CHAPTER 3 CURRENT ENVIRONMENTAL MANAGEMENT SYSTEM IN THE STUDY AREA

3.1 Legal Framework

(1) Legislation for the Conservation of Water Areas & Water Resources

There are federal, state and municipal legislation in Brazil, and these are categorized as a law, decree, resolution, and norm.

In terms of the legislation for the conservation of water areas・water resources, Decree No. 24673 (Water Code) was the first federal legislation of its kind enacted in 1934. Although now there are basic legislation at the federal and state levels, they are not properly enforced. For example, none of the municipalities in the Mar de Dentro area adhere to State Law No. 9921, which obliges sanitary landfilling for municipal wastes.

(2) Legislation for Wetland Conservation

Federal legislation for wetland conservation were enacted based on the Ramsar Convention with which Brazil affiliated in 1996.

The Ramsar Convention was initially established for the sole purpose of conserving wetlands of international importance, particularly as habitats of waterfowls. Later on, however, the convention was revised to include other living organisms as well as the preservation of the various functions of wetlands. Nations that have joined this convention are responsible for ① the designation of wetlands that have to be registered and their conservation, ② the promotion of the wise use of wetlands, ③ the establishment of wetland reserves, and ④ the promotion of international cooperation. As a member, Brazil is also responsible for the above activities.

There are no special state legislation for wetland conservation. Legislation for the protection of natural resources are applied instead. Municipal legislation for the protection of natural resources are considered unsubstantial.

3.2 Standards

(1) Water Quality Standards for Public Water Areas

The federal government supervises the Mirim Lake and Jaguarao River, both international water bodies, while Patos Lake and other rivers are under the supervision of the government of the state of Rio Grande do Sul. Accordingly federal water quality standards are applied for Mirim Lake and Jaguarao River, while the water quality standards of the state are applied for Patos Lake and other rivers.

The federal Resolution CONAMA No. 20 established in 1986 is the basis for water quality standards for the water bodies in the study area. In 1995, the state of Rio Grande do Sul classified the southern water section (brackish water area) of Patos Lake into 3 classes. Using the CONAMA No. 20 as a reference, the state established provisional water quality standards for this water section. However, the northern and central water sections have not been classified yet and are still without water quality standards. Provisional water quality standards were also established for the 4 main rivers that flow into Guaiba Lake to monitor fecal contamination. Standards for the water quality of other major rivers, however, have not been established.

(2) Effluent Standards

Effluent standards were also established based on the aforementioned Resolution CONAMA N0.20, mainly assuming that effluent will not change the class of the water section it will be discharged into.

In 1989, RS established its own water quality standards for wastewater. The levels (BOD, COD (Cr), SS), however, vary depending on effluent discharge. Standards established for factories constructed after April 1989 are a lot more stringent than previous ones.

3.3 Monitoring Activities

(1) Meteorological and Hydrological Monitoring Activities

Meteorological conditions in the state are monitored by CPRM, INMET (only within the Porto Alegre vicinity), EMBRAPA (Pelotas), FEPAGRO and Pilot Station (Rio Grande). The water level of Patos Lake is monitored by SOPSH and the Pilot Station, while river water level is monitored by CPRM. Although these monitoring activities are carried out (in accordance with the respective objectives of the implementing agencies), there is no database and the data are not made public.

(2) Monitoring of River Water Quality

For environmental conservation, FEPAM monitors the water quality of 4 rivers in the Guaiba River basin from 47 stations, using 20 water quality parameters. Since the monitoring activity does not cover flow measurements, load from these rivers cannot be calculated.

In the Mar de Dentro area, the water quality of the rivers is not periodically monitored in the aim to preserve the environment.

Monitoring activities to preserve the quality of the water supply source are carried out by DMAE and CORSAN. The context of these activities, however, differ from those of monitoring for environmental conservation.

(3) Monitoring of Lake Water Quality

The water quality of Patos Lake, even the southern section where water quality standards have been provisionally established, is not being monitored. On the other hand, the 4 areas by the lake coast designated for swimming are monitored in summer by FEPAM for fecal coliform numbers.

In contrast, the Mirim Lake Committee which both represents the Brazil and Uruguay sides, have been monitoring Mirim Lake (including the San Goncalo canal) twice to thrice a month since 1997, from 15 stations and using 29 water quality parameters.

