

**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**

**[I] LAWS AND ORGANIZATION**

**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)  
LAWS AND ORGANIZATION**

**Table of Contents**

**Table of Contents**  
**List of Tables**  
**List of Figures**

	Page
<b>CHAPTER 1 INTRODUCTION.....</b>	<b>I-1</b>
<b>CHAPTER 2 INSTITUTIONAL AND LEGISLATIVE ISSUES ON WATER RESOURCES MANAGEMENT .....</b>	<b>I-2</b>
2.1 Fundamentals for Water Resources Management .....	I-2
2.1.1 Historical Paradigm and New Concept of Water Resources Management .....	I-2
2.1.2 Institutional Principles for Water Resources Management .....	I-3
2.2 Institutional Functions .....	I-4
2.2.1 Function of Deliberative Organization .....	I-5
2.2.2 Function of Regulatory Organization .....	I-5
2.2.3 Function of Operation Organization .....	I-5
2.2.4 Function of Non-Governmental Organizations .....	I-6
2.3 Institutional and Regulatory Issues.....	I-6
2.3.1 Regulatory Tools.....	I-6
2.3.2 Decentralization and Civil Participation .....	I-7
2.3.3 Health and Environmental Protection .....	I-7
2.3.4 Incentives.....	I-7
2.3.5 Multiple Use of Water Resources .....	I-8
2.4 Cost Allocation of Multi-Purpose Facilities .....	I-9
<b>CHAPTER 3 CURRENT FRAMEWORK ON WATER RESOURCES MANAGEMENT.....</b>	<b>I-12</b>
3.1 Current Legislation for Water Resources.....	I-12
3.1.1 Federal Constitution 1988 .....	I-12
3.1.2 Policy of Water Resources Management.....	I-12
3.1.3 Laws and Regulations on Water Resources Conservation .....	I-13
3.2 Status of PROAGUA.....	I-13
3.3 Current Institutional Situation of Water Resources Management in Sergipe.....	I-14
3.3.1 Overall Administrative Structure of Sergipe State .....	I-14
3.3.2 Agencies Concerned to Water Resources .....	I-14
3.3.3 SEPLANTEC .....	I-14
3.3.4 SRH .....	I-14
3.3.5 Allocation of Responsibility for Water Resources .....	I-15

3.4	National Policy of Water Resources Management .....	I-16
3.5	State System of Water Resources Management.....	I-19
3.5.1	State Council of Water Resources .....	I-19
3.5.2	River Basin Committee .....	I-20
3.5.3	Water Agency .....	I-20
3.5.4	Granting Rights to Use of Water Resources.....	I-21
3.5.5	Charging to Use of Water Resources.....	I-22
3.5.6	State Fund of Water Resources.....	I-23
3.5.7	Master Plan of Water Resources.....	I-24
3.5.8	Participation of Civil Organizations.....	I-25
3.5.9	SEPLANTEC .....	I-25
3.6	Implementation Progress of Water Resources Management System .....	I-25
<b>CHAPTER 4 MASTER PLAN OF INSTITUTIONAL ISSUES.....</b>		<b>I-27</b>
4.1	Grant of Water Rights .....	I-27
4.2	Charging to Use of Water Resources.....	I-29
4.2.1	Charging to Water Resources Use .....	I-29
4.2.2	Charging to Effluent Discharge .....	I-33
4.3	Organization Plan .....	I-34
4.3.1	First Stage Plan of Water Resources Management.....	I-34
4.3.2	Training Plan .....	I-35
4.4	Participation of Civil Organizations .....	I-36
4.5	Implementation Schedule .....	I-37
4.6	Priorities in Institutional Plans .....	I-38

#### **APPENDICES**

Appendix-1	Cost Allocation by Separable Costs-remaining Benefits Method
Appendix-2	Laws and Regulations related to Water Resources conservation
Appendix-3	Goals of Institutional Development of the Water Resources Sector for PROAGUA in Sergipe State
Appendix-4	Organizational Diagrams
Appendix-5	Comparison of Water Resources Policy in National and Sergipe State
Appendix-6	Annual Charges to Surface Water Resources Users in Japan
Appendix-7	Withdraw Capacity of Source Water by River Basin and by Users
Appendix-8	Functions of Respective Organs for Water Resources Management in Sergipe State

## List of Tables

	Page
Table-3.1	Classification of River Basins in State of Sergipe .....I-12
Table-3.2	Laws and Regulations Related to Water Resources Conservation .....I-13
Table-3.3	Responsibility Allocation for Water Resources Management .....I-16
Table-4.1	Priority Order of Water Resources Use.....I-28
Table-4.2	Examples of Charging to Water Resources Use .....I-30
Table-4.3	Rate of Charging to Industrial Use in Foreign Countries .....I-31
Table-4.4	Converted Rates of Charging to Domestic Use in Brazil and Romania....I-31
Table-4.5	Water Withdraw: 1997 and 2020 .....I-32
Table-4.6	State Revenue through Water Charge: 1997 and 2020 .....I-32
Table-4.7	Estimated Expenses of Water Agency and River Basin Committees .....I-33
Table-4.8	Training Programs for Water Resources Management .....I-36
Table-4.9	Implementation Schedule of Water Resources Management Plans.....I-38

## List of Figures

	Page
Figure-2.1	Functions of Organizations Pertain to Water Resources Management.....I-5
Figure-2.2	Cost Allocation Procedure of Multi-purpose Facilities .....I-11
Figure-3.1	Organization Proposed for Water Resources Management .....I-26
Figure-4.1	Organization Plan of SRH at First Stage .....I-35



## **CHAPTER 1 INTRODUCTION**

The institutional study aims to propose organizational and legislative strengthening plan for water resources management in the State of Sergipe. The federal and state governments have legislatively promulgated their "Policy of Water Resources" in 1997. Then, the basic policies for water resources management are established in the national and state laws. In order to carry the policies into effect, however, the agencies concerned will have to carry out many activities listed in the policies. Thus, this study report proposes institutional plans for the state government to strengthen organizations and regulations in terms of water resources management. This report comprises three chapters, excluding this introductory chapter. The respective chapters contain the following subjects.

Chapter 2 describes institutional and legislative issues to introduce proper water resources management. In the advance countries in terms of water resources management, various trials for introduction of the management were carried out for long time. Through these experiences, the following topics are discussed in this chapter: (1) fundamentals for water resources management; (2) institutional functions, which are effective for formulating administrative structure; (3) institutional and regulatory systems for improvement of current conditions; and (4) cost allocation of multi-purpose facilities.

Chapter 3 discusses the present institutional situation of water resources management in the federal and state governments. The governments have already had laws, decrees and regulations in terms of water affairs so far. Then, these laws and regulations related to water resources management are summarized shortly. In addition, the federal government and the World Bank have been implementing PROAGUA in NORDESTE including Sergipe State. This project has strong relationship to this water resources development plan. The state government of Sergipe exists among these institutional surroundings. The government, furthermore, is going to be restructured reflecting the "State Policy of Water Resources", which was promulgated in 1997. Then, this chapter present the current conditions and framework on water resources management taking consideration of these background: (1) current legislation for water resources; (2) status of PROAGUA; (3) current administrative situation in Sergipe; (4) national policy of water resources; (5) state system of water resources management; (6) implementation progress of water resources management system.

Chapter 4 proposes a master plan of institutional issues. In this chapter, the following six components are discussed on the basis the analysis of the previous chapters. The components are: (1) grant of water rights; (2) charging to use of water resources; (3) organization plan in consideration of institutional and financial strengthening; (4) participation of civil organizations; and (5) implementation schedule of institutional strengthening.

## **CHAPTER 2 INSTITUTIONAL AND LEGISLATIVE ISSUES ON WATER RESOURCES MANAGEMENT**

### **2.1 Fundamentals for Water Resources Management**

#### **2.1.1 Historical Paradigm and New Concept of Water Resources Management**

The concept of water resources management becomes popular among the persons concerned, but it is still not well-known among people. It is quite important in the future that the concept becomes well-known among people. Before discussion to the water resources management, it might be useful to recognize the difference between the historical paradigm of water resources and the new concept of water resources management.

The following management issues were carried out as historical paradigm in many developing countries.

- 1) Thus far, water is provided virtually free to users by the public sectors. But its quantity and quality were not always sufficient for the users. They have not put reliance on water supplied through water system. Accordingly, they do not have strong willingness to pay for the water supply system.
- 2) All costs of water supply system are covered by the public sector. These costs include not only capital investment but also operation and maintenance of the water system. These financial resources are raised through the general tax revenue and borrowing from internal or external financial sources.
- 3) The top manager decides every management item, so far. There are no rooms for the people concerned to take part in the implementation and operation of water supply system. The people are scarcely familiar with the system. This unfamiliarity makes them take their willingness of supporting the system.

Anyhow, this old-paradigm resulted in waste and inequitable allocation of scarce water resources. The revival of democracy led to the realization that institutional reorganization was a must in the water sector. The new concept of water resources management is going to develop and refine methodologies for integrated management of water. This concept is addressing several key sectoral issues as follows.

- 1) On the contrary of "top-down management", "public participation" is the most fundamental key issue. The stakeholders influence policy formulation of water system, alternative designs, investment choices and management decisions. This concept will be greater reliance on incentives for efficient management of water system. Because of this, they will take on the responsibility for their water system.
- 2) At the same time, they have to support their water system by themselves. That means they bear the expenses of the system. They should bear all costs such as investment, operation and maintenance. However, it is too hard for them to bear everything at the first stage. Thus, at least they should cover O&M costs to support the sustainable financial accountability of the system.
- 3) In principle, the water system including consumption and exhausting would rather be treated in the hydrological basin, taking the natural ecosystems into consideration. This management idea would make water resources efficient and sustainable in the basin through comprehensive analytical framework. This is one of the important new concepts.

- 4) On the basis of these new concepts, the people concerned establish their management system of the water issues. They will strengthen their management capacity and keep the water system in effective and sufficient conditions. Then, the beneficiaries raise reliance on the water system. At the same time, the management would rather disclose their management information and promote the beneficiaries to know about importance of water. The water system is sustained by the people concerned in the basin.

### **2.1.2 Institutional Principles for Water Resources Management**

The new management system of water resources aims to maintain healthy environment and to sustain economic and social well-being. As mentioned above, the governments based on the old paradigm have often misallocated and wasted water resources, as well as permitted damage to the environment. Thus, a balanced set of policies and institutional reforms should be sought to manage water resources more effectively. The sound water resources institutions are gratified with the following principles.

#### **(1) Resource Ownership, Allocation and Rights**

In almost all instances, surface waters are owned by the nation or by the state. In terms of groundwater, the countries with more recent constitutions assign ownership to the public entities such as nation and states. Although some countries such as U.S. states like California as well as Japan treat groundwater in part as private ownership, usually retained by the overlying land-owner, the groundwater laws seem to be changing. In the countries intimately linked to surface water bodies, groundwater is treated as surface water.

Water resources should be allocated under consideration of the following: (a) to support long-term goals and investments; (b) to optimize overall benefits by mixing complimentary use; (c) to have geographical bounds to facilitate administration; (d) to guide real-time operations to meet annual variations; and (e) to incorporate a review/renewal mechanism for future generations.

Water right system should apply to not only surface water but also groundwater. It should generally stipulate the following: (a) category of use such as agricultural, urban, industrial, environmental, etc.; (b) class of use such as consumptive, non-consumptive and polluting; (c) quantity and quality implication; (d) priority, time and duration; and (e) administrative procedures. Furthermore, it should define (a) source of water, (b) geographical restrictions on use, (c) limitations on class of use, (d) quality restrictions on source and return flows, and (e) rules for any transfer of rights by the holders if permitted.

#### **(2) Standards, Regulations and Administrative Rules**

In general, most countries have water quality standards. However, the rules and procedures for administration such as reporting, penalties and specific enforcement actions are loose. As a result, the standards do not work well as expected at the beginning. Thus, it does not make sense to set standards without clear rules and procedures for enforcement.

For instance, precise administration on the basis of effective service standards and regulations is as essential for sustainable water service system as physical facilities fitted to their demands. The quality of water services influences the economic potential for customers. In the case of domestic water, it greatly influences consumers' well-being. Thus, where comprehensive service standards are enforced, service quality is high and the beneficiaries are more and have willingness to pay.



