobias Barreto	33	5.8	45	1.1	78	1.6	840
06. Agreste de Lagarto	44	7.7	126	2.9	170	3.5	1,810
07. Propria	20	3.6	44	1.0	64	1.3	780
08. Cotinguiba	20	3.6	10	0.2	30	0.6	780
09. Japarutuba	24	4.1	27	0.6	51	1.0	1,160
10. Baixo Cotinguiba	46	8.0	739	17.1	785	16.1	10,980
11. Aracaju	30	5.2	2,859	66.2	2,889	59.1	4,620
12. Boquim	82	14.6	31	0.7	113	2.3	840
13. Estancia	53	9.1	172	4.0	225	4.6	2,230
Total or Average	570	100.0	4,320	100.0	4,890	100.0	2,960
River Basin							
Sao Francisco	120	21.0	195	4.5	315	6.4	1,390
Japarutuba	45	7.9	243	5.6	288	5.9	3,040
Sergipe	122	21.4	3,209	74.3	3,331	68.1	4,290
Vaza Barris	87	15.4	336	7.8	423	8.7	2,650
Piaui	129	22.5	280	6.5	409	8.4	1,440
Real	67	11.8	57	1.3	124	2.5	1,090

Source: Censo Agropecuario 1995-1996/ IBGE
 Anuario Estatistico de Sergipe 1996/ SEPLANTEC, SUPES
 Anuario Estatistico do Brasil 1996/ IBGE

2.3.2 The Scenario for Regional Development Planning

Using the two planning factors regarding socio-economic situation, namely distribution planning of the state's population and GRDP, two scenarios are drawn in order to formulate the regional development plan which displays the regional socio-economic framework at the target year.

- **The Trend Scenario**
Scenario drawn under the condition that the present socio-economic framework will continue up to the target year without any change.
- **The Strategic Scenario**
Scenario drawn under the basic policy of decentralization to solve or to avoid the foreseeable problems, such as over-concentrated situation of population and economic activity in the central region, and to alleviate the large socio-economic disparity among these MRHs that was estimated in the trend scenario.

(1) The Trend Scenario

This scenario is drawn by distributing the state's scale estimation regarding the population and GRDP described in the previous section to MRHs with the following conditions.

- **Primary Sector/ Agriculture and Livestock/ per MRH:**
GRDP of this economic sector (1st Sector) per MRH is estimated by applying the ratio of production value per MRH and per municipality, based on the production value of agriculture's sector and livestock's sector per municipality shown in census of agriculture/livestock (Censo Agropecuario)-1995 with a precondition that ratio will continue up to the target year.
- **Secondary and Tertiary Sector/ Industry and Commerce & Service/ per MRH:**
GRDP of these economic sectors (2nd and 3rd Sector) per MRH is estimated by applying the ratio of the Circulation and Service Tax (Imposto sobre Circulacao Mercadorias e Servicos-ICMS) per MRH and municipality, based on the collection of this tax per municipality shown in Statistic Year Book of Sergipe (Anuario Estatistico de Sergipe)-1996 with a precondition that ratio will continue up to the target year.
- **Population by Area/Urban Population, Rural Population/ per MRH:**
Population by area per MRH is estimated by JICA Study Team by applying the same method used for estimation of population by Superintendence of Study and Research (SUPES) of the State Secretariat of Planning, Science and Technology (SEPLANTEC).

The remarkable prospective points of this scenario are shown as follows:

- The concentration ratio of population on central region rises from 42% to 48% and GRDP per capita of central region also rises from 75% to 80%.
- These two types of concentration on central region mentioned above mean that about half of state's population live in small area of the State (1,600 km², equivalent to 7% of the State's territory) and the greater part of economic activity is conducted in the same small area. And these may break out natural environmental problems such as preservation of coast area and urban environmental problems such as shortage of infrastructure in the water resources development works.