DMAE monitors Guaiba Lake from 9 stations once a month using 18 water quality

parameters. The monitoring results, however, are never made public.

(4) Monitoring of Wastewater from Factories

There are 2,418 factories and enterprises registered in the state of RS, and from 1985 these entities are obliged to monitor their own discharge amount and water quality. Now these entities, through their caretakers or administrators, monitor stipulated parameters according to the stipulated monitoring frequency. These monitoring activities, however, are not properly checked by FEPAM due to shortage in staff. In addition, there are doubts about the efficiency of wastewater treatment in preserving water quality, as the storage and disposal place for 50% of the sludge that results from wastewater treatment is unknown.

3.4 Agencies Relevant to Water Quality Control and Ecosystem Preservation

(1) Federal Government Agencies

Of the federal government agencies, SEMA undertakes the formulation of policies for water quality control and ecosystem preservation, and gives relevant instructions to subordinate agencies. Technical assistance (studies, establishment of water quality standards, etc.) for SEMA is supervised by CONAMA. The policies are implemented by IBAMA, who also supervises 3 of the biological reserves (one of which is still being planned) in the Mar de Dentro area.

(2) State Government Agencies

SEMA is responsible for the formulation of environmental policies for the state of Rio Grande do Sul. CONSEMA acts as the screening agency, FEPAM as the implementing agency, and FZB conducts the research work.

FEPAM is responsible for the various works that are relevant to the conservation of the water quality and the ecosystem, such as land and water zoning, establishment of water quality standards, water quality monitoring (including industrial wastewater),

assessment of development projects, licensing of factories and enterprises, etc. The implementation of these services, however, are always delayed due to shortage in staff. FZB mainly conducts research on the ecosystem.

CORSAN, which falls under SOPSH, is also a state agency responsible for the conservation of the water quality and the ecosystem. With 4,000 employees, CORSAN is responsible for the waterworks and sewerage planning for the 357 municipalities (a total population of 6.5 million and excluding Porto Alegre) in the state, as well as giving financial and technical assistance to these municipalities. The agency also monitors the quality of the water supply source and treated water from the sewage treatment plant.

(3) Municipal Agencies

Only a few municipalities in Mar de Dentro have agencies that specialize in services relevant to the preservation of water quality and the ecosystem, which are partly undertaken by the construction and agricultural sectors. Moreover, these municipalities usually receive technical assistance from state agencies for project planning and implementation.

Pelotas has an agency of its own called SANEP that is independent of state management and operation activities. The agency has 450 employees and contracts out water supply, sewage treatment and the collection/disposal of domestic solid waste services.

(4) Basin Management Committee

The Basin Committee is responsible for the establishment of policies for the management of water resources in the state, in accordance with State Law No. 10,350 which was enacted in 1994. The committee holds discussions on and concludes the following: water area division, formulation of a comprehensive master plan for the development and conservation of water resources, relevant construction works and restrictions in water resource use, priority ranking for wetland preservation, importance of dredging, introduction of a fee collection system, etc. A basin committee consists of 50 to 100 members: 20% representatives of government agencies, 40% water users, and 40% residents.

The state of Rio Grande do Sul is divided into a total of 22 basins, each with a basin

committee of their own. In actuality, however, only a few of these committees are really functioning. The Mar de Dentro area is divided into 3 basins, but only L-30 (Camaqua River basin) has a basin committee. DRH decides the policies for the basins that are without a basin committee.

(5) Universities

Of the universities in the state of Rio Grande do Sul, the following universities conduct research on the water environment and the ecosystem: FURG on the southern water section of Patos Lake, UFPEL on Mirim Lake, UNISINOS on Camaqua River and its basin, UFRGS/IPH on the northern water section of Patos Lake and the Guaiba Lake. Through foundations, each university implements studies/research consigned by the government and actively participates in every type of deliberation relevant to their fields of interest.

(6) NGO

There are over 70 environmental NGOs in the state of Rio Grande do Sul, 90% of which focus on the protection of the natural environment (fauna, flora, shores of lakes/rivers, etc.), and are mainly carrying out dissemination and enlightenment activities for the residents, particularly the impoverished class, as well as environmental education programs in cooperation with schools. Some of the NGOs carry out studies and projects consigned by the government with the assistance of universities.