### **(3) Government and Non-government Responsibilities and Organizations**

The government controls overall exploitation and management of the water resources for the beneficiaries in the river basins. It also undertakes programs in all phases and provides public services for the society. It takes its responsibilities in the following six functions: (a) data collection and dissemination; (b) planning; (c) design; (d) construction; (e) operation and maintenance; and (f) regulatory.

Non-government sectors consist of non-government entities and individuals. The former are composed of beneficiaries owned or for-profit utilities in general. These non-governmental entities develop and manage water resources for their members' or customers' benefits within areas established by the government. Power generation and distribution, water supply, waste disposal, irrigation supply, navigation, drainage and flood protection services are fundamental services in water resources management. The first four services are almost operated as utilities in many countries. In most developed countries, in particular, the non-governmental entities provide readily defined services to customers without peripheral support.

Non-governmental individuals participate in advisory role for water resources management. Beneficiaries can serve on agency boards. Experts can serve on technical committees. Public workers can serve on policy and advisory commissions. They could provide a timely reaction from an outside perspective. These advisories would result in public understanding and support of government actions and be essential to instituting changes.

### **(4) Financial Rationality**

The governments should adopt formal cost allocation methods and apply them consistently in their planning and management of water resources. Allocation categories should include all services such as urban water supply, irrigation, refuse collection and treatment, flood control, drainage, navigation and hydropower and non-service purposes such as recreation and any environmental enhancement. Allocation should be made in full to all purposes with any subsidies if they were identified.

The governments should institute a system of direct and indirect charges to recover costs of most services in the water sector including all services mentioned in the previous paragraph. However, the cost recovery from the beneficiaries of full costs to water services is rarely accomplished particularly in developing countries. Most of water services are subsidized by the governments. For instance, although some government-built irrigation systems are turned over to farmers to operate and maintain, no capital costs are recovered usually. Service charges should be calculated on each specific system to reflect its peculiarities and the level of services by the beneficiaries. These charges should be rigorously allocated to the beneficiaries, in accordance with their purpose if necessary.

## **2.2 Institutional Functions**

In general, the government actions constitute three areas for the government to manage its duties applicably. They are deliberative, regulatory and operational functions. In water resources management, these areas function to improve resources management capability. The respective areas play their following roles in the water resources management. The relation among these areas are illustrated as follows.

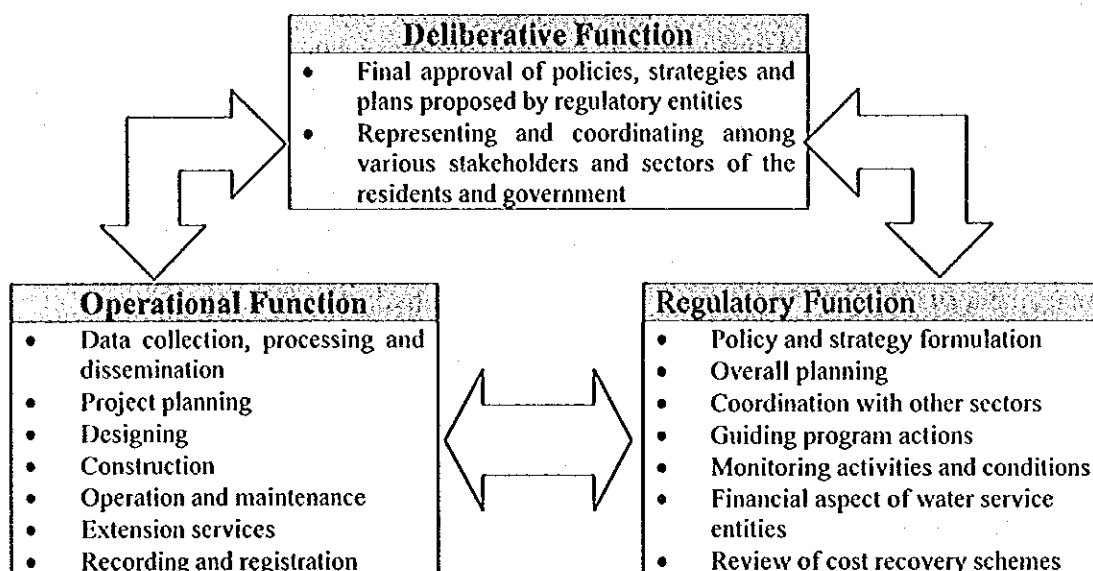


Figure-2.1 Functions of Organizations Pertain to Water Resources Management

### 2.2.1 Function of Deliberative Organization

The deliberative function is to give final approval of policies, strategies and plans proposed by regulatory entities. Its activities are based on legal fairness and response to changing conditions of the country. It includes policies of water resources management, basic formulation of regulation and authorization, and funding to basic programs and projects. Their final decisions should represent and coordinate among various stakeholders, sectors of the residents and the government in their hydrological basin area. Thus, the deliberative function is set in a shape of board, council or committee, in general.

### 2.2.2 Function of Regulatory Organization

The regulatory function constitutes the framework for guiding program actions and measuring results in conformity with certain objectives particularly in the environmental area. It includes monitoring activities and conditions in the basins, and enforcing laws and regulations, and specific-purpose agreements in terms of water resources. It covers granting water rights to resources users, allocating water resources in real-time, collecting and providing useful information regarding water resources, appropriating water resources usage, monitoring quality of water resources, and observing environment impacts by water resources users.

### 2.2.3 Function of Operation Organization

The operation function constitutes planning, design, construction, and operation and maintenance activities. In addition, it carries out data collection processing and dissemination related to water resources, recording and registration of water resources users and extension services for water users. The primary activities of the operation function are prescribed by the deliberative body. The operation organization deals with the activities to utilize and manage water resources. Governmental agencies dominate these operation activities in the most countries. In some developing countries, the non-governmental organizations (NGOs) often carry out these activities.

## **2.2.4 Function of Non-Governmental Organizations**

In addition to these public functions above, participation of non-public organizations and communities is considered as a key issue for a process in managing water resources properly. These organizations improve their roles in the fields of project selection, service delivery and cost recovery. In particular, the stakeholders influence policy formulation, alternative designs, investment choices, and management decisions affecting their communities. They come to their necessary sense of ownership. Thus, these non-governmental organizations should be involved in a process of water resources management as beneficiaries and affected parties in the hydrological basin areas.

## **2.3 Institutional and Regulatory Issues**

### **2.3.1 Regulatory Tools**

The governments have to establish a strong legal and regulatory framework to lead the water resources use properly. To deal with the water resources management, they adopt regulatory tools in general. They comprise five instruments: (a) water resources master plan; (b) classification of waters; (c) grants of water rights; (d) charging to water resources usage; and (e) information system.

In the water resources master plan, "River Basin" is a basic planning and managing unit for water resources. Hence, the watershed is the high land separating two river systems, that is, formulating boundaries of river basins. The watershed is one of the important key words for water resources management.

The water resources are under the public domain. The agencies concerned should capture the conditions of water resources through classification of waters. They could get information regarding quality and quantity of water resources in terms of surface water and ground water. As a result, people can approach to water resources. To keep these water resources uncontaminated and to be allocated properly, however, the people trying to use water resources should get the right of water use from the public. The water rights are issued not only for water withdraw but also for effluent dilution to every water users. Furthermore, water is not free but an economic good. Thus, its use should be charged to achieve rational allocation and proper management. The sustainable use of water resources maintains sound river basin systems in the natural ecosystem.

These instruments have to be set up under the consideration of the current technical level for the water resources conditions in the state and/or in the country. To establish the respective systems of the instruments, the basic information such as hydrological, topographical, hydro-geological, social and economic data is indispensable in the whole objective areas. Thus, the governments should start to collect and arrange these data and information at the first stage. In addition, they should make various experts such as policy analysts, planners, managers and technicians upgrade their skills concerned to water resources management.

### **2.3.2 Decentralization and Civil Participation**

The government's financial and administrative resources are so limited that the government should be selective in their responsibilities. In the case that local capabilities exist and that an appropriately regulatory system is established, the central government should decentralize responsibilities to local governments. In general, things that are done at a higher level of government do not always satisfy people at lower level. The central government should make efforts to decentralize its responsibilities to local governments and to transfer service delivery functions to the private sector, to financially autonomous public entities, and/or to community organizations such as water user associations. These transformations could improve incentives for cost recovery and service provision to beneficiaries. Furthermore, the beneficiaries would be given a sense of ownership and participation.

Stakeholders' participation in managing water resources is a key policy of water resources management. The civil participation is a process to decide the issues affecting their communities and to establish the necessary sense of ownership, as mentioned above. The more do the stakeholders participate in managing water resources, the more widely and deeply they can realize the water resources' issues like project selection, service delivery and cost recovery. This is the primary purpose of civil participation in water resources management. In environmental assessment as well, it is important for the people concerned to water resources development such as affected people and local non-governmental organizations as well as stakeholders to participate in planning, designing, implementing, and managing the projects.

### **2.3.3 Health and Environmental Protection**

Preservation of water resources and their environment is essential for sustainable development. In order to provide safe drinking water, the agencies concerned should make efforts at protection, enhancement and restoration of water quality, and abatement of water pollution. The safe drinking water is fundamental and critical for maintaining and improving human health. The governments have to improve environment of water resources and expand sanitation programs such as collection and treatment of wastewater. For promoting these activities, the governments should apply "user-polluter-pays" principle to water resources users and wastewater dischargers to encourage water conservation and reduce pollution.

### **2.3.4 Incentives**

In general, water allocations of domestic and agricultural purposes were set separately because of their historical background and different economic implications. In many areas, the higher value of water in domestic uses than agricultural uses reflects a high economic cost as shown in existing cases. Even in the case of domestic water, however, pricing of domestic water at low level of cost recovery makes a water supply entity financially difficult because of political reasons. The low level pricing cannot provide suitable services for water users, so they are not willing to pay for the services. They need to be provided with a wider range of options so that they can choose the level of water services for which they are willing to pay.

Water prices for irrigation purposes are often significantly low as compared with the opportunity cost or even an estimated cost of water prepared. Then, the irrigation water services are often less sufficient than those the farmers expected. Furthermore, they do not make efforts to reduce misuse of irrigation water. It is said that even poor farmers will pay high fees for good quality and reliable irrigation services that raise and stabilize their income. The critical issue is providing these poor farmers with reliable, profitable and sustainable irrigation services.

The pricing of water resources should be set on the basis of opportunity cost of water as a guide in setting water charges. In practice, however, immediate adoption of opportunity cost pricing might be difficult politically. Thus, the pricing of water resources could be accomplished in principle through the following three mechanisms: (a) administrative pricing by government decree; (b) trading among water resources users; and (c) setting at public auction market of water rights. The USA and Chile seems to be countries advanced in terms of auction market system for water resources transaction. In order to reflect the economic value of water resources, this market system would be appropriate as recommended by the World Bank. This market system, however, is still not full-grown even in the advanced countries. Though the transaction seems to be familiarized more in the market of Chile, it might not completely be successful in the USA. Thus, when the market system is introduced in the state and/or in the country in the future, the agencies concerned should discuss and decide it with care taking consideration of the trend of market system at that time. Anyhow, at the starting point of water resources pricing, the first mechanism, i.e., the administrative pricing by government decree would be better than other mechanisms.

### **2.3.5 Multiple Use of Water Resources**

In the past, small water demand could be satisfied with the natural flow without any investment to provide water intake. Economic growth and population increase have brought about intensive use of water resources. As a result, the intensive use caused water resources shortage in some places and made conflicts among water users regarding priority usage. At the same time, the modern society enlarged diversification of water use. These phenomena make the water resources market complex.

At the beginning, water resources were developed for the supply for an individual demand through a project which aims at only one purpose such as for irrigation, flood control and hydropower and water supply. After various conflicts in terms of water resources utilization among users, a multiple use of water resources was expected to solve these conflicts. The multiple uses have the following advantages: (1) a multiple dam within the limited areas for dam construction is effective for the respective water resources users; (2) a multiple-use facility gets advantage of peak-cut because the demand peaks of the respective users occur at different period; and (3) a large-scale dam can take advantage of economies of scale.

Yet, multi-purpose facility requires new institutional and legislative arrangement. In case of establishment of the multi-purpose facility, new knowledge and know-how are prerequisite in the fields of co-ordination among stakeholders, implementing organizations, cost allocation, planning, designing, operation and maintenance. The agencies concerned have to learn these integrated management characters from the advanced countries.

