

Chapter 10

Solid Waste Management System in the Urban Areas

CHAPTER 10 SOLID WASTE MANAGEMENT SYSTEM IN THE URBAN AREAS

10.1 Introduction

10.1.1 Objectives

The objectives of the Study are to elaborate the diagnosis on the conditions of the Solid Waste Management System for the municipalities of Pelotas, Rio Grande, Camaquã, São Lourenço do Sul and Tapes, identifying the existing problems in the system as well as in their dumping sites in order to make recommendations on the improvement of the existing systems and on countermeasures to reduce the impact of the waste disposal sites on surrounding water bodies. As a result, high priority programs and plans shall be identified and the basic concepts of an Improved Solid Waste Management Plan in due consideration of the identified priorities shall be elaborated (see Fig.10.1-1).

10.1.2 Collected Data

In this stage of the work, the municipalities of Camaquã, Tapes, and São Lourenço do Sul were visited twice each in order to grasp the present conditions of their respective Solid Waste Management Systems. In these occasions, their open dumping sites were visited as well as meetings were carried out with the officials in charge.

Besides that, a research was carried out at the IPH (Institute of Hydrologic Research), UFRGS, on information about leachate. For the same purpose, a visit to the DMLU (Municipal Dept. of Urban Cleaning) of Porto Alegre was carried out in order to get some information from the officials in charge of the Sanitary Landfill of Extrema in that municipality.

In order to get some local parameters on Solid Waste Management items, further meetings were carried out with the officials in charge in the Municipality of Pelotas, besides consultation on the Master Plan of Solid Waste Management of the Metropolitan Region of Porto Alegre.

For a better understanding of the sanitary landfills licensing procedures, a meeting was carried out with the official in charge at the Urban Solid Waste Service of FEPAM.