3.5 Budget for Environmental Conservation

(1) RS Revenue and Expenditure & Budget for Environmental Conservation

Every Brazilian state derives its revenues from state taxes and consumption taxes, as well as subsidies from the federal government. In the case of Rio Grande do Sul, the subsidy from the federal government is small that the majority of the state's revenue is derived from state and consumption taxes (ICMS). Of the revenues in 2000 fiscal year, 82% are distributed to the salary/pension of civil employee and ordinary expenditure, 6 % to payment for a loan and only 7% to the new development projects..

The budget of Rio Grande do Sul for fiscal year 2000 will total R$8.8 billion, and 1.5% (R$130 million) will be appropriated to SEMA. It would be impossible to implement a new large scale environmental conservation project with this budget, however, as SEMA consists of FEPAM and FZB, agencies with ongoing environmental conservation services. For the Mar de Dentro Program executing secretariat under SCP, R$2.7 million will be appropriated from the budget.

Aside from the budget appropriated for every sector, a participatory type budget is independently appropriated by the state of Rio Grande do Sul to directly deal with the demands of the residents. This budget is appropriated for agricultural, educational, public health and sanitation services.

(2) Municipal Revenue and Expenditure and Budget for Environmental Conservation

Municipal revenues are mainly derived from subsidies appropriated by the federal government and the state government, as well as fixed property taxes (IPTU). The municipalities in the state of Rio Grande do Sul have a low fixed property tax collection rate, only about 10% on average of the municipal revenue. Majority of the revenue is derived from federal and state government appropriated funds.

Sanitation related services (water supply, sewage treatment, solid waste management) are administered by the municipality. However, most of these municipalities find it difficult to sustain these services as, except for water charges, they collect no fees at all. Even the budget of CORSAN, who finances the construction of the municipal water supply and sewage facilities, was curtailed as a result of the decline in state taxes for the past 20 years, and covers up the shortage using funds from the federal government for unemployment, and financing from the state bank, BID, and WB.

CHAPTER 4 JUSTIFICATION AND FRAMEWORK OF THE MASTER PLAN

4.1 Justification

If suitable countermeasures are not taken in the future against the aforementioned prevailing environmental conditions in the study area, the various processes indicated in **Fig. 4-1** are forecast to bring about a myriad of social losses.

The Mar de Dentro Program currently being promoted in the state of Rio Grande do Sul aims to improve the standard of living of the residents in the Mar de Dentro area—the study area for the master plan proposed herein. The basic policy of this program is to develop the features and potential of the area by conducting training in environmental education and environmental preservation, and to increase residents' income and create employment. The materialization of social losses such as those indicated in **Fig. 4-1** would mean losing rich water resources and bio-diversity, as well as the production potential of the land and water bodies, consequently making the attainment of the objectives of the Mar de Dentro Program impossible.