## **2.4 Cost Allocation of Multi-Purpose Facilities**

In development of multiple use facilities, the costs for their construction are allocated to users taking part in their works. The method of this cost sharing is called as cost allocation. There are several methods for cost allocation. The major methods of cost allocation are summarized as follows.

### **(1) Benefit Method**

This method is to allot the total cost in proportion to the percentages of the benefits expected for the respective sectors joining the multiple use facilities. It premises that the respective sectors have the same ratio's benefits as the benefit-cost ratio of the multiple use facilities.

### **(2) Justifiable Expenditure Method**

The investment costs for the sectors concerned are estimated by means of benefit capitalization as justifiable expenditure. The allotment costs for the respective sectors are the difference between the justifiable expenditure and the respective costs of exclusive facilities. This is a variation of benefit method.

### **(3) Alternative Expenditure Method**

An alternative expenditure means an estimated cost of a single-purpose alternate that has the same benefit as the proper function of the multiple facilities. The expenditure is estimated on the basis of the following conditions as fundamental premises.

- 1) A single-purpose alternate can be constructed instead of the multiple-use facilities, which has equivalent benefit produced by the proper function of the multiple-use facilities.
- 2) The single-purpose alternate is the most likely installation.
- 3) The multiple-use facilities are more economical than the accumulation total of the respective single-purpose facilities.

### **(4) Alternative Justifiable Expenditure Method**

This method is a combination of the methods (2) and (3) above. The proper expenditure is the lesser of the alternative expenditure and the justifiable expenditure. The allotment costs for the respective sectors are the difference between the proper expenditure and the respective costs of exclusive facilities. The total costs of the multiple-use facilities are distributed in proportion of the allotment cost ratios of the respective sectors. The "Tennessee Valley Authority" in the U.S.A. introduced this method.

### **(5) Use of Facilities Method**

The total costs of the multiple-use facilities are allocated in proportion to the extent of using the facilities. Although there are several ways to measure the degree of usage, the general method is based on the water volume of reservoir and consumption.

**(6) Priority of Use Method**

The public users are given higher priority than the other users. The proper expenditures for the public users are selected as the lesser of the alternative expenditure and the justifiable expenditure. The allotment costs for the public users are the difference between the proper expenditure and the respective costs of exclusive facilities. The public users bear these allotment costs only. The rest of the total costs of the multiple-use facilities are allocated to the non-public users based on alternative justifiable expenditure method.

**(7) Separable Cost Remaining Benefit Method**

This method is similar to the alternative justifiable expenditure method. The difference between the two methods is that this method adopts a separable cost instead of applying the cost for exclusive facility.

The principles of cost allocation method are that the method should be applied for every multiple-use project and that it allocates the proper burden for the respective users joining the multiple use facilities. The principles are broken down as follows.

- 1) Multiple-use facility of several sectors is more economic than a gathering of individual facilities for the respective sectors.
- 2) The total cost of multiple-use facilities should be fairly allocated to the respective water users.
- 3) The savings and benefit from multiple-use should be distributed to the respective water users impartially.
- 4) Every cost allocated to a user taking part in the multiple-use facilities should be less than the benefit accrued from the facilities, and also less than the cost for its single-purpose facility.

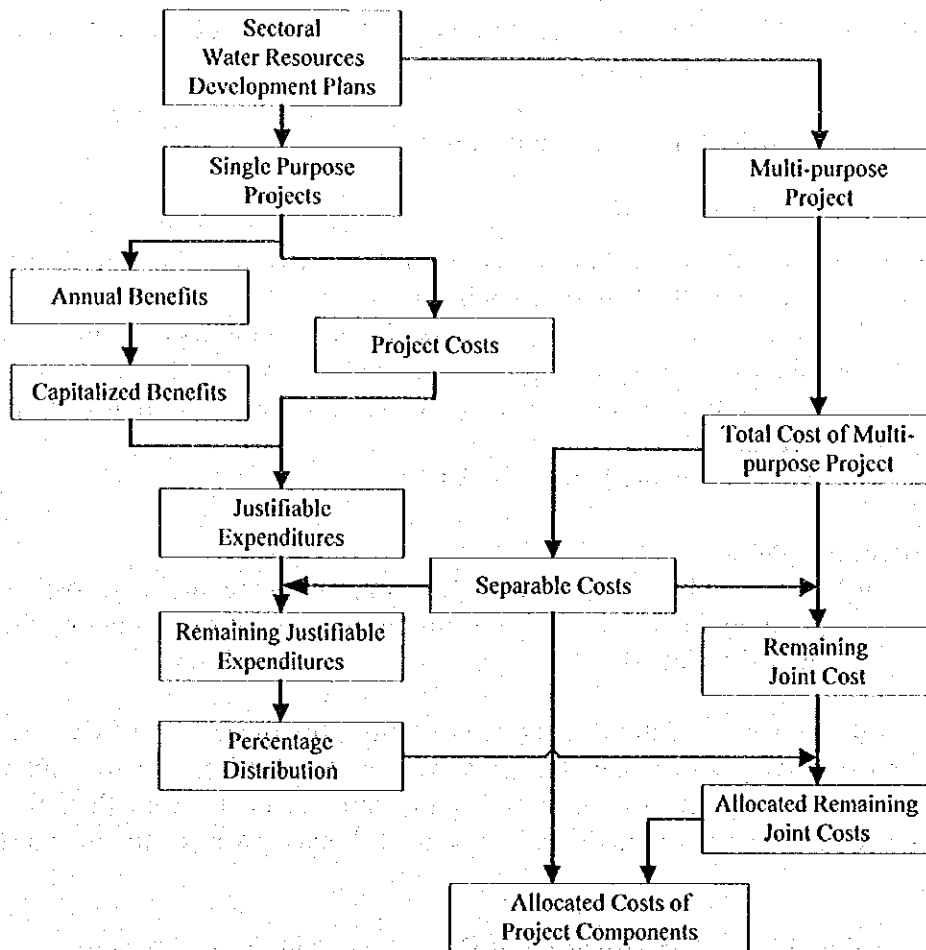


Figure-2.2 Cost Allocation Procedure of Multi-purpose Facilities

In general, the cost allocation methods applied for water resources development are (4) alternative justifiable expenditure method or (7) separable cost remaining benefit method. In the U.S.A., the separable cost remaining benefit method is adopted for multi-purpose river improvement projects. Since 1968, Japan has also adopted this method for cost allocation of multiple-use facilities in the law for "Promotion of Power Resources Development". Thus, the separable cost remaining benefit method is the most popular way for cost allocation of multiple-use facilities. It is recommendable for Brazil to adopt this method to allocate the costs of multiple-use facilities. Incidentally, the detail procedure of this method is described in Appendix 1.

After the discussion of a method of cost allocation of multi-purpose facilities with the Brazilian counterparts, "separable cost remaining benefit method" is selected as the most appropriate method for the proposed project. Although the basic procedure is described in Appendix 1 which shows an example of complicated multi-purpose dam, the simplified procedure is illustrated in Figure-2.2 above.



## CHAPTER 3 CURRENT FRAMEWORK ON WATER RESOURCES MANAGEMENT

### 3.1 Current Legislation for Water Resources

#### 3.1.1 Federal Constitution 1988

The Constitution, promulgated in 5th of October 1988, gives the following declaration as properties to the Union, i.e., the Federal Republic (Art. 20):

- The lakes, rivers and any watercourse in land within its domain, or that wash more than one state, that serve as boundaries with other countries, or that extends into foreign territory or from there proceed, as well as bank lands and river beaches (III);
- The hydraulic energy potentials (VIII);

The property of the States includes (Art. 26):

- surface or subterranean waters, flowing, emerging or in deposit, with the exception, in this case, of those resulting from work carried out by the Union, as provided by law (I).

According to the above stipulation of the Constitution, the ownership of river water and groundwater exclusively situated in the State vest n the State except hydraulic energy potential. The water of the tributary rivers of some Federal rivers than the energy potential is also the property of the State, in case the tributary washes only one State.

Table-3.1 Classification of River Basins in State of Sergipe

No.	River Basin	Administrative Classification (States where the main stream flows through)
1	Sao Francisco	Federal (States of Alagoas, Pernanbuco, Bahia, Minas Gerais, and Federal District)
2	Japartupa	State
3	Sergipe	State (a little upstream portion in State of Bahia, which has almost no interests)
4	Vaza-Barris	Federal (State of Bahia)
5	Piaui	State (a little upstream portion in State of Bahia, which has almost no interests)
6	Real	Federal (State of Bahia)

#### 3.1.2 Policy of Water Resources Management

The National Policy of Water Resources, Federal Law No. 9443 promulgated on 18th of January 1997, gives a framework on the management policy of water resources in the federal domain. It provides (a) national policy such as fundamentals, objectives, general directives of actions), (b) management instruments such as water resources plans, classification of water, granting of water rights, charging for water resources use, information system, actions of public power, (c) systems of water resources management such as objectives and composition, National Council of Water Resources (CONARH),

River Basin Committees (RBCs), Water Agency (WAs), Executive Secretariat of the National Council, Civil Organization of Water Resources, (d) infraction and penalties, and (e) general and temporary provisions.

Succeeding to the national policy, the State Government of Sergipe enacted the State Policy of Water Resources, State Law No. 3870 promulgated on 25th of September 1997. It stipulates the management policy of water resources in the state domain, which has almost the same contents as the National Policy, except raising State Fund of Water Resources as one of the management instruments.

### 3.1.3 Laws and Regulations on Water Resources Conservation

The Constitution of the Federal Republic provides a legal base for the government administration on environmental protection and conservation. Major environmental enactment related to water resources conservation is shown in the following table. As for the rivers of the state domain, the classification of the waters by predominant use has not been designated yet. These laws and regulations are summarized in Appendix 2.

Table-3.2 Laws and Regulations Related to Water Resources Conservation

Laws and Regulation	Subject
Federal Law No. 6938, 1981 and Federal Decree No. 99274, 1990	National Environmental Policy
Federal Decree No. 1413, 1975, Federal Decree No. 76389, 1975	Industrial Pollution Control
Federal Law No. 7802, 1989	Control of Agro toxics
Resolution of CONAMA No.001, 1986	Environmental Impact Assessment
Resolution of CONAMA No. 20, 1986	Classification of Water Quality and Effluent Standards

### 3.2 Status of PROAGUA

The PROAGUA (Water Resources Development Program for Brazilian Semi-arid Areas) broadly includes the water resources sector in the Northeast in Brazil. The State of Sergipe is one of the Northeastern States. The main focus of PROAGUA is policy support and institutional strengthening. Institutional development program is shown in the table of Appendix 3. In the table, the program started in 1998. All activities shown in the first year have already done in the implementation of PROAGUA. In 1999, the second year in the program, most of institutional formulation delayed almost one year from the scheduled goals, according to the persons in charge of the State Unit of PROAGUA Management (UEGP). Incidentally, the UEGP is a branch office of PROAGUA in Sergipe State. It promotes the PROAGUA itself in the state and co-ordinate the agencies concerned for implementation of PROAGUA. The Superintendency of Water Resources in the State of Sergipe (SRH/SE) is a counterpart agency of PROAGUA.

The PROAGUA also includes the construction of priority infrastructure works. The UEGP has provided two infrastructure projects, which are on stand-by at present. The UEGP has already requested the headquarter of PROAGUA in Brasilia to implement these project as soon as possible. They are expansion projects of water supply schemes, namely, (1) Project of Agreste Pipeline System and (2) Project of Piauitinga Pipeline System.

### **3.3 Current Institutional Situation of Water Resources Management in Sergipe**

#### **3.3.1 Overall Administrative Structure of Sergipe State**

The state government is composed of fourteen (14) secretariats under the governor as of September 1999. Besides these secretariats, there are twenty-four (24) external organs under the respective secretariats. The organizational diagram of the state is shown in Appendix 4-1. By the end of 1999, however, the state government is going to be reorganized under the policy of administrative reform.

#### **3.3.2 Agencies Concerned to Water Resources**

The following five secretariats in the state government are related to water affairs: (1) Secretariat of Industry, Commercial and Tourism (SEICT), (2) Secretariat of Public Works (SESP), (3) Secretariat of Environment (SEMA), (4) Secretariat of Agriculture, Supply and Irrigation and (5) Secretariat of Planning, Science and Technology (SEPLANTEC). Some of these secretariats have their subordinate external sections and/or independent outer cooperative agencies, which are related to water resources. These relations among them and their functions are illustrated in Appendix 4-2.