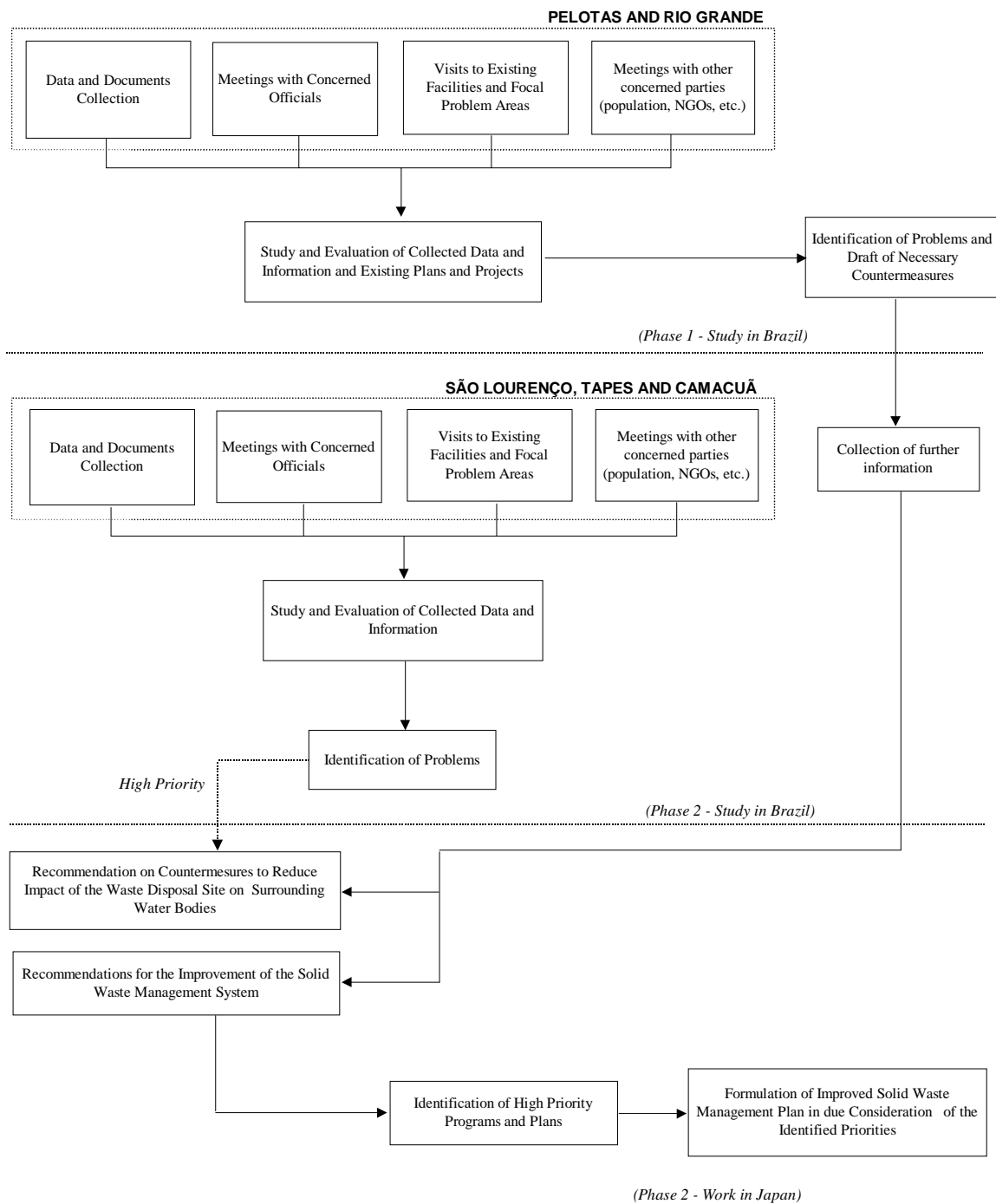


Fig. 10.1-1 Work Flow of the Study on Solid Waste Management

10.2 Solid Waste Management in Pelotas

10.2.1 Institutional Framework

SANEP (Sanitation Autonomous Service of Pelotas), through the Dept. of Solid Waste Processing, is the public local institution responsible for the collection, treatment and final disposal of domestic solid waste. The Municipal Secretariat of Urban Services (SMSU) is the responsible institution for the cleaning of gutters, drains, channels, sweeping and cleaning of streets and avenues, among others, and for the maintenance of public gardens and green areas, collection of construction debris, etc.

At present, the Dept. of Solid Waste Processing has the following staff: engineers (2), technical assistant (1), administrative staff (4), selective collection workers (7), and landfill staff (10). The domestic solid waste ordinary collection is fully contracted.

10.2.2 Legal Framework

(1) National and State Level

Table 10.2-1 Legal Framework at National and State Levels

Law	Contents
National Level	
Law no. 6.938 (Aug 31 st , 1981)	Establishes the Environment National Policy.
Decree no. 99.274 (June 6 th , 1990)	Details the Laws no. 6.938 and no. 6.902. In its articles 17 to 19, it establishes the procedures for the licensing of potentially polluting facilities (e.g. Sanitary Landfills).
Resolution CONAMA* no. 001 (Jan 23 rd , 1986) *National Council of Environment	Establishes general guidelines for the use and implementation of Environmental Impact Evaluation. In its item X, sanitary landfills, processing and final disposal of toxic and hazardous waste are included.
Resolution CONAMA no. 005 (Aug 5 th , 1993)	Establishes guidelines about the management of solid waste deriving from medical services, harbors and airports, as well as railway and bus stations, aiming at preserving the public health and the environment quality.
Resolution CONAMA no. 237 (Dec 19 th , 1997)	Defines the Environmental Licensing, License, Studies and Regional Environmental Impact. It details the three levels of licensing (LP-Previous License, LI – Installation License, and LO – Operation License) and the respective terms of validity, and renewal procedures.
State Level	
Law no. 9.921 (July 27 th , 1993)	Establishes the guidelines for the management of solid waste, according to the article 247, paragraph 3 rd of the State Constitution.
Decree no. 38.356 (April 1 st , 1998)	Details the law no. 9.921. In its article 27, it defines that municipalities with more than 50,000 inhabitants shall elaborate, within 180 days and the others within 1 year from the date of this Decree, the project of a “proper location and operational” system for the management of urban solid waste.
Law no. 10.009 (Feb 7 th , 1994)	Establishes guidelines for the management of medical services solid waste.
Regulation no. 012/95 State Secretariat of Health and Environment	Approves the Technical Standard no. 03/95-FEPAM. This Technical Standard classifies the processing and final disposal facilities as for the requirement of Environmental Impact Study and Report (EIA-RIMA) in Rio Grande do Sul State.