Table-2.6 Estimated Population of Sergipe State in 2020 (Trend Scenario)

No. & Name of MRH	Urban Population		Rural Population		Total Population		Urban/Total (%)
	persons	%	persons	%	persons	%	
01. Sergipana do Sertao do S.F.	107,262	4.8	46,819	8.7	154,082	5.6	69.6
02. Carira	61,605	2.7	23,466	4.3	85,071	3.1	72.4
03. Nossa Senhora das Dores	51,109	2.3	22,118	4.1	73,227	2.6	69.8
04. Agreste de Itabaiana	222,917	10.0	74,400	13.8	297,317	10.7	75.0
05. Tobias Barreto	95,376	4.3	36,275	6.7	131,651	4.7	72.5
06. Agreste de Lagarto	62,662	2.8	55,716	10.3	118,378	4.3	52.9
07. Propria	127,681	5.7	23,912	4.4	151,593	5.5	84.2
08. Cotinguiba	30,344	1.4	16,974	3.1	47,318	1.7	64.1
09. Japarutuba	33,732	1.5	25,598	4.7	59,330	2.1	56.9
10. Baixo Cotinguiba	106,042	4.7	9,116	1.7	115,157	4.1	92.1
11. Aracaju	1,147,670	51.3	64,075	11.8	1,211,745	43.6	94.7
12. Boquim	111,393	5.0	92,210	17.1	203,602	7.3	54.7
13. Estancia	79,515	3.5	50,359	9.3	129,874	4.7	61.2
Total or Average	2,237,309	100.0	541,037	100.0	2,778,346	100.0	80.5
River Basin							
Sao Francisco	239,204	10.7	92,410	17.1	331,614	11.9	72.1
Japarutuba	105,418	4.7	41,594	7.7	147,012	5.3	71.7
Sergipe	1,370,935	61.3	123,820	22.9	1,494,755	53.8	91.7
Vaza Barris	188,050	8.4	64,787	12.0	252,837	9.1	74.4
Piaui	234,054	10.5	146,162	27.0	380,216	13.7	61.6
Real	99,648	4.4	72,264	13.3	171,912	6.2	58.0

Table-2.7 Estimated GRDP & GRDP per Capita in 2020 at 1998 Constant Prices (Trend Scenario)

Unit: R\$ million for GRDP

No. & Name of MRH	1st Sector		2nd & 3rd Sector		Total of GRDP		GRDP per Capita (R\$)
	GRDP	(%)	GRDP	(%)	GRDP	(%)	
01. Sergipana do Sertao do S.F.	108	15.2	519	3.6	627	4.2	4,070
02. Carira	48	6.8	30	0.2	78	0.5	920
03. Nossa Senhora das Dores	30	4.2	26	0.2	56	0.4	760
04. Agreste de Itabaiana	85	12.1	308	2.2	393	2.6	1,320
05. Tobias Barreto	41	5.8	150	1.1	191	1.3	1,450
06. Agreste de Lagarto	55	7.7	416	2.9	471	3.1	3,980
07. Propria	25	3.6	145	1.0	170	1.1	1,120
08. Cotinguiba	25	3.5	33	0.2	58	0.4	1,230
09. Japarutuba	29	4.1	92	0.6	121	0.8	2,040
10. Baixo Cotinguiba	59	8.1	2,447	17.1	2,506	16.7	21,750
11. Aracaju	37	5.2	9,473	66.2	9,510	63.3	7,850
12. Boquim	103	14.6	102	0.7	205	1.4	1,010
13. Estancia	65	9.1	569	4.0	634	4.2	4,880
Total or Average	710	100.0	14,310	100.0	15,020	100.0	5,400
River Basin							
Sao Francisco	149	21.0	614	4.3	763	5.1	2,300
Japarutuba	56	7.9	927	6.5	983	6.5	6,690
Sergipe	150	21.2	10,718	74.9	10,868	72.4	7,270
Vaza Barris	109	15.4	931	6.5	1,040	6.9	4,110
Piaui	162	22.8	931	6.5	1,093	7.3	2,870
Real	84	11.7	189	1.3	273	1.8	1,590

- The rise of GRDP per capita in central region is estimated to be about R\$3,700 but the rises of GRDP per capita in other MRHs range from R\$100 to R\$2,700. It means that the difference of socio-economic condition among MRHs will become wider.

(2) The Strategic Scenario

This scenario is drawn under preconditions as follows in order to improve the negative part estimated in the Trend Scenario. The outline of this scenario is shown in Table-2.9 and Table-2.10. Also, the method of decentralization of population and economic activity is shown in Table-2.8.