Among these organizations, the SEPLANTEC is the leading organ of water resources management in the state. In SEPLANTEC, the authority competent for the "State Policy of Water Resources" is the Superintendency of Water Resources (SRH). The SRH under the Secretary is in charge of water resources management in Sergipe. The SRH administers all issues of water resources within the state domain.

#### **3.3.3 SEPLANTEC**

The SEPLANTEC comprises three management sections as well as administration department. These sections are (1) Superintendency of Economic Planning and Budget (SPEO), (2) Superintendency of Studies and Researches (SUPES), and (3) Superintendency of Water Resources (SRH). The SPEO is responsible for economic planning of the state, elaboration of economic development project, and compilation of state budget. The SUPES is responsible for collection, analysis and presentation of social, economic and geographical information and for studies and researches in the areas of science and technology. The SRH is responsible for water resources management. It was created under agreement of the State Law No. 3870 on 25th of September 1997. The organizational diagram of the SEPLANTEC is illustrated in Appendix 4-3.

#### **3.3.4 SRH**

The present SRH is still tentative, and will completely be established after enactment of the drafts of decrees by the governor. It is expected to fulfill the following functions as described in the Article 47 of "State Policy of Water Resources (Law No. 3870)". In the following description, the organizations of council, committee and agency are explained in the succeeding sub-sections.

- 1) To promote rational use and sustainable development of water
- 2) To formulate policies and instructions for the state's water resources management
- 3) To coordinate, to supervise and to plan activities concerning to water resources
- 4) To function as an executive secretariat of the state council of water resources, and to

- give necessary administrative and technical support
- 5) To promote engineering and economic studies of water resources
  - 6) To develop and to maintain a state information system of water resources
  - 7) To make the state plan of water resources and to submit it for appraisal by the state council of water resources
  - 8) To coordinate the state plan of water resources and to submit an appraisal report to the national council of water resources
  - 9) To do office works derived from the state council of water resources and the river basin committee
  - 10) To analyze applications and to grant water use rights on the basis of regulation of the law
  - 11) To analyze projects and to permit technical licenses for water facilities in case of no environment problems
  - 12) To maintain communication and integration with agencies of operation and monitoring in terms of hydrometric net and hydro-meteologic data
  - 13) To make an annual report regarding conditions of water resources
  - 14) To make research aiming to settle criteria and standards for granting water usage right, charging system to users and arranging rational use of water resources, and to collect water tariff
  - 15) To encourage water users to organize associations under the river basin committee

The head of SRH, the superintendence of water resources, is responsible for organizing, coordinating, executing, observing and controlling the activities of water affairs. The SRH is composed of two departments and four coordinator's offices at present. The departments are (1) the department of planning and coordination and (2) the department of administration and control. As of October 1999, the SRH consists of eleven (11) members, who are distributed as follows: two members for the superintendent office, four members in the department of planning and coordination and five members in the department of administration and control.

The head of the department of planning and coordination is responsible for planning, observation and technical evaluation of policies, management standards and directions for water resources. These duties are integrated by the coordinator of planning and programming and by the coordinator of evaluation and observation. The head of the department of administration and control is responsible for production management regarding supply and demand for water resources applying instrument and legal way, and for implementation and management of the state information system. These duties are integrated by the coordinator of grants and inspection and the coordinator of information.

### **3.3.5 Allocation of Responsibility for Water Resources**

The institutional functions of the government actions can be classified into three basic areas as mentioned in Section 2.2. They are allocated in state level and in basin level as shown in Table-3.3. For sustainable development of water resources, water resources conservation is an indispensable field. In the case that the present organizations for environmental issues take charge of this conservation even in the future, the three basic functions would be covered by the organs indicated in the table in the state level. In the

basin level, river basin committee, SRH and water agency would be in charge of the water resources conservation.

Yet, most of organs in the diagram are still under preparation and do not exist except CONERH and SRH. On the other hand, the water development activities are being implemented by existing agencies such as COHIDRO, CEHOP and DESO. There is no clear consecutiveness from the present executive structure to the system proposed in the policy.

**Table-3.3 Responsibility Allocation for Water Resources Management**

	Deliberative	Regulatory	Operational
<b>State Level</b>			
Water allocation	State Council of Water Resources (CONERH) (to be covered by Basin Level)	SRH	
Water resources development		SRH	(to be covered by Basin Level)
Water supply and sanitation	(to be covered by Basin Level)	SESP	DESO
Irrigation	(to be covered by Basin Level)	SAGRI	COHIDRO
Water resources conservation	State Council of Environment	SEMA	ADEMA
<b>Basin Level</b>			
Water resources development	River Basin Committee	SRH	Water Agency
Water resources conservation			

### 3.4 National Policy of Water Resources Management

The authority competent in the "National Policy of Water Resources (Law No. 9433, 8th of January 1997)" is Ministry of Environment, Water Resources and Legal Amazon (MMARIAL). The Secretariat of Water Resources (SRH) under the ministry is in charge of water resources management. The SRH administers all issues of water resources within the federal domain. It is also the leading authority of PROAGUA.

The federal government is preparing some drafts of decrees to promote the "National Policy of Water Resources" as early as possible. Among the drafts, Nation Council of Water Resources (CONARH) was established under the Decree No. 2612 on 3rd of June 1998. The CONARH composes 29 members as stipulated in the law. They are as follows:

- 1) 12 members from Ministries concerned such as (a) Agriculture and Supply; (b) Science and Technology; (c) Finance; (d) Navy; (e) Environment, Water Resources and Legal Amazon; (f) Planning and Budget; (g) Foreign Relations; (h) Health; (i) Transports; (j) Education and Sports; (k) Industry, Commerce and Tourism; and (l) Justice
- 2) Two members from Ministry of Mines and Energy
- 3) One member from Secretariat of the Republic Presidency
- 4) Five members from Water Resources State Councils
- 5) Six members from water resources users
- 6) Three members from civil organizations of water resources

In addition, the federal government prepares to set up the "National Water Agency" (ANA

or Agencia Nacional de Aguas). It is expected to be established within this year. It is only one water agency on the national level. It covers the water resources of the whole federal surface waters such as rivers and lakes in the federal domain. The ANA plays a role of managing agency for the river basin committees in the federal domain. It prepares data, information and draft reports for the committees, and makes the budget proposal and the application plan of financial resources collected through charging to water resources users. The ANA is established as an administrative and management body based on the national policy. Then, the agency has a character of autonomy and public company, and is indirectly a part of administrative function of the nation.

Under MMARHAL, on the other hand, Sao Francisco Valley Development Corporation (CODEVASF) has been in charge of water affairs within Sao Francisco River Basin. Applying the water resources of the river, it has implemented agricultural development projects such as irrigation and inland fishery, and also river improvement projects along the main and tributary courses of the river. It has headquarters in Brasilia and six branch offices in the states related to the river basin. The basin has a territory of around 0.64 million km<sup>2</sup>, 33% of which is located in the State of Sergipe. In the state, the fourth branch office is located in the state capital city, Aracaju. To date, it has executed three irrigation development projects in (i) Propria, (ii) Betume and (iii) Cotinguiba/Pindoba. After the establishment of ANA in the near future, however, CODEVASF will be pressed to change its roles in the Sao Francisco River Basin.

The "National Policy of Water Resources" declares to adopt methodologies for integrated management of water resources in the whole country. The special features of the policy are summarized as follows.

- 1) The water resources are under the following two domains (Art. 1):
  - a) The federal domain, covering surface waters such as rivers, lagoons and lakes that extend over more than one state unit, or between Brazil's territory and neighboring countries; and
  - b) The state domain, covering surface and underground waters in one state.
- 2) The laws push forward to decentralization against power concentration (Art. 1).
- 3) The following basic principles are practiced for improvement of water resources management (Art. 1):
  - a) The river basin is adopted as a planning unit. In principle, various conflicts of water resources in a river basin should be resolved in its own river basin.
  - b) The multiple usage of water is promoted against the usual predominance of one user. In Brazil, the electricity sector has had the top priority over water resources traditionally. Under the new law, all sectors have equal access to water resources.
  - c) The water resources are recognized as an ending and vulnerable natural resource.
  - d) The water resources are an economic good and have economic value. This is a basis for the government to charge to users of water resources. This activity is also expected to lead them to use natural resources rationally.
  - e) The water resources are managed by the decentralized entities, which allow the participation of water users. The top management decides every management item traditionally so far. On the contrary of this "top-down management", "public participation" becomes the most fundamental key item for decision

making. The stakeholders influence policy formulation of water system, alternative designs, investment choices and management decisions. This concept will be greater reliance on incentives for efficient management of water system. Because of this, they will take on responsibility for their water system.

- 4) The five essential instruments are employed for water resources management (Art. 5):
  - a) Water resources plan, as a guide for the implementation of the national policy of water resources.
  - b) Classification of waters, as indicators of the present and future situation of waters, classified on the basis of the environmental legislation.
  - c) Grant of water rights, as instruments for ensuring quality and quantity control of waters
  - d) Charge to water resources use, for giving users incentives of rational use of water
  - e) Information system of water resources, for uniting, organizing and disclosing data and information about qualitative, quantitative and usage situation of water resources.
- 5) The new organizations are established for water resources management:
  - a) National council of water resources (Art. 34), which coordinate, inspect and deliberate water resources issues and establish the state system of water resources management.
  - b) River basin committee (Art. 37), which has the following competency:
    - i) to promote debates on issues of water resources management
    - ii) to approve and to promote the basin-wide water resources plan
    - iii) to establish charging mechanism and to suggest values of charging
    - iv) to identify small water users who are exempted from getting water right
    - v) to establish criteria and allocation of costs for multiple use
  - c) Water agency (Art. 41), functioning as a managing agency for the river basin committees. It prepares data, information and draft reports for the committees, and makes the budget proposal and the application plan of financial resources collected through charging to water resources users.
  - d) Civil organizations of water resources (Art. 47), which are legally constituted to participate into the national plan of water resources. The following civil organizations are considered to attend: i) internal-municipal consortiums and associations; ii) local association of water users; iii) technical organizations interested in water resources; iv) non-governmental organizations; and v) other organizations recognized by the national council of water resources.
- 6) The secretariat of MMARHAL/SRH in the nation (Art. 45) is obliged:
  - a) To support the national council of water resources
  - b) To make the national plan of water resources
  - c) To coordinate the information system of water resources
  - d) To make work programs and annual budget proposal, and to submit them to the national council of water resources

### **3.5 State System of Water Resources Management**

As mentioned in Section 3.1.2, the State Government of Sergipe enacted the State Policy of Water Resources, State Law No. 3870 on 25th of September 1997. It has almost the same contents as the National Policy, except raising State Fund of Water Resources. The comparison of the Federal Policy and the State Policy is listed in Appendix 5. The main components of the State Policy of Water Resources are itemized in the following sections.

#### **3.5.1 State Council of Water Resources**

The state council of water resources (CONERH/SE) was set up in the first place among organizations proposed in the state policy. It is the top deliberative organization in the field of water resources. It coordinates, inspect and deliberate issues of water resources in the state's domain. The CONERH/SE was established on the basis of the State Decree No. 19088 on 26th of May 1999. Its major competence and prerogatives are as follows.

- 1) To promote coordination between the state plan of water resources, and the plans of neighboring states, regions and the nation and/or the plans of the stakeholders related to water resources.
- 2) To approve the state plan of water resources, reflecting the state policy of water resources.
- 3) To deliberate projects of interbasin water resources transfer
- 4) To establish a guideline for implementation of the state policy of water resources
- 5) To establish criteria to grant rights to users of water resources and to charge to users of water resources.
- 6) To approve establishment of river basin committees and water agencies.
- 7) To send the state plan of water resources to the national council of water resources for integration of the national plan of water resources.
- 8) To appraise an annual report analyzing the situation of water resources in the state.