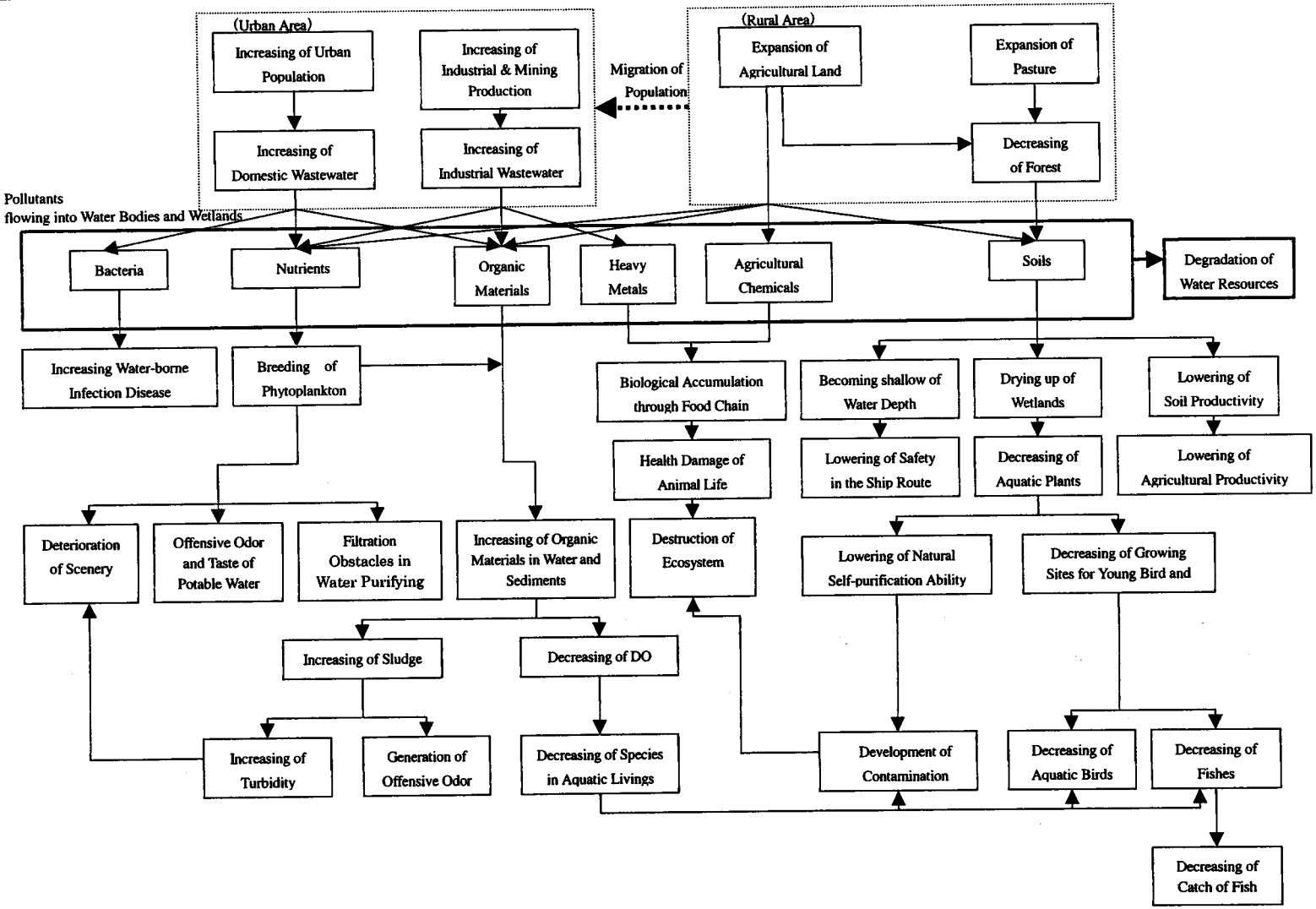
If suitable countermeasures are taken against these conditions, the following benefits can be obtained:

① The elimination of contamination by excreta would improve the urban sanitary environment, restore the use of the lake shore for recreation, and consequently improve the mental and physical disposition of the residents.

② The elimination of organic contamination and eutrophication would mean the preservation of the quality of water resources and the bio-diversity in water areas and wetlands, thereby expanding the use of the water resources and increasing the biological population (including fish). This would also lead to the acquisition of a place for the observation and study of nature.

③ The prevention of soil runoff would restore the intrinsic qualities of the basin and therefore improve agricultural production.

The realization of these benefits would help sustain a highly productive agriculture and stock raising industry, fishing industry (inclusive of breeding), the development of a primary product manufacturing industry as well as eco-tourism, and the attainment of the objectives of the Mar de Dentro Program.



THE STUDY ON THE ENVIRONMENTAL MANAGEMENT
OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
IN THE FEDERATIVE REPUBLIC OF BRAZIL

JAPAN INTERNATIONAL COOPERATION AGENCY
KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL

Fig. 4-1

Causal Materials of Aquatic Environment Deterioration and the Social Loss Brought by them

Based on these viewpoints, the master plan proposed herein recommends suitable countermeasures for the restoration and preservation of the water areas and wetlands in the Mar de Dentro area. These countermeasures are indispensable to the development of the area.

4.2 Components of the Master Plan

For environmental restoration and preservation, targets based on present conditions and the planned use of the environment should be established first, followed by the selection and application of direct and indirect countermeasures that are effective and feasible based on prevailing conditions at the site of study, to attain the targets for preservation (see **Fig. 4-2**). Monitoring determines to what extent the targets were attained. Once it is clear that the targets have not been attained, the target level and scale of the countermeasures will be revised, and monitoring will be continued further.