- **Primary Sector per MRH:**
Increment of GRDP is distributed to some MRHs based on the analysis and the planning which is described in the section 2.4. MRHs which receive the distribution are 7 MRH, namely MRH-Sergipana do Sertao do Sao Francisco, MRH-Agreste Itabaiana, MRH-Tobias Barreto, MRH-Agreste de Lagarto, MRH-Propria, MRH-Japaratuba, MRH-Estancia. But the domestic water demand for workers who move to planned irrigation sites is negligibly small compared to the irrigation water demand; therefore, the number of worker is not estimated.
- **Secondary Sector and Tertiary Sector per MRH:**
A part (15%) of the 2nd and 3rd Sector's GRDP of municipality Aracaju is distributed to some MRHs based on the various alternative study. And also, a part of urban population is distributed to same MRHs as its GRDP's distribution; therefore, the estimation regarding number of immigrants is shown in Table-2.8.

Table-2.8 Distribution of GRDP by Sector & Urban Population with Strategic Scenario (2020)

Unit : R\$ million for GRDP

No. & Name of MRH	1st Sector		2nd & 3rd Sector GRDP		Distribution of Urban Population	
	Area(ha)	GRDP	GRDP	(%)	(Persons)	(%)
01. Sergipana do Sertao do S.F.	24,709	76.4	284.20	20.0	43,860	20.0
02. Carira	0	0.0	0	0	0	0
03. Nossa Senhora das Dores	0	0.0	0	0	0	0
04. Agreste de Itabaiana	2,452	7.6	284.20	20.0	43,860	20.0
05. Tobias Barreto	225	0.7	0	0	0	0
06. Agreste de Lagarto	3,203	9.9	284.20	20.0	43,860	20.0
07. Propria	13,483	41.6	142.10	10.0	21,930	10.0
08. Cotinguiba	0	0.0	71.05	5.0	10,963	5.0
09. Japaratuba	890	2.7	71.05	5.0	10,963	5.0
10. Baixo Cotinguiba	0	0.0	0	0	0	0
11. Aracaju	0	0.0	-1,421.00	-100.0	-219,294	-100.0
12. Boquim	0	0.0	0	0	0	0
13. Estancia	370	1.1	284.20	20.0	43,858	20.0
Total	46,332	140.00	0	0	0	0

Note-1: The number of distribution urban population = Total urban population in 2020 / Total GRDP by 2nd & 3rd Sector in 2020 = 190 person/ million R\$ GRDP

Note-2: Distribution GRDP by 1st Sector = Increase of GRDP of 1st Sector until 2020(140 million R\$) / Irrigation area existents & projected (46,322 ha) = 3,020.00 R\$/ ha

Table-2.9 Estimated GRDP & GRDP per Capita in 2020 at 1998 Constant Prices (Strategic Scenario)

Unit : R\$ million for GRDP

No. & Name of MRH	1st Sector		2nd & 3rd Sector		Total of GRDP		GRDP per Capita (R\$)
	GRDP	(%)	GRDP	(%)	GRDP	(%)	
01. Sergipana do Sertao do S.F.	162	22.9	804	5.6	966	6.5	4,910
02. Carira	39	5.5	30	0.2	69	0.5	800
03. Nossa Senhora das Dores	24	3.4	26	0.2	50	0.3	670
04. Agreste de Itabaiana	76	10.7	592	4.1	668	4.5	1,960
05. Tobias Barreto	34	4.7	150	1.1	184	1.2	1,390
06. Agreste de Lagarto	54	7.5	700	4.9	754	5.0	4,650
07. Propria	62	8.7	287	2.0	349	2.3	2,020
08. Cotinguiba	20	2.9	104	0.7	124	0.8	2,130
09. Japarutuba	27	3.8	163	1.1	190	1.3	2,680
10. Baixo Cotinguiba	46	6.5	2,447	17.1	2,493	16.6	21,640
11. Aracaju	30	4.2	8,052	56.3	8,082	53.8	8,140
12. Boquim	82	11.6	102	0.7	184	1.2	900
13. Estancia	54	7.6	853	6.0	907	6.0	5,220
Total or Average	710	100.0	14,310	100.0	15,020	100.0	5,400
River Basin							
Sao Francisco	238	33.6	1,024	7.2	1,262	8.4	3,190
Japarutuba	47	6.6	1,033	7.2	1,080	7.2	6,610
Sergipe	129	18.1	9,552	66.7	9,681	64.5	7,300
Vaza Barris	93	13.1	1,101	7.7	1,194	7.9	4,460
Piaui	135	19.1	1,403	9.8	1,538	10.2	3,390
Real	68	9.5	197	1.4	265	1.8	1,540