The CONERH/SE consists of 17 members. Nine members represent administrative organs and another eight members represent civil organizations related to water resources. They are broken down as follows:

- 1) Four members from the state governments, who are representatives of (a) secretariat of planning, science and technology; (b) secretariat of public services; (c) secretariat of environment; and (d) secretariat of agriculture, supply and irrigation.
- 2) Three members from municipal mayors who represent three river basins in the state domain: (a) Sergipe River; (b) Piauí River; and (c) Japaratinga River.
- 3) One member from the state legislative power.
- 4) One member from the state public ministry.
- 5) Eight members who are representatives from civil organizations having relevance to water resources. They are:
  - a) One representative of the Regional Council of Engineering and Architecture (CREA/SE) Section
  - b) One representative elected among the teaching and survey entities, legally constituted in the Sergipe State
  - c) One representative elected among the associations linked to agriculture, which are legally constituted in Sergipe State



- d) One representative elected among the associations of irrigation users, which are legally constituted in Sergipe State
- e) One representative elected among associations which are legally constituted for protection, conservation and improvement of environment in Sergipe State
- f) One representative of Japaratuba River Basin Committee
- g) One representative of Sergipe River Basin Committee
- h) One representative of Piauí River Basin Committee

The composition of the CONERH/SE is reviewed after a year from the start, and then on every three years. The mandate of the council members is duration of two years with possibility of return. The executive secretariat of the CONERH/SE is assigned to the superintendent of water resources in the SEPLANTEC. The superintendent is responsible for administrative support to the council.

### **3.5.2 River Basin Committee**

A river basin committee is a deliberative organization covering whole water issues within the area closed in the watershed of the river. The committee is a forum for debating problems, planning multiple water usage and making decisions on issues of water resources, with the aim at sustainable development in the basin. There are three river basins of the state domain: Sergipe, Japaratuba and Piauí Rivers. The major competence and prerogatives of the committee are as follow:

- 1) To approve the master plan of water resources in the competent river basin and to suggest necessary procedures for execution of its goals.
- 2) To coordinate conflicts concerning water resources use among users
- 3) To deliberate projects of water resources use
- 4) To establish charging mechanisms of water resources use and their values of water charges and to suggest them to the CONERH/SE.
- 5) To propose exemption of obligation applying for water right and paying water charges for small users to the CONERH/SE.
- 6) To propose creation of River Basin Sub-committee for its tributaries under proposal from the water users and/or the civil societies.

The each committee is composed of around twenty members. The number of members differs from one basin to another, which depends on the situation of the basin. However, the composition of the committee is made up of half members from the public power such as state and municipalities and half members from water users and civil societies. The respective members are proposed by the CONERH/SE and approve by the governor. The mandate of the members is duration of two years with possibility of return.

### **3.5.3 Water Agency**

A water agency in Sergipe is placed as an executive secretariat under the river basin committees. The agency is established as an administrative and management body based on the state policy. Then, the agency has a character of autonomy and public company, and is indirectly a part of administrative structure of the state. In the state, it seems to be reasonable due to its territorial characteristics that only one agency assists its three river basin committees of Sergipe, Japaratuba and Piauí Rivers. Its major competence and prerogatives of the agency are as follows:

- 1) To maintain an updated water balance on the basis of water resources potential.
- 2) To make a report regarding the situation of water resources periodically, and to submit it to the river basin committee.
- 3) To formulate a master plan of water resources, and to open it to the public through mass media.
- 4) To collect water charges from water resources users as a delegation of the authorizing power, and to manage financial resources accruing from water charge system.
- 5) To manage a state information system of water resources.
- 6) To promote researches and studies necessary for water resources management.
- 7) To render administrative, technical and financial support to the river basin committees.
- 8) To propose the following data and information to the river basin committees.
  - a) Classification of waters based on usage classes.
  - b) Charging mechanism to water resources usage.
  - c) Prices of water charges through technical studies.
  - d) Operational plan of financial resources through collection of water charges.
  - e) Cost allocation of water works for multiple use.

The water agency is directed by the following councils and section: administration council, supervising council and executive management. The members of the councils are elected by the river basin committees, among their members. The composition of the councils respects the proportionality of the members of the committees. The executive management is composed of a managing president and directors, the number of whom is set in a statute of the water agency.

#### **3.5.4 Granting Rights to Use of Water Resources**

The water resources are public domain, so the grant of rights to use of water resources is an administrative act in the nation and also in the states. The granted users are allowed to use water resources in a specified period on the basis of terms and conditions in the formal act. The water rights are given not to small end users but to bulk users of water resources. The purposes of the water rights are (a) to control quality and quantity of water resources and (b) to distribute water access rights effectively.

The water users of the following objectives have to apply for the water right and to get a permission of the right from the public power.

- 1) Utilizing water resources with regime alteration of quality and quantity in surface or underground waters
- 2) Deriving, impounding or extracting water from existent surface or underground waters for final consumption including public water supply or manufacturing process.
- 3) Throwing sewer, other liquid or gas residues, treated or not, into waters with purposes of dilution, transportation or final disposition.
- 4) Utilizing water resources for hydroelectric power generation.

On the other hand, the following users do not have to apply for the water right.

- 1) Use of water resources for small population community in rural areas
- 2) Storage of water resources considered to be insignificant
- 3) Derivation, impounding water resources or throwing liquid residues, volume of which is considered as insignificant

The water rights are effective for a renewable time limit that can not exceed thirty-five (35) years. In the case of reasonable time limit because of environmental license and other judgments, the time limit will not exceed ten years. Even within the time limit, the water rights can be suspended totally or partially in the following situation. The water rights suspended come under the jurisdiction of the water agency.

- 1) In case of water shortage because of calamity situation such as unusual weather conditions.
- 2) In case of preventing or recovering serious environmental degradation.
- 3) In case that a priority user has no alternative water resources with the exception of the competent resource.
- 4) In case of maintaining the navigation in the stream.
- 5) In case that a holder of water rights does not pay for charges of water resources use.
- 6) Under rational conditions for suspension of water use.

In case that water shortage continues for three years consecutively, the water rights could be canceled by the authority.

The SEPLANTEC/SRH is an authority responsible for the grant the rights to the use of water resources. It can not concede the water rights in tributaries of main waters under the federal domain without an agreement with the agencies concerned. On behalf of the SEPLANTEC/SRH, the water agency can carry out the following activities related to grant the water rights:

- 1) To accept an application for the water rights.
- 2) To analyze the application from the technical point of view.
- 3) To make a technical appraisal report on the application.
- 4) To supervise and to control the water rights including suspension of granting under water shortage situation.

### **3.5.5 Charging to Use of Water Resources**

The charging to the users of water resources is considered as an administrative instrument as well as the granting. The charging system could ensure water availability not only under present conditions but also for future generation. It will urge water users to consume water rationally for sustainable economic growth. On the other hand, the fund from the charging covers the administrative costs of the agencies concerned and the costs of researches, studies and planning of works for water resources.

The charging system is laid on all persons who intake, derive, consume water resources and who use water for dilution, transport or assimilation of effluents or other liquid. The amount expected from charging to water resources use is estimated taking the following conditions into consideration.

- 1) To approve the scope and conditions settled by the CONERH/SE.
- 2) To approve quadrennial programs by the river basin committees and projects by water users.
- 3) To approve quadrennial investment programs by CONERH/SE and the fund of charging system by the water agency.
- 4) To estimate expenses necessary for the quadrennial period in the respective river basins.
- 5) To estimate expenses of general administration costs for the water agency and share-parts of operational costs for the water resources management in the state, which corresponds to not more than 7.5% (10% after amendment of the State Policy) of the total items above.

The charging system is under the jurisdiction of the water agency. The collected charges are revenue for water resources management, practically for the water agency and deposited in the water resources state fund (described later). Although the fund will basically be used to the competent basin, less than 50% of the total could be applied to the other areas under the committee's approval.

### **3.5.6 State Fund of Water Resources**

The state fund of water resources (FUNERH) is an independent accounting organization under the control of SEPLANTEC, with support of BANESE and under supervision of both the CONERH/SE and the Secretary of Finance. It is established to play a financial role in the field of water resources management in the state. It aims to reduce regional distortions and economic disparities among sub-regions in the state. It is also expected to work for resolving or mitigating water problems in the river basins.

The fund comes from the charges to water resources use, basically. The fund should be utilized for improvement of water resources conditions in the state. However, a fund is generally absorbed into the state general fund, unless there are any blocking legal actions for the absorption. This is another justification for existence of the FUNERH.

The following financial resources are expected to make a contribution to funds of FUNERH.

- 1) Resources of the state's and the municipalities' treasury
- 2) Transference from the union for execution of water resources management
- 3) 60% of financial compensation of hydro-energetic utilization to the state and to the municipalities
- 4) A part of financial compensation of minerals utilization such as petroleum, natural gas, etc. to the state.
- 5) Charges to the use of water resources
- 6) Loans and contribution from national and international organizations
- 7) Resources through international assistance
- 8) Products through credit operation of fund for public and private borrowers
- 9) Eventual Resources
- 10) Fines charged to water legislation offenders
- 11) Donation

The fund is basically utilized for the water resources management. Up to 50% of the fund from the charges to water resources use in a river basin is applied to solve some problems in the said river basin. The fund of FUNERH is basically applied to borrowers through the type of loan. The terms of loan are set up as follows:

- 1) Credit amount: at least 25% of the total investment costs
- 2) Repayment period: maximum 12 years and not exceeding the period required to recover the investment.
- 3) Interest rate: less than 12% per annum.

The FUNERH is managed by the director council. The council comprises (i) the secretary of SEPLANTEC, (ii) the secretary of state finance, (iii) the president of BANESE, and (iv) mayors elected from the respective river basins (a mayor for one basin).

### **3.5.7 Master Plan of Water Resources**

The master plan of water resources (PERH/SE) shows development targets, guidelines and procedures to goals of water resources in the state. The plan aims to guarantee preservation and sustainable development of water resources and to promote decentralization and civil participation.

The plan has the following order of procedure.

- 1) To implement a geographical information system for water resources.
- 2) To keep compatibility of the plans, programs, norms, and procedures of technological and administrative application among decentralized management of water resources.
- 3) To support formation of river basin committees through effective legislation.
- 4) To execute federal and state norms of water resources management.

River basin formed by watershed is another sub-division of the state in addition to administrative division and a planning unit of water resources management, as mentioned in the State Policy. Thus, the river basin committees and the water agency are established in conformity with this policy. Accordingly, the PERH/SE has to be formulated on the basis of the policy.

In order to promote the implementation programs of the PERH/SE, the following information network should be intensified to grasp availability, demand and quality of water resources through monitoring system.

- 1) Integration of forms for geographical database and standardization of access into information network.
- 2) Promotion of cooperation among institutions producing data related to water resources.
- 3) Adaptation of the network for collection of data.
- 4) Selection of representative basins and points of monitoring for hydrological and meteorological observation and socio-economic indicators.
- 5) Establishment of a meteorological center of water resources.
- 6) Professional training to technicians and experts of water resources in institutions and companies.

### **3.5.8 Participation of Civil Organizations**

Public participation and decentralization are the key concepts of water resources management, as mentioned before. In the laws, civil organizations are expected to attend to river basin committees, members of which are selected from the local associations and organizations interested in water resources. Thus, the stakeholders influence policy formulation of water system, alternative design, investment choice and management decisions. Then, they will take the responsibility for their water system.

The participation of civil organization is put into practice through CONERH and River Basin Committees (RBCs). As mentioned in Section 3.5.1, the eight non-governmental members are expected to attend CONERH as representatives of the respective water users and civil societies related to water resources.

According to the drafts of RBCs, the ten members are expected to attend each RBC as representatives of the respective water users and civil societies related to water resources. However, the names of the members are not identified like CONERH members. Only a representative of Indian communities is expected to attend the competent committee. Other members are selected among almost the same economic fields for CONERH. In addition to those, some members of professional or academic standing should be added to the respective committees in compliance with the situation of the river basins.

### **3.5.9 SEPLANTEC**

The draft of "SEPLANTEC" describes the function and organizations proposed for water resources management onto the current organization of SEPLANTEC at the beginning of 1999. The structure is divided into the following three levels in the whole organization: (i) superior management level, (ii) section management level and (iii) operating staff level. The state council of water resources is placed at the superior management level, which has charge of the top deliberative role on water resources in the state. The Secretary of SEPLANTEC presides the State Council of Water Resources and to represent the State Council of Environment. The conditions of SEPLANTEC are mentioned in Section 3.3.3.