As shown in **Table 4-1**, the master plan for the restoration and preservation of the water areas and wetland ecosystem in the Mar de Dentro area is made up of 8 components (plans). The position of the components are shown in **Fig. 4-2** in numbers.

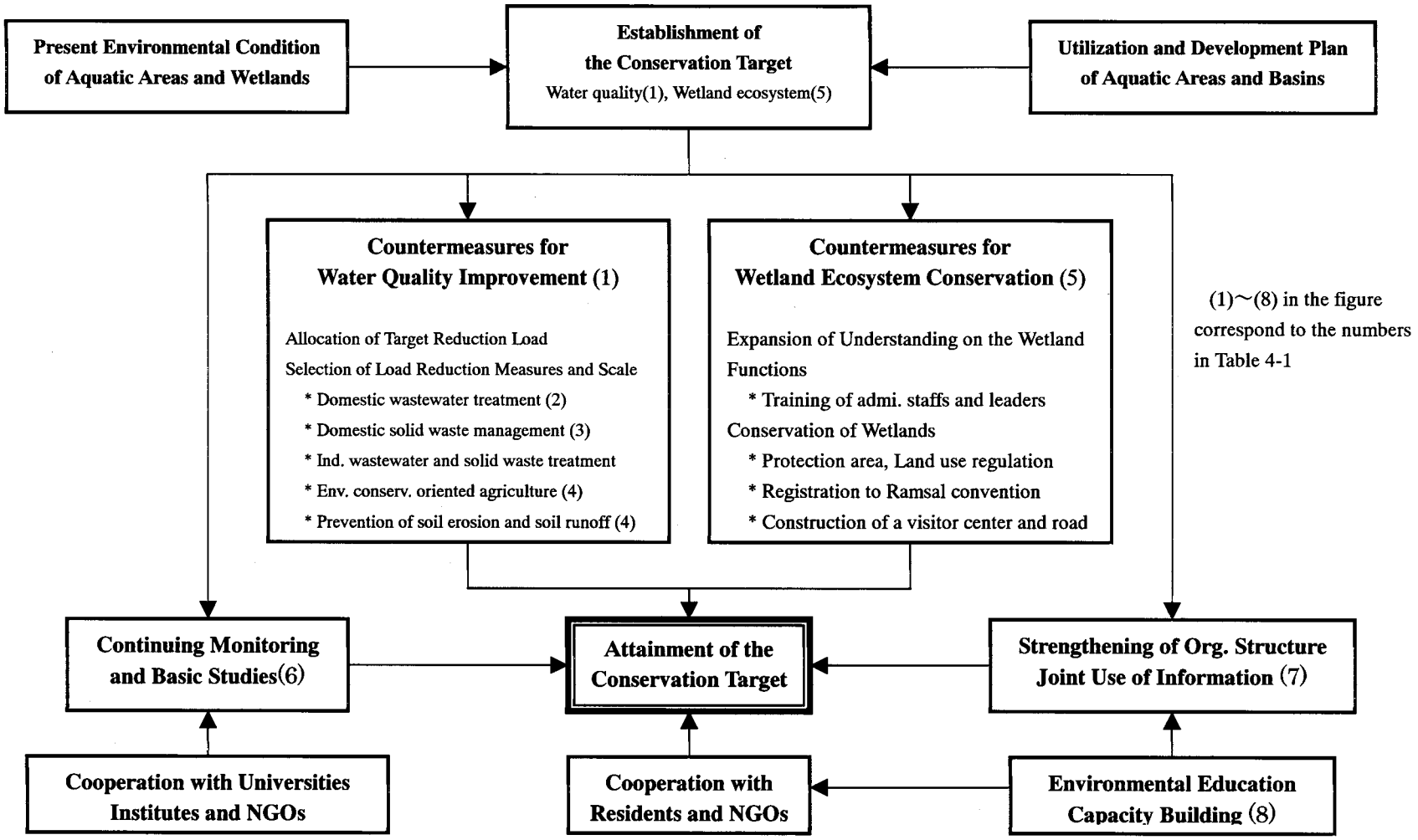


Fig. 4-2 From Establishment of the Conservation Target to its Attainment

Table 4-1 Components of the Master Plan

Component	Proposed Items
(1) Water Quality Control Plan	・ Establishment of conservation targets (water quality standards, allowable inflow load, target reduction load) ・ Principles for the distribution of the target reduction load (selection of important areas and generation sources) ・ Selection and evaluation of load reduction measures ・ Applicable scale of load reduction measures
(2) Sewage Treatment Plan	・ Basic policy for domestic wastewater treatment in urban areas ・ Domestic wastewater treatment plan (basic concept) for Pelotas
(3) Solid Waste Management Plan	・ Basic policy for domestic solid waste management plan in urban areas ・ Domestic solid waste management plan (basic concept) for Pelotas ・ Improvement plan for the existing disposal site in Rio Grande
(4) River and Basin Management Plan	・ Important areas for the implementation of the soil runoff prevention measures ・ Measures for environmental conservation oriented agriculture ・ Selection and evaluation of soil runoff prevention measures
(5) Wetland Ecosystem Conservation Plan	・ Means to promote understanding of the value of wetlands ・ Measures for the conservation of wetlands
(6) Water Quality and Hydrological Monitoring Plan	・ Specifications for monitoring in Patos Lake ・ Specifications for monitoring in main rivers flowing into Patos Lake ・ Industrial wastewater monitoring
(7) Organizational Strengthening and Joint Information Use Plan	・ Master plan implementation system ・ Items for the improvement of the organizational structure of relevant agencies ・ Environmental information collection, management and utilization system.