Table-2.10 Estimated Population of Sergipe in 2020 (Strategic Scenario)

No. & Name of MRH	Urban population		Rural Population		Total Population		Urban/Total (%)
	persons	%	persons	%	persons	%	
01. Sergipana do Sertao do S.F.	151,122	6.7	46,819	8.7	197,942	7.1	76.4
02. Carira	61,605	2.8	23,466	4.3	85,071	3.1	72.4
03. Nossa Senhora das Dores	51,109	2.3	22,118	4.1	73,227	2.6	69.8
04. Agreste de Itabaiana	266,777	11.9	74,400	13.8	341,177	12.3	78.2
05. Tobias Barreto	95,376	4.3	36,275	6.7	131,651	4.7	72.5
06. Agreste de Lagarto	106,522	4.8	55,716	10.3	162,238	5.8	65.7
07. Propria	149,611	6.7	23,912	4.4	173,523	6.3	86.2
08. Cotinguiba	41,307	1.8	16,974	3.1	58,281	2.1	70.9
09. Japarutuba	44,695	2.0	25,598	4.7	70,293	2.5	63.6
10. Baixo Cotinguiba	106,042	4.7	9,116	1.7	115,157	4.1	92.1
11. Aracaju	928,376	41.5	64,075	11.9	992,451	35.8	93.5
12. Boquim	111,393	5.0	92,210	17.0	203,602	7.3	54.7
13. Estancia	123,373	5.5	50,359	9.3	173,732	6.3	71.0
Total or Average	2,237,309	100.0	541,037	100.0	2,778,346	100.0	80.5
River Basin							
Sao Francisco	303,164	13.8	92,410	17.1	395,574	14.2	76.6
Japarutuba	121,865	5.2	41,594	7.7	163,459	5.9	74.6
Sergipe	1,202,811	41.9	123,821	22.9	1,326,632	47.8	90.7
Vaza Barris	202,669	21.4	64,787	12.0	267,456	9.6	75.8
Piaui	307,152	13.3	146,162	27.0	453,314	16.3	67.8
Real	99,648	4.4	72,263	13.3	171,911	6.2	58.0

MRHs which receive the distribution of this GRDP are also studied from various view points regarding socio-economic and natural potential such as estimated urban population, estimated sector's GRDP and accessibility to water resource. And MRHs which receive the distribution are 7 MRH, namely MRH-Sergipana do Sertao do Sao Francisco, MRH-Agreste Itabaiana, MRH-Agreste de Lagarto, MRH-Propria, MRH-Cotinguiba, MRH-Japaratuba and MRH-Estancia.

2.3.3 Scenario to be applied for the Study

The Strategic Scenario is applied to the formulation of the Master Plan of Water Resources Development for the reasons as follows:

- Prospective high level of concentration of population and economic activity in the central region estimated in Trend Scenario has quite a possibility which breaks out the new problems regarding social and environmental fields. And it needs a large amount of investment to solve these problems. For this reason, the regional planning led from decentralized scenario should be selected.
- A harmonized development planning of the state is expected with a full use of water resources, other natural resources and human resources. From these viewpoints, the decentralized progress is considered desirable.