## **3.6 Implementation Progress of Water Resources Management System**

The new organizations for water resources management will be formulated on the basis of the policies above. They are illustrated in a diagram form in Figure-3.1. In the state level, the CONERH/SE is located onto the top position, which functions as a deliberative organ in the state. It coordinates, inspects and deliberates issues of water resources and establishes the state system of water resources. Under the state council, the river basin committees will be organized to coordinate and to deliberate issues of water resources in the respective basins. To support these committees in operational function, a water agency will be created for the respective basins. In the State of Sergipe, these river basins are the following three rivers only: Japarutuba, Sergipe and Piaui. As mentioned in the drafts of the decrees, the water agencies might be unified into one agency because of geographical characteristics in the state.

The rivers of Sao Francisco, Vaza Barris and Real are under the federal domain. Then, the council, committees and water agencies will be organized under the federal government. However, the latter two rivers extend between Sergipe and Bahia States only, so the special committees might be organized between the two state governments. Furthermore, the SRH is considering getting the delegation to manage the state portions of these three federal rivers after the management system is established in the future.

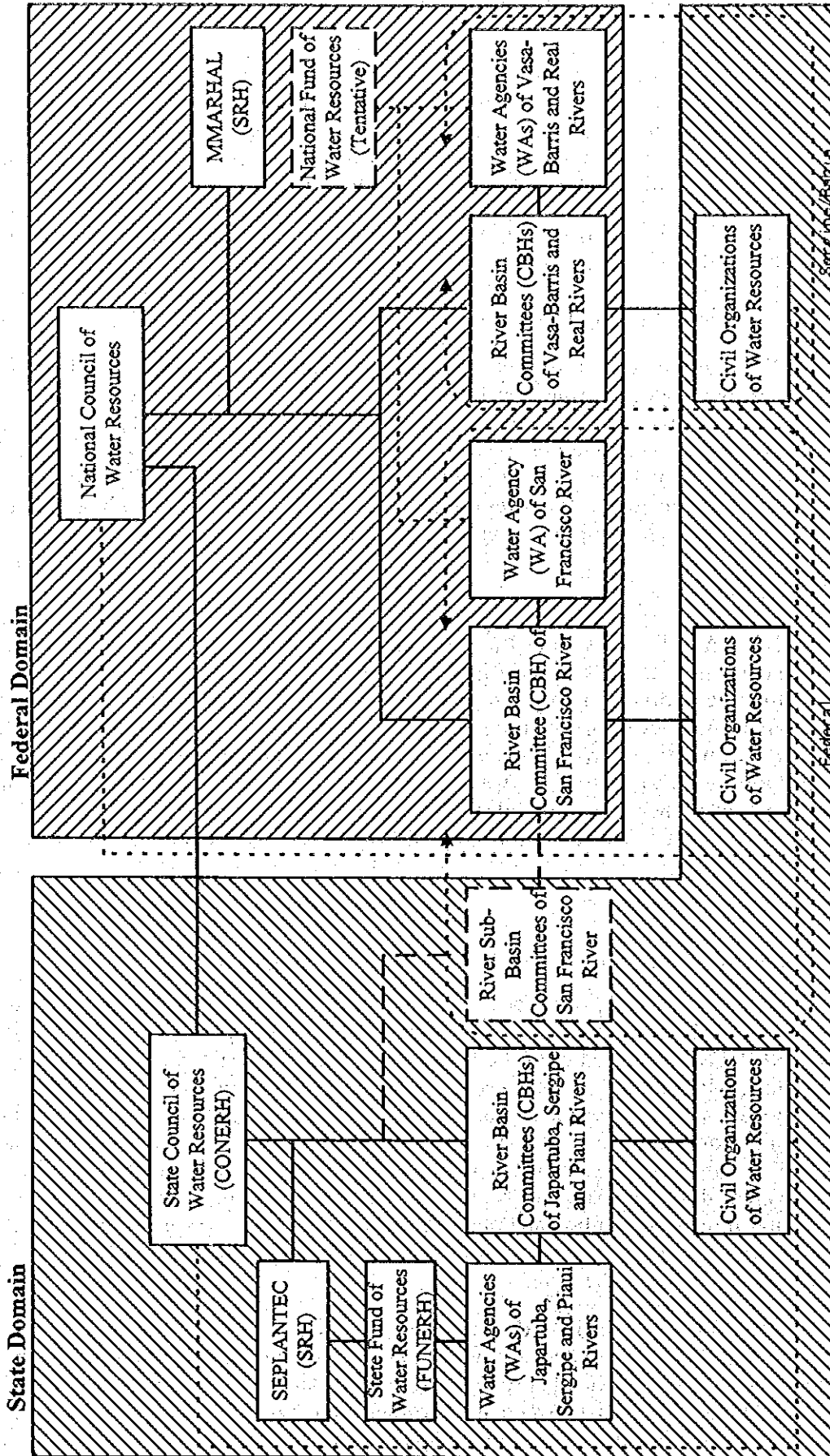


Figure-3.1 Organization Proposed for Water Resources Management

## **CHAPTER 4 MASTER PLAN OF INSTITUTIONAL ISSUES**

### **4.1 Grant of Water Rights**

In the Federal Constitution in 1988, water resources are stipulated as public domain under the federal or state governments. The competent government has to manage its water resources properly and accordingly has a grant power for water resources management. It has created to grant "water right" for water withdraw and for effluent drainage to every water users. Then, water users have to get water rights from the competent government. Thus, the grant system of water use rights is a legal action and also an effective tool for water resources management by the federal or state governments.

The water right aims to manage water quantity and quality for water use and to control the access right to water resources effectively. Its objectives are sorted out as follows:

- 1) To support long-term goals and investments,
- 2) To optimize overall benefits by mixing complimentary use (multiple use),
- 3) To have geographical bounds to facilitate administration,
- 4) To guide real-time operations to meet annual variations, and
- 5) To incorporate review/renewal mechanism for future generations.

As a result, the water users could consider using water rationally, and accordingly try to conserve water resources. However, the grant system does not always vouch sufficient quantity and quality water for water users.

The water code (Decree No. 24643, July 1934) also stipulates that a water user obligatorily has to get a water right from the government. It also gives general stipulation on concession, authorization or permission of water use and obligation to titleholders. It classifies water rights into two types: (a) water for public utility as concession level and (b) water use other than public utility as authorization level.

In the first category, the water use for necessity of human lives has the top priority and is free of charge, if the access to water is lawful (Water Code, Art. 34). The succeeding priority is given to navigation of public purposes. Harbors, hunting and fishing are sanctioned as public purposes in the Code. The Water Code allows the grant of water use at longest for 30 years for these high priority users. In the second category, other types of use include agricultural and industrial production purposes. Furthermore, the Water Code prohibits degrading or contaminating waters by discharging effluent. The Code orders the users who cause the nuisance to take remedial activities at the polluter's expense and to compensate for the loss of damage caused by the effluent drainage.

In the drafts of the state decrees, the grant is also admitted as a legal tool for water resources management. Then, the grant should be set up in consideration of the following conditions.

- 1) Priority of water use purposes.
- 2) Classification of waters under environmental legislation.
- 3) Preservation of multiple water use.
- 4) Maintenance of navigation system whenever necessary.



The criteria of examination for granting to water resources users include the following basic conditions.

- 1) Persons who intake, derive, consume water resources:
  - a) Total volume of water resources use at intake place,
  - b) Potential of water resources,
  - c) Limitation from the point of hydraulic observation view,
  - d) Discharge volume for intake under consideration of river regime,
  - e) Effective consumption volume reflecting type of water use, and
  - f) Objectives of water use.
- 2) Persons who use water for dilution, transport or assimilation of effluents or other liquid:
  - a) Total volume of water resources utilization at applying place,
  - b) Limitation from the point of hydraulic observation view,
  - c) Loads of water thrown into river regime, pondering organic and physical-chemical parameters of effluent and natural capacity of purification in the river, and
  - d) Treatment type of effluent.

In these laws and regulations, public purposes have higher priority than private purposes. In particular, water use concerning to human lives is considered to have the highest priority. Environmental issues are also important concern among public purposes. Besides, mass transportation systems such as navigation are opened for public users, and thus regarded as public utility. Non-public purposes are given lower priority than public purposes. Priorities among non-public purposes depend on the socio-economic situation of the river basin, which comprise economic activities and other activities such as amusement and extravagance. On the other hand, although drainage of effluent into rivers is different from water intake from water resources, its priority order could be considered in the same manner. As a matter of course, the statutes regulate the quality of effluent. Taking the discussion above into consideration, the following priority order is proposed as shown in Table-4.1.

**Table-4.1 Priority Order of Water Resources Use**

Purposes	Priority Order	Categories of Water Use
Public Purposes	1) For support of human lives	Potable water, domestic water supply
	2) For keeping natural & social environment	Public hygiene, safety, natural animal lives, ecological balance
	3) For public utilities	Transportation (navigation)
Private Purposes	4) For economic activities*	Agricultural, livestock & fishery production, industrial production, commercial & service activities, tourism
	5) For amusement*	Recreation, sports

Note: \* Priority order depends on the socio-economic situation in the river basin.

As mentioned in the law of state policy, the water resources are quite limited in the State of Sergipe. In addition, there are many existing water users in the state, who live relying on water and therefore who have to get rights of water uses. At the time of granting for water use applicants, thus, the competent agency should consider the following conditions to control water quality and quantity and to distribute water rights effectively and equally in the state. Incidentally, the small water users do not have to apply for water rights because of little influence to water environment.

- 1) In case of water intake, to maintain water balance taking into consideration of water availability, influence of downstream and existing water users.
- 2) To promote multiple-use system to utilize water resources effectively.
- 3) In case of effluent drainage, to effectuate the ecological balance without detriment to environment in the basin.
- 4) To take great care to grant water rights to pollutant charge dilution of effluent, because the dilution does not make the quantity of pollutant decrease and makes the treatment of effluent difficult technologically.

The water rights may be suspended in the emergency situation. These topics are already mentioned in the present movement in Section 3.5.4. The grant of water rights is under the jurisdiction of the public power, so the drafts propose that the SRH is set as the authority responsible for the grant. In the case that the granting rule is established firmly in the law, the granting work could be run in the decentralized agencies such as water agency and/or river basin committee which are familiar with the basin's water situation.

In the state policy, the allocation of water resources is coordinated by the state power on the basis of the priority order. In the process of allocation, a major focus is on debate among water users based on water allocation objectives. In the future, however, a new mechanism would be necessary for reallocating water to increase aggregate economic benefits. In advanced countries in the field of water resources allocation, the following mechanisms are applied for maximization of benefits: (a) trading among water users and (b) auction among users, as mentioned in 2.3.4. In particular, the auction system could set higher prices for water so that low-value users would release water for higher-value users. In the US and Chile, this system is said to have taken a firm hold on transaction of water rights.

## **4.2 Charging to Use of Water Resources**

### **4.2.1 Charging to Water Resources Use**

The charging system to users of water resources is a new administrative instrument in the state as well as in the country. Therefore, there are almost no examples of the charging system in the country. The study team collected some examples in foreign countries implementing the charging system. Table-4.2 shows the present water resources charges in the countries. In the table, the water resources use for potable water purpose is not charged in Japan and the Philippines. As mentioned in the previous section, the water use for support of human lives has the top priority and is the most fundamental water use.

In the top four examples, the unit of pricing water resources is "per liter/sec per year". This is because the water resources potential is given in the form of discharge capacity, i.e., "liter/second". Even in reservoir and groundwater resources, their potential is given in the same form taking into account of rechargeable capacity. In areas of scarce water resources, thus, the pricing unit would rather be based on "per liter/sec per year". In Sergipe State, water resources are quite serious particularly during dry season, so a charging unit would rather be set as "per liter/sec per year".

For industrial use of water resources, the table shows considerable variations in pricing. In Japan, the annual charge to industrial use is set at US\$27.60 per lit/sec on average in

1998. It varies from the minimum charge of US\$10.64 in Nagasaki to the maximum one of US\$45.53 per lit/sec in Tokyo. The details of these rates are tabulated in Appendix 6. In the Philippines, the annual charge is prices at US\$0.02 per lit/sec for the withdrawal capacity of less than 30 lit/sec. In Zambia, the annual charge is set at US\$8.20 per lit/sec for less than 6 lit/sec capacities.

In Chile, an average price of transactions between framers and urban water companies was US\$950 per lit/sec in 1992. This price is a lump-sum payment and not an annual charge. Once this price is annualized by means of capital recovery factor (CRF) of 10% discount rate and 50 years, i.e.,  $CRF=0.1009$ , the equivalent annual charge was calculated at US\$95.90 per lit/sec.