(2) Municipal Level

At the municipal level, Pelotas has the Law no. 4354 (March/1999) establishing the Municipal Code of Urban Cleaning. This law shall regulate the collection, transportation and final disposal of public, domestic and special solid waste, except, for this last, when the law determines that the responsibility is of the generator. It shall also regulate the maintenance and cleaning of public ways and toilets, green areas, beaches, parks and other public equipment.

10.2.3 Present Conditions of Collection Services

The collection of domestic solid waste is carried out by a contractor, which reckons on 7 trucks (15 ton/truck). The SANEP itself utilizes 1 truck with a wooden body and 1 micro-tractor with an attached agricultural use wagon in the selective collection carried out at the schools. The SMSU reckons on 12 collection trucks, 1 collection/compaction truck and 1 truck attached with a water reservoir for washing the streets. The services carried out by SMSU are also partially contracted.

The domestic solid waste collection system covers 99% of the municipality area and population, excluding the rural zone. Although according to the legislation, the local government is not responsible for the collection of medical services solid waste, SANEP is collecting this type of solid waste deriving from existing hospitals, 56 public health posts and some clinics. The industrial solid waste is not being collected nor treated by SANEP. This is the responsibility of the industries themselves according to the legislation.

The total amount of municipal solid waste disposed in the Pelotas controlled landfill is approximately 150 ton/day (**Table 10.2-2**)

Table 10.2-2 Solid Waste Disposed at the Controlled Landfill

Generation Area	Disposed Amount	
	ton/day	ton/year
Urban Center	36	11,412
Suburban Area	114	36,138
Rural Zone	-	-
Total	150	47,550

Source: Dept. of Solid Waste Processing – SANEP (1998)

Despite of this high collection rate, one can observe that in many places, in special alongside the drainage canals, there is garbage scattered all along the place. The explanation could be that perhaps some scavengers collect the garbage bags disposed for collection, before the official collection, remove the recyclables for selling and throw away the remains on the mentioned places. Besides that, it seems that some of the people also throw away large size solid waste improperly on abandoned land and on the drainage canals causing flood hazards.