(8) Environmental Education and Capacity Building Plan	・ Method for the implementation of environmental education as social education ・ Capacity building method to create human resources that can contribute to the effective management of the environment.

4.3 Master Plan Study Area

(1) Water Area Influenced by Runoff Load

For the restoration and conservation of the environment in the Patos and Mirim lake areas, a plan solely targeting these objectives should be made. As mentioned in **1.3**, however, this study will focus on the Mar de Dentro area and as such the master plan will restrictively cover the same area, excluding the Guaiba River basin.

The contribution rates of factors that adversely affect the water quality of Patos Lake were calculated using the runoff load simulation model and hydrological and water quality simulation models developed for this study. The results are summarized in **Table 4-2** and state that about 2/3 of the water quality (TP) of the southern lake area is due to runoff load from the Camaqua River and San Goncalo canal. Also, 1/2 of the water quality (TP) in the central lake area is due to runoff load from the Camaqua River. On the other hand, about 1/3 of the water quality of the central lake area is attributed to the runoff load from the Guaiba River. Runoff load from this river, however, was not found to have any effect whatsoever on the water quality of the southern lake area. Based on these calculations, the countermeasures adopted for the Mar de Dentro area will directly contribute to the restoration and conservation of the water quality and wetland ecosystem of the southern and central sections of the Patos Lake.

Table 4-2 T-P Contribution Rates of Particular Factors to the Water Quality of Patos Lake