**Table-4.2 Examples of Charging to Water Resources Use**

I. Examples of Charging Unit in "per liter/sec. per year"		
Japan (Average of all Prefectures)	Category of uses	Annual charge per liter/sec.
	1) For industry	¥3,860 (US\$27.60)
	2) For power except electric generation	¥1,330 (US\$ 9.60)
	3) For fish culture	¥630 (US\$ 4.50)
	4) For other uses	¥2,500 (US\$ 18.10)
Charges of water uses for irrigation and potable water supply are free. Water use charge for hydroelectric generation is provided separately. Refer to Appendix A for charge data in the respective prefectures.		
Philippines	Rate of withdrawal (liter/sec.)	Annual charge per liter/sec.
	1) Not more than 30	0.50 pesos (US\$0.02)
	2) More than 30 but not exceeding 50	0.75 (US\$0.03)
	3) More than 50	1.00 (US\$0.04)
Except when the appropriation is for family domestic purpose or when the quantity of water appropriated for agricultural use is not more than 5 liter per second.		
Zambia	Rate of withdrawal	Annual charge
	1) Up to 500 m <sup>3</sup> /day (6 lit/sec)	5,000 kwachas (US\$8.20)
	2) Beyond 500 m <sup>3</sup> /day (6 lit/sec)	2 kwachas/ m <sup>3</sup> /day (US\$0.003/ m <sup>3</sup> /day)
Charges on temporary users are laid down separately.		
Chile (Water Registry of Santiago)	Transactions of water rights (separate from the land only), 1992	
	1) Transactions between farmers	US\$500 per lit/sec.
	2) Transactions between farmers and urban water comp.	US\$950 per lit/sec.
	3) Transactions between farmers and mining comp.	US\$950 per lit/sec.
II. Examples of Charging Unit of "per m <sup>3</sup> "		
Romania	Rate of withdrawal	Charge per m <sup>3</sup>
	1) Potable water supply use	42.00 lei (US\$0.0026)
	2) Industrial & commercial use	93.92 lei (US\$0.0082)
Brazil, Ceara	Rate of withdrawal	Charge per m <sup>3</sup>
	1) Potable water supply use	R\$0.01217 (US\$0.0103)
	2) Industrial use	R\$0.73000 (US\$0.6186)
The water charges are set up for extraction from water reservoirs as water resources charge.		

In the bottom two examples in Table-4.2, the unit of pricing water resources is "per m<sup>3</sup>" of water resources consumption. This is that the charge of water use is based on the consumption volume. If water resources are enough for withdrawal, a water user might install a pump with enough capacity to withdraw from water sources such as river and groundwater. Once the water user is permitted to install an enough capacity pump, he does not have to install a larger storage tank as buffer to meet peak water demand. In this case, he can save an investment cost for his water facility. On the other hand, this

condition would not be appropriate for areas of scarce water resources. In case that more than one user withdraws water from a scarce water source, the total capacity might exceed the discharge capacity. Thus, it should be careful to set a pricing unit of "per m<sup>3</sup>" of water source withdrawal.

On the basis of the discussion above, the water charge to industrial use is summarized in Table-4.3. As shown in the table, the water price of industrial use varies considerably. The prices are set by the respective governments, which reflects the water policy of the respective countries except Chile. In Chile, the price depends on the relative value of water in a free market. In most of other countries, the price is generally set lower pricing than the relative value of water. It is said that the under-pricing has caused misuse of water.

**Table-4.3 Rate of Charging to Industrial Use in Foreign Countries**

Country	Water Price (US\$ per lit/sec)	GDP per Capita (US\$)
Japan	27.60	28,500
Philippines	0.02	900
Zambia	8.20	450
Chile	96.00	2,700

Industrial and agricultural uses have separately determined sectoral water allocations in most countries. In many countries to date, the much higher value of industrial water, as compared with agricultural uses, is set a high economic cost in the existing allocation. In Japan in fact, the agricultural use is not charged to usage of water resources. In the Philippines, the small users (less than 5 lit/sec) of agricultural purpose are not charged, either. Although these allocations may have been appropriate historically, future developments might change their economic implications.

If the charging unit of the cases of Romania and Ceara in Brazil is converted from "m<sup>3</sup>" to "lit/sec" applying a human consumption of 120 lit/day/capita, the water price was estimated as shown in Table-4.4. 120 lit/day is calculated at 43.8 m<sup>3</sup> per year, and furthermore at 0.0014 lit/sec. In the case of Ceara, the unit price is US\$0.0103 per m<sup>3</sup>, so the price for 43.8 m<sup>3</sup> is calculated at about US\$0.45. Accordingly, the converted price is calculated at around US\$320 per/lit per year.

**Table-4.4 Converted Rates of Charging to Domestic Use in Brazil and Romania**

Country	Water Price (US\$ per lit/sec)	GDP per Capita (US\$)
Romania	80	1,500
Brazil, Ceara	320	2,800

The GDP per capita in Sergipe State is estimated at R\$2,400 (equivalent to US\$2,600) in 1997. This value is close to Chile and Ceara in Brazil. It is also about six times higher than that in Zambia but one-tenth lower than that of Japan. Taking this observation into account, the unit charge for Sergipe is set at most between US\$50 and US\$100 per lit/sec.

The source water requirement of the respective sectors is estimated under the present conditions and in the target year 2020. Hence, the requirement means not actual peak water demand of consumers but water volume withdrawn from the competent river basin. Then, in case that the river basin has poor water resources and can not cover the water demand, the withdraw volume would be smaller than the peak water demand because some source water has to be transferred from other river basins. Table-4.5 shows the results of

the estimate of source water withdraw from the state domain, that is, three river basins of Japarutuba, Sergipe and Piaui. The table also shows two kinds of requirement estimates, i.e., five river basins except Sao Francisco River and all six river basins. The details of the water requirement estimates are given in Appendix 7.

**Table-4.5 Water Withdraw: 1997 and 2020**

Water Resources User	1997			2020		
	Surface Water	Ground-water	Total	Surface Water	Ground-water	Total
<b>Three River Basins <sup>*1</sup></b>	1,287	2,278	3,565	4,522	3,147	7,669
Urban & Large Rural Water Supply	487	2,264	2,751	1,662	3,070	4,731
Small Rural Water Supply	0	14	14	0	77	77
Irrigation	800	0	800	2,860	0	2,860
<b>Five River Basins <sup>*2</sup></b>	2,894	2,625	5,519	10,218	3,572	13,790
Urban & Large Rural Water Supply	894	2,602	3,496	3,245	3,460	6,705
Small Rural Water Supply	0	23	23	0	112	112
Irrigation	2,000	0	2,000	6,972	0	6,972
<b>All River Basins <sup>*3</sup></b>	23,897	3,006	26,903	50,440	4,002	54,442
Urban & Large Rural Water Supply	3,597	2,979	6,576	8,718	3,866	12,585
Small Rural Water Supply	0	27	27	0	135	135
Irrigation	20,300	0	20,300	41,722	0	41,722

Note: <sup>\*1</sup> Three rivers under state domain are Japarutuba, Sergipe and Piaui.

<sup>\*2</sup> Five rivers include Vaza Barris and Real in addition to the three rivers above.

<sup>\*3</sup> Six rivers include Sao Francisco in addition to the five rivers above.

The revenue of the state government through the charging system is estimated as a product of water requirement and a unit rate of charging to water resources use. Table-4.6 shows the results of the total amount through water resources charge in terms of the three cases mentioned in Table-4.5. Hence, groundwater is under state domain, so charging revenues to groundwater of the respective cases are identical in all cases, as shown in the table. The annual revenue from the three river basins in the state domain is estimated approximately at US\$215,000 in 1997 and US\$426,000 in 2020, in case that the unit rate is set as US\$50 per lit/sec. Furthermore, in case that the unit rate is set as US\$100 per lit/sec, the annual revenue from the three river basins is estimated approximately at US\$429,000 in 1997 and US\$852,000 in 2020.

**Table-4.6 State Revenue through Water Charge: 1997 and 2020**

Water Resources User	Requirement (lit/sec)	1997		Requirement (lit/sec)	2020	
		Water Resources Charge <sup>*1</sup>			Water Resources Charge <sup>*1</sup>	
		US\$50 (US\$1000/Year)	US\$100 (US\$1000/Year)		US\$50 (US\$1000/Year)	US\$100 (US\$1000/Year)
<b>Surface Water</b>						
Three River Basins <sup>*2</sup>	1,287	65	129	4,522	226	452
Five River Basins <sup>*3</sup>	2,894	145	289	10,208	510	1,021
All River Basins <sup>*4</sup>	23,897	1,195	2,390	50,440	2,522	5,044
<b>Groundwater</b>	3,006	150	300	4,002	200	400
<b>Total</b>						
Three River Basin Case	4,293	215	429	8,524	426	852
Five River Basins Case	5,900	295	589	14,210	710	1,421
All River Basins Case	26,903	1,345	2,690	54,442	2,722	5,444

Note: <sup>\*1</sup> Unit rates of charging are set in two alternatives: US\$50 per lit/sec and US\$100 per lit/sec.

<sup>\*2</sup> Three rivers under state domain are Japarutuba, Sergipe and Piaui.

<sup>\*3</sup> Five rivers include Vaza Barris and Real in addition to the three rivers above.

<sup>\*4</sup> Six rivers include Sao Francisco in addition to the five rivers above.

If the state government take over the authorization of water right granting to the three rivers under federal domain from the federal government, the state government could have a power on granting of water resources use right on the federal rivers, i.e., Vaza Barris, Real and Sao Francisco. Table-4.6 shows two kinds of revenue estimates, i.e., five river basins except Sao Francisco River and all six river basins. Hence, the unit rates of water resources charge are assumed to be the same as those in the above. The revenue from five river basins is estimated approximately at US\$589,000 in 1997 and US\$1,421,000 in 2020. In the case of six river basins, the revenue is estimated approximately at US\$2,690,000 in 1997 and US\$5,444,000 in 2020. The total revenue from the six river basins is 6.3 times larger than that from the three river basins in the state domain in 1997 and also 6.4 times in 2020.

As discussed in the following section, a water agency will be established in the future. The water agency will be managed on the basis of the charging revenue to water resources use. Furthermore, the appropriation to the water agency and river basin committees is limited to less than 7.5% of the total revenue from the charging to water resources uses (State Law No.3870, Art.27). Since this rate of 7.5% will be increased to 10% in the near future after the law amendment, the rate of 10% is used to estimate the budget for the water agency and committee expenses.

Supposing that the water agency has 12 full-time members at matured stage, the annual expenses for the agency and river basin committees are estimated as US\$264,000 at 1999 price level, as shown in Table-4.7.

**Table-4.7 Estimated Expenses of Water Agency and River Basin Committees**

(Unit : US\$ 1,000 per annum)			
	Cost Item	Amount	Remark
1.	Basic Salary	120	12 persons times US\$ 10,000 per annum
2.	Expense for Worker Benefits	60	50% of Item 1
3.	Administrative expenses	60	50% of Item 1
4.	Expenses for Committees	24	10% of Item 1 to 3
	Total	264	

The total annual expense of US\$264,000 is larger than the total revenue in 1997 from the charging to water uses in three river basins under the unit rate of US\$50 per lit/sec. Even in the case of the unit rate US\$100 per lit/sec, the total annual expense accounts for 62% of the total revenue in 1997. That is far larger than 10%, the rate limited in the state law after amendment. The cases that exceed ten times of the total annual expense are only the following two cases: (1) the revenue in 1997 from the six river basins under the unit rate of US\$100 per lit/sec; and (2) the revenue in 2020 from the six river basins under the unit rate of US\$50 per lit/sec as well as US\$100 per lit/sec. Since the rate of US\$100 per lit/sec seems to be considerably high as compared with the foreign examples, the rate should be set at US\$50 for the starting point. The water agency could be established in accordance with the progress of water resources charging system.

#### 4.2.2 Charging to Effluent Discharge

The charging system to effluent discharge is also found here and there in the foreign countries mainly in Europe, although the examples of the system are not many even in Europe. According to Romanian charging system to effluent discharge, the basic units are

based on the weight of pollutants. They are suspended solids and BOD. In Romanian case, the charging rates are as follows: (1) 32,298 lei/ton (US\$0.0020 per ton) of suspended solids; and (2) 130,578 lei/ton (US\$0.0082 per ton) of BOD. In Sergipe State, the charging system to effluent discharge would better be introduced after the establishment of the charging system to withdrawal of water resources in the future.