10.2.4 Present Conditions of the Existing Landfill

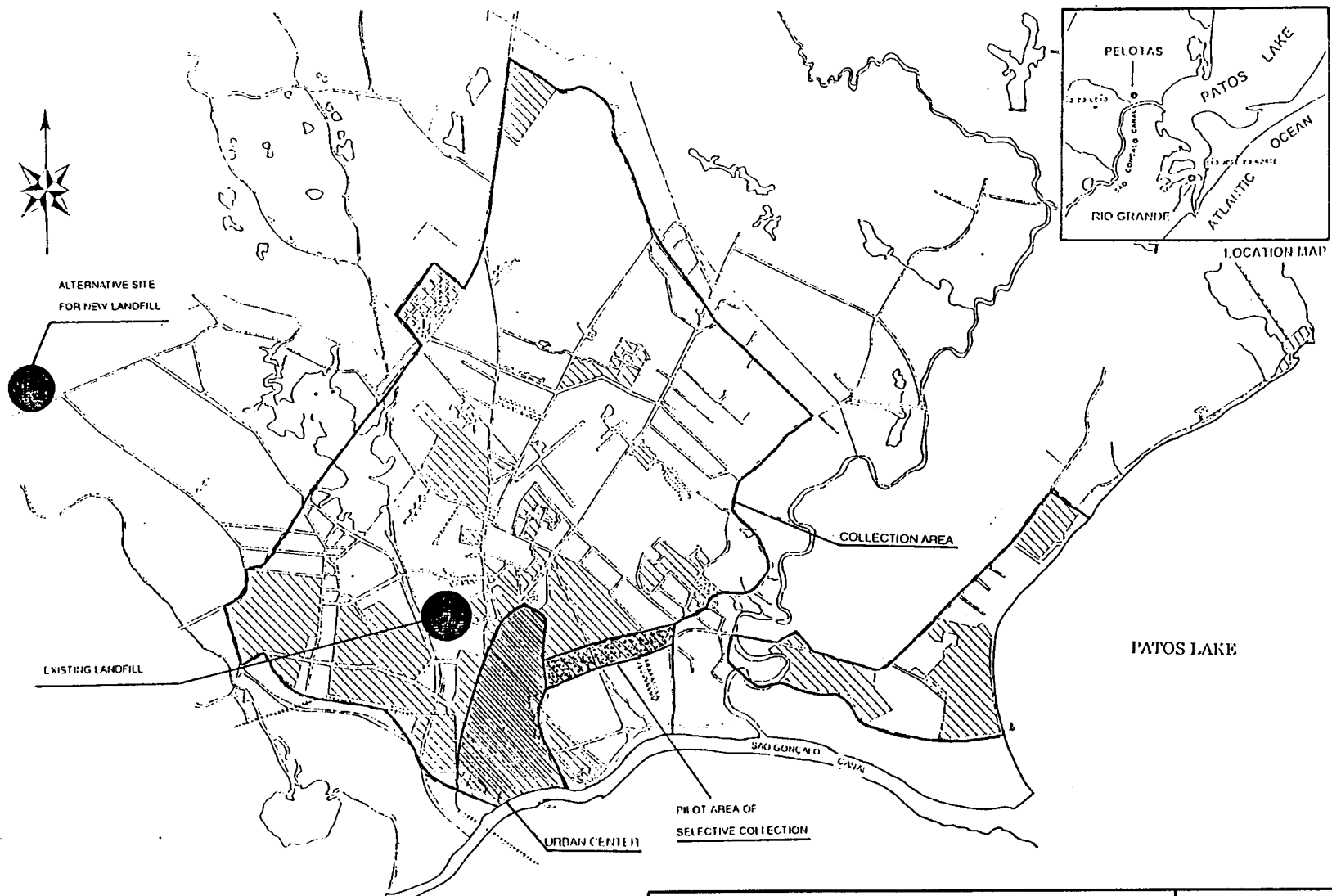
At present, the disposition of the collected solid waste is carried out in a controlled landfill located within the urban area limits (**Fig. 10.2-1**). Originally, part of this area (3 ha) was supposed to be utilized as the green area of a housing district. However, due to the fact that this area was a swampish area, its owner agreed to lend it to SANEP as a solid waste landfill until it could be utilized as a green area. This landfill was already closed (with a coverage of 60 cm of earth).

This landfill is not considered a “Sanitary Landfill” which has all necessary measures to prevent contamination of surrounding environment. However it is considered as a “Controlled Landfill” because it reckons on some of these measures. It reckons on gas emission vertical pipelines and leachate drains (pebbles). The original foundation is formed of turf soil that has a low infiltration capacity, and it was covered in a daily basis with earth. The final height of this landfill is 4 m. The leachate is drained into stabilization ponds (four in a sequence) and then the resulting effluent is discharged into a nearby stream (Sanga do Matadouro).

The collected medical services solid waste is disposed in ditches lined with plastic sheet. After the disposition, each layer is covered with lime. The collected material is not separated. It contains around 35% of infecting material and the rest is composed of ordinary solid waste. That means that there is no source separation.

Just beside this private area, another area (1.5 ha) was acquired by SANEP to continue the operation once the capacity of the former area was fully utilized. This area has also reached the full capacity at present.