unit: %

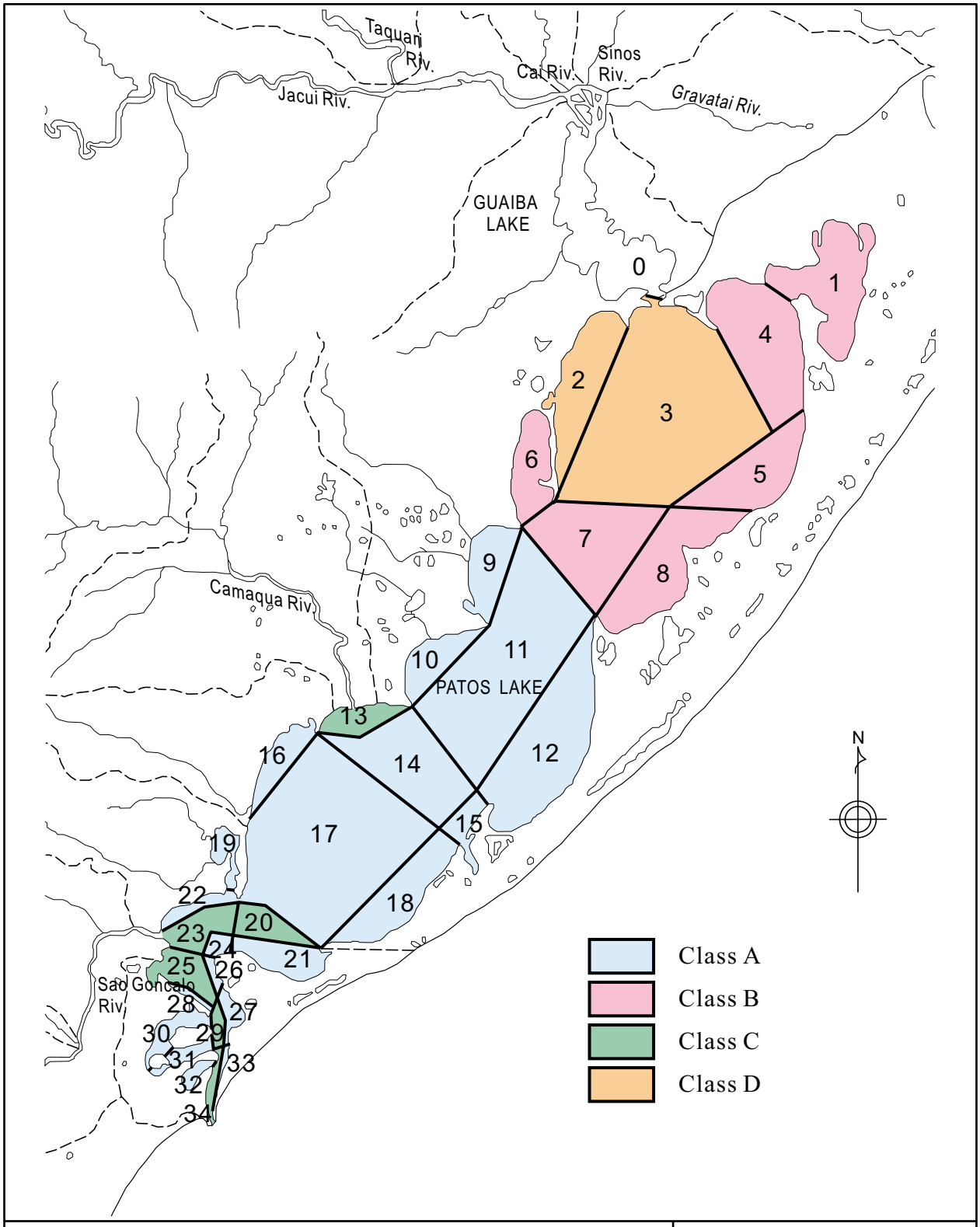
Factors / Water Section	River Runoff Load				Sludge Elution Load and Others
	Guaiba River	Camaqua River	San Goncalo Canal	Total	
Northern Section	85	0	0	85	15
Central Section	33	54	0	87	13
Southern Section	0	19	47	66	34

(2) Division & Water Quality Standards of Patos Lake

As indicated in Chapter 3 herein, the CONAMA No. 20 stipulates the water quality standards based on water use for freshwater areas, brackish water areas, and open seas. Since Patos Lake has not been classified by use, except for some parts, there are no standards for the water quality of each lake section. Based on the present utilization,

therefore, the lake water will be tentatively divided (see **Fig. 4-3**) and water quality standards based on the CONAMA No. 20 will be established (see **Table 4-3**).

As for the safety standard for TP, the indicator for eutrophication, CONAMA No. 20 only specifies the level for particular water types. This study, therefore, establishes the safety standard for TP in consideration of the study report by Vollenweider (1984) on algae production and the water quality of Patos Lake.



THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	**Fig. 4-3**
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	**Proposed Water Area Classification in Patos Lake**

Table 4-3 Targets for Patos Lake Water Quality (related to the Living Environment)

Principal Index

Class	pH	Biochemical Oxygen Demand (BOD)	Chemical Oxygen Demand (COD(Cr))	Dissolved Oxygen (DO)	Total Nitrogen (T-N)	Total Phosphorus (T-P)	No. of Coliform Groups (Fecal)
Special	6.5 | 8.5	3 mg/l or less	10 mg/l or less	6.0 mg/l or more	0.2 mg/l or less	0.02mg/l or less	250 MPN /100ml or less
A	6.5 | 8.5	5 mg/l or less	20 mg/l or less	5.0 mg/l or more	0.3 mg/l or less	0.03mg/l or less	1000 MPN /100ml or less
B	6.0 | 9.0	10 mg/l or less	30 mg/l or less	4.0 mg/l or more	0.6 mg/l or less	0.05mg/l or less	1000 MPN /100ml or less
C	5.0 | 9.0	10 mg/l or less	30 mg/l or less	3.0 mg/l or more	0.6 mg/l or less	0.05mg/l or less	1000 MPN /100ml or less
D	6.0 | 9.0	—	—	2.0 mg/l or more	1.0 mg/l or less	0.09mg/l or less	4000 MPN /100ml or less

[Note] 1. Values given in DO are target values in bottom layers.