APPENDIX-1

Distribution of Basin Area by Municipality

Appendix-1 Distribution of Basin Area by Municipality

Code	Name of Municipality and Region	River Basin						Total	Distribution of urban population in the municipalities located in two or more river basins *
		Sao Francisco	Japarutuba	Sergipe	Vaza Barris	Piaui	Real		
01-0120	Caninde do Sao Francisco	908.2						908.2	
01-0220	Feira Nova		27.4	161.9				189.3	<i>Japarutuba 50%; Sergipe 50%</i>
01-0240	Gararu	640.4						640.4	
01-0260	Gracho Cardoso	142.9	93.3					236.2	<i>Sao Francisco 50%; Japarutuba 50%</i>
01-0310	Itabi	202.9						202.9	
01-0420	Monte Alegre de Sergipe	418.5						418.5	
01-0450	Nossa Senhora da Gloria	471.5		273.9				745.4	<i>Sao Francisco 50%; Sergipe 50%</i>
01-0540	Poco Redondo	1220.0						1220.0	
01-0560	Porto da Folha	895.1						895.1	
02-0140	Carira			296.4	338.2			634.6	<i>Vaza Barris 100%</i>
02-0230	Frei Paulo			68.2	338.6			406.8	<i>Vaza Barris 100%</i>
02-0445	Nossa Senhora Aparecida			347.1				347.1	
02-0500	Pedra Mole				79.0			79.0	
02-0520	Pinhao				152.7			152.7	
02-0600	Ribeiropolis			263.0				263.0	
03-0020	Aquidaba	241.5	128.7					370.2	<i>Sao Francisco 100%</i>
03-0190	Cumbe		131.4					131.4	
03-0380	Malhada dos Bois	53.4	5.9					59.3	<i>Sao Francisco 100%</i>
03-0430	Muribeca	25.5	56.5					82.0	<i>Japarutuba 100%</i>
03-0460	Nossa Senhora das Dores		54.2	428.4				482.6	<i>Japarutuba 50%; Sergipe 50%</i>
03-0700	Sao Miguel do Aleixo			143.3				143.3	
04-0050	Arca Branca			86.8	42.3			129.0	<i>Sergipe 100%</i>
04-0100	Campo do Brito				200.8			200.8	
04-0290	Itabaiana			154.8	183.6			338.4	<i>Sergipe 100%</i>
04-0370	Macambira				137.4			137.4	
04-0390	Malhador			102.2				102.2	
04-0410	Moita Bonita			95.7				95.7	
04-0680	Sao Domingos				102.3			102.3	
05-0550	Poco Verde					18.0	362.7	380.7	<i>Real 100%</i>
05-0710	Simao Dias				135.8	413.8	11.2	560.8	<i>Piaui 100%</i>
05-0740	Tobias Barreto					42.7	1076.4	1119.1	<i>Real 100%</i>
06-0350	Lagarto				208.8	753.7		962.5	<i>Piaui 100%</i>
06-0580	Riachao do Dantas					391.9	136.5	528.4	<i>Piaui 100%</i>
07-0010	Amparo de Sao Francisco	39.8						39.8	
07-0070	Brejo Grande	149.2						149.2	
07-0110	Canhoba	165.8						165.8	
07-0160	Cedro de Sao Joao	73.0						73.0	
07-0270	Ilha das Flores	57.6						57.6	
07-0410	Neopolis	249.9						249.9	
07-0470	Nossa Senhora de Lourdes	80.6						80.6	
07-0570	Propria	95.5						95.5	
07-0730	Telha	56.5						56.5	
07-9999	Santana de Sao Francisco	47.0						47.0	
08-0130	Capela		431.9					431.9	
08-0200	Divina Pastora		14.8	78.2				93.0	<i>Sergipe 100%</i>
08-0650	Santa Rosa de Lima			66.2				66.2	
08-0720	Siriri		123.4	43.7				167.1	<i>Japarutuba 100%</i>
09-0330	Japarutuba	90.2	283.8					374.0	<i>Japarutuba 100%</i>
09-0340	Japoata	332.9	64.5					397.4	<i>Sao Francisco 100%</i>
09-0490	Pacatuba	407.3						407.3	
09-0530	Pirambu	138.8	60.4					199.2	<i>Japarutuba 100%</i>
09-0690	Sao Francisco	72.2	14.6					86.8	<i>Sao Francisco 100%</i>
10-0150	Carmopolis		40.0					40.0	
10-0250	General Maynard		18.1					18.1	
10-0360	Laranjeiras			163.4				163.4	
10-0400	Maruim		10.5	81.7				92.2	<i>Sergipe 100%</i>
10-0590	Riachuelo			78.6				78.6	
10-0610	Rosario do Calete		80.7	23.2				103.9	<i>Japarutuba 100%</i>
10-0660	Santo Amaro das Brotas		70.8	167.1				237.9	<i>Sergipe 100%</i>
11-0030	Aracaju			96.3	85.5			181.8	<i>Sergipe 100%</i>
11-0060	Barra dos Coqueiros		11.2	76.7				87.9	<i>Sergipe 100%</i>
11-0180	Nossa Senhora do Socorro			157.2				157.2	
11-0670	Sao Cristovao			183.3	249.1			432.4	<i>Vaza Barris 100%</i>
12-0040	Araua					194.6		194.6	
12-0067	Boquim					213.6		213.6	
12-0170	Cristinapolis						251.3	251.3	
12-0300	Itabaianinha					301.6	178.4	480.0	<i>Piaui 50%; Real 50%</i>
12-0510	Pedrinhas					39.9		39.9	
12-0620	Salgado					255.8		255.8	
12-0750	Tomar do Geru						337.1	337.1	
12-0760	Umbauba					74.1	50.0	124.1	<i>Piaui 100%</i>
13-0210	Estancia					649.6		649.6	
13-0280	Indiaroba					156.9	154.5	311.4	<i>Real 100%</i>
13-0320	Itaperanga D'Ajuda			32.9	304.9	419.5		757.3	<i>Vaza Barris 100%</i>
13-0630	Santa Luzia do Itanhay					336.2		336.2	
01- Sergipana do Sertao do Sao Francisco		4899.6	120.7	435.8				5456.0	
02- Carira				974.7	908.5			1883.2	
03- Nossa Senhora das Dores		320.4	376.7	571.7				1268.8	
04- Agreste de Itabaiana				439.4	666.4			1105.8	
05- Tobias Barreto					135.8	474.6	1450.3	2060.6	
06- Agreste de Lagarto					208.8	1145.6	136.5	1490.9	
07- Propria		1014.9						1014.9	
08- Cotinguiba			570.1	188.1				758.2	
09- Japarutuba		1041.4	423.3					1464.7	
10- Baixo Cotinguiba			220.1	516.9				737.0	
11- Aracaju			11.2	513.5	334.6			859.3	
12- Boquim						1079.6	816.8	1896.4	
13- Estancia				32.9	304.9	1562.2	154.5	2054.5	
Sertao Sergipano (01-02)		4899.6	120.7	1410.5	908.5			7339.2	
Agreste Sergipano (03-06)		320.4	376.7	1011.1	1011.0	1620.1	1586.8	5926.1	
Leste Sergipano (07-13)		2056.3	1224.6	1251.4	639.5	2641.9	971.2	8785.0	
Sergipe		7276.3	1722.0	3673.0	2559.0	4262.0	2558.0	22050.3	