In order to continue the operation, a temporary sanitary landfill (11 ha) shall be installed at a nearby site on an emergency basis until the definite site of the sanitary landfill is approved by FEPAM. The area belongs to the local government, and the operation of the sanitary landfill shall be carried out by a contracted company (now in bidding process). This landfill shall not be licensed by FEPAM because of its location. The same contract shall foresee the reclamation of the “Controlled Landfill” (4.5 ha in total).



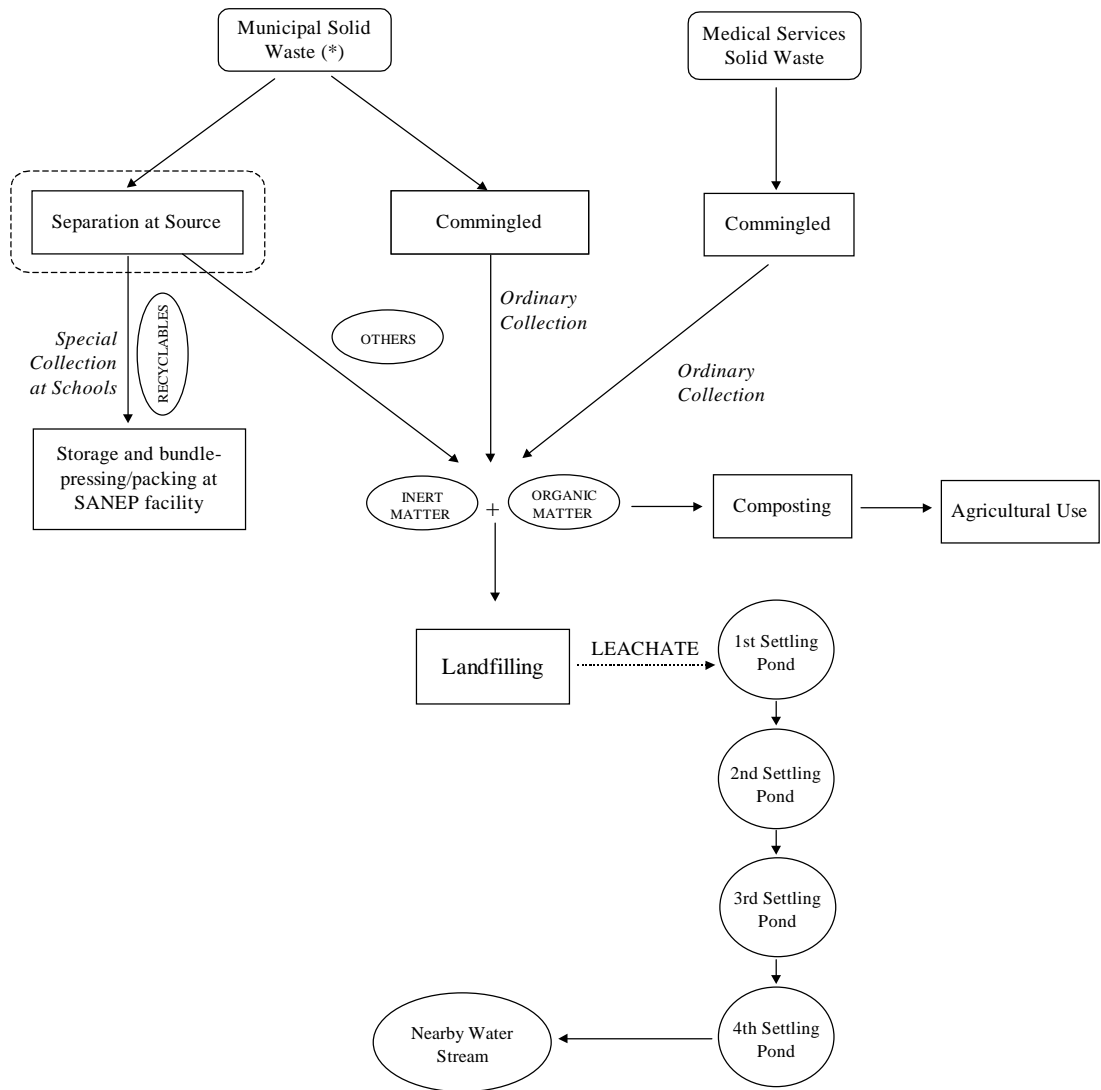
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Fig. 10.2-1

Location of Existing and Alternative
Site for New Landfill
in Pelotas

The following figure presents the present stream of Solid Waste in the municipality of Pelotas.