#### **4.3 Organization Plan**

##### **4.3.1 First Stage Plan of Water Resources Management**

In the state policy, the organizations for water resources management are composed of CONERH, RBCs, WA, FUNERH and SRH, as discussed in Section 3.5. The works and obligations of these organs are listed up in Appendix 8. The structure of these organs is figured out as shown in Figure-3.1. However, most of organs are still under preparation and do not exist at present except SRH and CONERH/SE in the state level.

The SRH has to promote the following major works for the beginning period.

- 1) To form River Basin Committees in the state domain.
- 2) To establish a draft of grant system of water resources use
- 3) To create a draft of charging systems to water resources users and effluent discharge
- 4) To formulate a master plan of water resources for the respective river basins
- 5) To promote some multiple-use water resources projects in the master plan
- 6) To set up and to operate an information system of water resources
- 7) To get hold of present situation of water resources in the respective basins
- 8) To establish an observation network of hydrology and aquifer

Moreover, the state revenue from the charging system is expected for supporting the new organizations. The expected amount through the charging system might be not enough to support the new organizations and their works, if the charging rates were smaller than the expected. In order to promote the works above, thus, the SRH has to be financially supported by the general fund of the state government for the time being. Besides, the SRH has to be strengthened to promote the works as a leading organization in the state government. Then, the SRH must be strengthened in accordance with the progress of requirement to water resources management. A draft plan of the new SRH for the first stage is illustrated in Figure-4.1. The detailed duties for the new SRH are listed in Appendix 8.

In the future, a lot of works in water resources management would make headway along with the economic growth in the state. At the time when the SRH will not be able to do works effectively, the water agency (WA) could be separated as an independent organization, that is, the second stage for water resources management. In the second stage, the WA treats some duties listed up in Appendix 8.

Finally, the FUNERH could be established for managing the fund from the charging system, after the water market takes a firm hold in the state and also in the country. This is the final stage for the institutional frame of water resources management. The structure

of the frame shown in Figure-3.1 is carried out in the third stage.

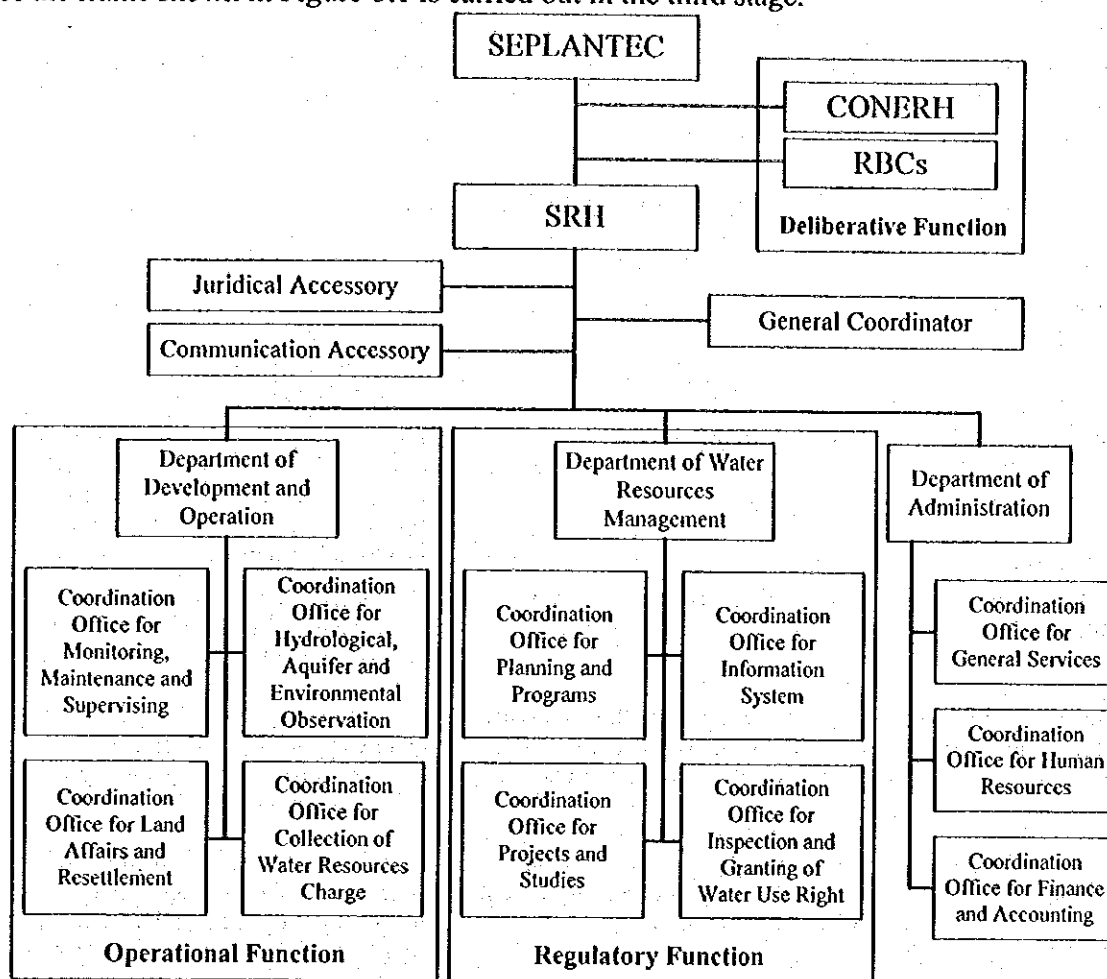


Figure-4.1 Organization Plan of SRH at First Stage

### 4.3.2 Training Plan

The water resources management administration started only a couple years ago. In order that the SRH fills up the administration power under the present situation, there is no other way of recruiting several experts among existing professionals of water affairs such as water supply and irrigation. In fact, the present staff in the SRH comes from water supply entity and irrigation authority such as DESP and COHIDRO. Even the present SRH are still learning the expertise of water resources management through the national training programs provided by the SRH in the MMARHAL.

The vocational training is essential to improve the employee's capability and eventually the performance of the organization. The ways having been applied for a long time in the water affairs were an on-the-job training. Although the on-the-job training is still one of the considerably efficient methods and therefore it has been applied in every field widely, it will be necessary that the training be carried out with more systematic and premeditated planning. In addition to the on-the-job training, workshops and seminar programs might be useful for new workers in the field of water resources management to get necessary technical knowledge for the time being.

Furthermore, the SEPLANTEC/SRH has to create a training program for new workers and



agencies concerned. The SRH in the MMARHAL must have enough capability of staff training owing to cooperation with the World Bank's training program. Upon deliberation with the MMARHAL/SRH, the senior members of the SEPLANTEC/SRH should formulate an optimum training program. The training programs for water resources development should include the following fields.

**Table-4.8 Training Programs for Water Resources Management**

Field	Main Curriculum	Contents
Water Resources Management	Basic knowledge of water resources management	Water situation of water resources; history of water resources development; management factors in advanced countries
Hydrology, Meteorology and Hydrogeology	Basic science of hydrology, meteorology and hydrogeology	Basic knowledge of water circulation; observation and measurement of water conditions; characteristics of water flow mechanism such as discharge, intake and recharge
Environmental Conservation	Principles and techniques of water environmental conservation	Fundamental knowledge of water environment; scientific bases of water environment; classification of waters,
Water Resources Usage and Effluent Discharge	Water utilization and effluent discharge of domestic, industrial, agricultural, navigation and recreation users	Water consumption quantity and quality by water users; effluent discharge quantity and quality by water users; seasonal fluctuation of water use
Water Resources Legislation	Basic concepts of laws, regulations and acts, and principles of legislative tools for water use controls	Structure and legislative methods of laws and legislations; legislative instruments such as granting of water rights and charging system to water resources uses
Water Resources Master Plan	Formulation methodology of water resources master plan in river basin	Contents of master plan; formulation procedure of master plan; references and data necessary for master plan
Finance and Accounting	Principle rules of budget planning, procurement of financial sources, accounting	Structure and procedure of budget planning; revenue from charging and other sources; procurement of finance; accounting system; financial statement

#### **4.4 Participation of Civil Organizations**

Water has been provided virtually free to users by the public sectors, still in rural areas, under the historical old paradigm. Thus far, the public sector decides every management issue of water. There are no rooms for the stakeholders to take part in implementation and O&M of water supply system. It hinders them becoming familiar with the system. This old paradigm results in waste and inequitable allocation of scarce water resources. The revival of democracy leads to the realization that institutional reorganization, i.e., participation and decentralization, is a must in the water sector. In rural water supply in particular, it is important that the people of beneficiaries are aware of this key concept and that they participate into the management of their water supply system.

Public participation and decentralization are the key concepts of water resources management. In the laws, civil organizations are expected to attend to river basin committees, members of which are selected from the local associations and organizations interested in water resources. Thus, the stakeholders influence policy formulation of water system, alternative design, investment choice and management decisions. Then, they will take the responsibility for their water system. In fact, the stronger the participation and interest to water system the users have, the more successful the project will be in achieving its associations as the primary agents for water resources management.

The participation of civil organization is put into practice through CONERH/SE and River Basin Committees (RBCs). According to the state decree No. 18099 disposed on 26th of May 1999, the eight members are expected to attend CONERH as representatives of the water users and civil societies related to water resources. The list of eight members is made as an inventory in Section 3.5.1.

The members of (1) a representative of CREA/SE Section and (2) a representative elected among the teaching and survey entities are expected to give professional judgments objectively for various conflicts in water resources management. The members of (3) a representative elected among the associations linked to agriculture and (4) a representative elected among the associations of irrigation users represent the major industry in the state, who are familiar with the agricultural situation in the state as well as in the country. The member of (5) a representative elected among associations which are legally constituted for protection, conservation and improvement of environment has great concern with water environment in the state. These members have serious concern in water resources utilization.

According to the draft of the water resources management, the ten members are expected to attend each RBC as representatives of the respective water users and civil societies related to water resources. However, the names or statuses of the members are not identified so far. Only a representative of Indian communities is expected to attend the competent committee. Other members are selected among the economic fields such as agriculture and manufacturing industry. In addition to those, some members of professional or academic standing should be added to the respective committees in compliance with the situation of the river basins.

#### **4.5 Implementation Schedule**

Implementation schedule of water resources management plans are shown in Table-4.8. The schedule is formulated taking into account of the following concepts, in principle.

- 1) For sequential implementation of programs, a program that the implementation is prerequisite to another program is placed earlier.
- 2) For preparation of programs including social interests or multiple sectors, at least two years are necessary, while one year is allocated for preparation of a program within a sector on a division of the government.
- 3) Overburden on a division of the government must be avoided.

**Table-4.9 Implementation Schedule of Water Resources Management Plans**

Program	First: 2000-2004					Second: 2005-2009					Third: 2010-2014					Fourth: 2015-2019						
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	
<b>Institutional Plan</b>																						
1. Grant of Water Rights	**	**	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	
2. Charging to Use of Water Resources		**	**	##	##	(From nominal ones to the ones reflecting economic value)																
3. Organization Set-up	**	##	##	(Phase 1)		##	##	##	##	(Phase 2)					##	##	##	##	(Phase 3)			##
4. Cost Allocation for Multi-purpose Facilities	**	**	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##

Note: \*\* Legislative arrangement, institutional set-up, initial training or other preparations  
## Regular operations and management with gradual enhancement and periodical institutional review

#### 4.6 Priorities in Institutional Plans

Water resources management is a continuous activities, starting with a basic part of each program. Gradual upgrading should continue in each of the program. Although there are some sequences among programs as mentioned in Chapter 5, each program has its basic or fundamental parts and additional parts for upgrading. Implementation of the basic parts has a priority, in principle. Therefore, the highest priority should be placed on the implementation of the fundamental parts of a program which is placed earlier stages in the implementation schedule.

The State Water Resources Policy introduces new sets of paradigm and concepts. To realize the policy, priority should be place on the implementation of fundamental programs. Fundamental programs are granting system of water rights and public participation through River Basin Committees. The highest priority should be placed on organization set-up of phase 1, which includes strengthening SRH for the preparation and management of equitable water right granting and establishment of River Basin Committees for attaining public participation in water resources management.

Charging on use of water resources and cost allocation of multi-purpose facilities are the instruments to achieve rational use of limited water resources. To establish the basic rules to manage these tools should have the next priority.