2. With regard to the Number of Coliform Groups for Recreation (primary contact),Fecal Coliforms shall be less than 250 MPN/100ml.

3. With regard to the Number of Coliform Groups for Recreation (secondary contact),Fecal Coliforms shall be less than 500 MPN/100ml.

Supplementary Index

Class	Trans-parency	Turbidity	Oil Film	Floatage	Color	Odor	Biotic Community
Special	4 m or more	10 NTU	Not observed	Not observed	Greenish (not Brownish)	Not smelt	Diverse species
A	3 m or more	25 NTU	Not observed	Not observed	Greenish (not Brownish)	Not smelt	Diverse species
B	2 m or more	50 NTU	Not observed	Not observed	—	Not smelt	Existence of benthonic organisms
C	2 m or more	50 NTU	Not commonly observed	Not commonly observed	—	Not smelt	Existence of benthonic organisms
D	1 m or more	100 NTU	—	—	—	—	—

4.4 Master Plan Target Year and Target Level

(1) Target Year

The master plan will target the year 2010 for the medium term and 2020 for the long term, taking the following into consideration: the expansiveness of the water area, wetland, and basin to be covered by the master plan, the present management of the Mar de Dentro environment, and the implementation schedule for the Mar de Dentro Program planned by the state government.

(2) Target Level

The main issues to be taken into account concerning water quality are counteracting contamination by human excreta (medium term) and eutrophication and soil runoff (long term). The solution to these problems will be made with due consideration of the present contaminated state of Patos Lake, the needs of the residents, scale of the countermeasures to be adopted, and the time it would take for the countermeasures to take effect. The indicators that would be used to attain the target level would be the number of fecal coliform group for contamination by human excreta and TP for eutrophication. These will be used to attain the standards by water section indicated in **Table 4-3**.

For the wetland ecosystem, the residents' and the local governments' lack of understanding of the value of wetlands, as well as the loss in bio-diversity in some wetlands will be taken into consideration. In this regard, the following were planned: ① promote understanding of the value of wetlands among the administrative staff and the residents, and ② preserve significant wetlands. Significant wetlands used to be so biologically diverse. This study selects 4 different types of wetlands that are rich in biological diversity. As parameters, the number of people for field visits and training will be adopted to promote understanding of the value of wetlands, and regulations and protective legislation will be established for the preservation of significant wetlands.

Table 4-4 below summarizes the target year and target level of the master plan as above-mentioned.

Table 4-4 Master Plan Target Year and Target Level

Target Level / Target Year	Water Quality	Wetland Ecosystem
Targets for the Medium Term （2010）	**Solving contamination by human excreta** To attain the no. of fecal coliform groups (annual average) designated by water section A Class: less than 1,000MPN/100ml B Class: less than 1,000MPN/100ml C Class: less than 1,000MPN/100ml D Class: less than 4,000MPN/100ml For water areas used for recreation, however, the following should be attained during the peak season Less than 250MPN/100ml (primary) Less than 500MPN/100ml (secondary)	**1. Promote understanding of the value of wetlands** ・ Training of the staff of government agencies, schools, environmental NGOs. ・ Attain the target number of users of the visitor center **2. Conservation of significant wetlands** (Del Rey wetland, Camaqua riverine forest, Pequena Lake, S. Goncalo canal） ・ Maintain bio-diversity (number of species) ・ Maintain wetland area and water level
Targets for the Long Term （2020）	**Solving problems concerning eutrophication and soil runoff** To attain the TP level (annual average) established for every water section. A Class: less than 0.03mg/l B Class: less than 0.05mg/l C Class: less than 0.05mg/l For the majority of the northern water section, B class will be applied, while A class will be applied to the central and eastern sections, and C class will be designated for the most part of the southern water sections.	**1. Promote understanding of the value of wetlands** Have at least 1 member of every household in the study area visit the wetlands. **2. Preservation and recuperation of other wetlands** Restoration and preservation of essential vegetation.