* The municipalities located in two or more river basins are calculated as follows: In general, the rural population was distributed by the percentage of each river basin area in the municipality. Urban population of each municipality was totally allocated to the river basin in which town is located. For the 5 cases where the town is located on the boundary between two river basins, the urban population is divided equally to each basin as shown in italic letters.

APPENDIX-2

Census and Projected Population of Sergipe State

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 I)
MASTER PLAN STUDY**

[B] GEOLOGY AND HYDROGEOLOGY

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 (B)
GEOLOGY AND HYDROGEOLOGY**

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Introduction

The first part of the document discusses the importance of maintaining accurate records in a business context. It highlights how proper record-keeping can lead to better decision-making and operational efficiency. The text emphasizes the need for a systematic approach to data collection and storage, ensuring that all relevant information is captured and easily accessible. This section also touches upon the legal implications of record-keeping, particularly in industries where compliance is a critical requirement.

Methodology

The methodology section describes the research approach used to gather data for this study. It outlines the selection of participants, the design of the data collection instruments, and the procedures for data analysis. The study employs a mixed-methods approach, combining quantitative surveys with qualitative interviews to gain a comprehensive understanding of the research topic. The data collection process was conducted over a period of six months, with regular intervals for data review and analysis.

The results of the study are presented in the following section, where the findings are discussed in detail. The analysis reveals several key trends and insights that have implications for both theory and practice. The study concludes by summarizing the main findings and offering recommendations for future research and practical applications. The overall goal of the research was to provide a clear and actionable framework for improving record-keeping practices in business environments.

CHAPTER 1 INTRODUCTION

This report describes the result of groundwater development study carried out within the Study on Water Resources Development in the State of Sergipe in the Federative Republic of Brazil which was carried out by JICA during 1998 and 2000.

The groundwater development study was mainly carried out within the Master Plan Study, which occupied the first half of the above JICA Study. The field surveys were performed for the groundwater development study during July 1998 and December 1998. The summary of this groundwater development study is described in the Main Report of this Study, and the more detailed results are described in this Supporting Report. Important data and all the results are expressed in this report except the deep well data-base established by SRH which is expressed in the Data-Book. This data-base, which saves more than 4,000 deep well data obtained when these wells were drilled, was main data sources for this groundwater study as well as the hydrogeological data which was obtained from the field surveys carried out by the Study Team. This report deals with mainly groundwater potential analysis and its results. The groundwater development plan, which was formulated based on the potential analysis, was described in the Main Report and Supporting Report-G (Water Resource Development Plan) with the surface water development plan.

In this study, the Study Team member in charge of groundwater development obtained important hydrogeological data and information through the discussions and the field surveys performed with the hydrogeologists of Sergipe state. As described former, the purpose of this study was to formulate groundwater development plan as a part of the comprehensive water resources master plan for all the Sergipe state during limited study period and with limited information. Consequently, the analyzed results such as groundwater potential may have some insufficiency in its accuracy because the study area is too wide to be covered by the existing data in quality and quantity, in addition the study area is too wide and complicated in hydrogeological structure to be analyzed by the usual analysis method. It is expected that hydrogeologists of Sergipe state with many experiences will revise some results of the groundwater potential analysis by the careful examination of this report and moreover will assess by themselves more detailed groundwater potential in the near future.

CHAPTER 2 TOPOGRAPHY AND GEOLOGY

Very old rocks of Precambrian age form geological frame of Sergipe State. Shield with flat geomorphic surface covers the state. Earth movements finished in Mesozoic age, then Sergipe State became geologically stable.

2.1 Topography

Geomorphological map is shown in Figure-2.1. Classification of landform in Sergipe State is outlined as shown in Table-2.1.

Table-2.1 Classification of Landform

Classification		Note
Plain along coast and near river mouth	Marine deposit	Distributes along the coast of the study area.
	Marine and fluvial deposit	Distributes near river mouth.
	Flood plain	Distributes down stream of rivers.
	Terrace	Distributes in border between coastal plain and plateau.
Flat plateau spreading inland	Plateau spreading in Cretaceous and Tertiary	Plateau surface is flat, rainfall carves and divide plateau into many small hills. Elevation is less than 150m.
	Plateau spreading in Precambrian	Inselbergs and pediments form this landscape. The ground surface is undulating. Elevation is 150-300m
Mountain rising from plateau	Mountain	Hard rock remains from erosion as mountain. Elevation is 300-600m.

2.2 Geology

Table-2.2 and Figure-2.2 show geology of Sergipe State. As shown in the figures, metamorphic rock of Precambrian distributes in 2/3 of inland area. Mesozoic system distributes in the other 1/3 area near the coast covering Precambrian rocks, and Tertiary system distributes covering Mesozoic system. Quaternary system distributes along the coast.

Table-2.2 Stratigraphy and Rock Faces of the Study Area

Age		Stratigraphy	Rock Faces
Cenozoic	Quaternary	Diluvium, Alluvium	Clay, silt, sand, gravel
	Tertiary	Barreiras Formation	Claystone, siltstone, sandstone, conglomerate
Mesozoic Paleozoic	Cretaceous	Tucano Basin	Limestone, sandstone, shale
	Silurian	Sergipe Basin	Limestone, sandstone, shale
Late Proterozoic		Caninde Domain	Gabbro, amphibolite, metavolcanic rock, ultramafic rock
		Poco Redondo Domain	Granites, migmatite, gneiss
		Maranco Domain	Granites, metaconglomerate, phyllite
		Macurure Domain	Micaschist, quartzite, gabbro
Middle Proterozoic late Proterozoic		Vaza-Barris Domain	Carbonate, phyllite, argillaceous rock
		Estancia Domain	Sandstone, argillaceous rock, conglomerate.
Archaean – early Proterozoic		Sao Francisco Craton	Gneiss, migmatite, granodiorite.
		Itabaiana Dome Craton	Migmatite.