Destination of Solid Waste		
	Present	Future
Recycled	1.5%	28.0%
Composted	0.5%	52.0%
Incinerated	-	3.0%
Disposed in the landfill	98.5%	17%

(*) The domestic solid waste collection system is available for 100% of the city. However, part of the solid waste is not properly disposed for collection (specially the big size solid waste). This portion is sometimes stored at the houses backyards, improperly thrown at drainage canals, water streams, etc., or at abandoned area land. This amount is not measurable.

 Environmental Education Action

Fig. 10.2-2 Solid Waste Stream in the Municipality of Pelotas

10.2.5 Budgetary Organization

At present, the solid waste collection, transportation and treatment services are being carried out without any burden to the population. Recently, a law imposing the charge of these services to the population was elaborated but, due to political problems, it was rejected by the municipal council of representatives.

The expenses are shared by SANEP and the Municipal Secretariat of Urban Services. The breakdown of expenses is presented in the following table.

Table 10.2-3 Monthly Expenses with Solid Waste Management (1998)

ITEM	EXPENSES (R\$/Month)
SANEP (Dept. of Solid Waste Processing)	
Ordinary Collection	155,000.00
Selective Collection	9,000.00
Special Collection (within the ordinary collection cost)	
Final Destination	16,000.00
TOTAL SANEP	180,000.00
Municipal Secretariat of Urban Services	
CONTRACTED SERVICES*	
Sweeping + weeding	52,000.00
Scraping of block paved streets + cleaning of open markets	22,000.00
Painting of gutters	7,000.00
Painting of posts	392.00
Cleaning of gully-holes	4,400.00
Cleaning of canals	1,320.00
Cleaning of pumping houses	4,800.00
Cleaning of drainage aqueducts	12,000.00
Cleaning of ditches	22,500.00
Sub-total	126,412.00
DIRECT SERVICES	
General services	120,000.00
Sub-total	120,000.00
TOTAL SMSU	246,412.00
GENERAL TOTAL	426,412.00

Source: Dept. of Solid Waste Processing – SANEP (1998)

**Table 10.2-4 Comparison of Total Budget and SW Management
Budget (1998)**

Dept. of SW Processing (SANEP)	SANEP	% of Dept. of SWP
R\$ 2,160,000.00	R\$ 19,000,000.00	11.0%
Municipal Secretariat of Urban Services	MUNICIPALITY	% of SMSU
R\$ 2,956,944.00	R\$ 89,000,000.00	3.5%

Source: Dept. of Solid Waste Processing – SANEP (1998)

These expenses are covered by SANEP budget that is formed by the charging of water supply and sewage treatment, and by part of the municipal budget in the case of SMSU.

10.3 Solid Waste Management in Rio Grande

10.3.1 Institutional Framework

The collection, transportation and final disposal of domestic solid waste services are responsibility of the Municipal Secretariat of Urban Services of Rio Grande. Furthermore they are also responsible for the cleaning of public ways and weeding of non utilized land. The cleaning of ditches, gutters and drainage system is responsibility of the Municipal Secretariat of Civil Works.

10.3.2 Legal Framework

As for the national and state levels, please refer to item (1) in 10.2.2 – Legal Framework in Pelotas.

At the municipal level, Rio Grande does not have a specific law for the management of solid waste. However, the Municipal Law no. 4116 (Nov 3, 1986), the Master Plan of Integrated Development of Rio Grande Municipality, establishes some criteria about urban cleaning and management and treatment of solid waste.

10.3.3 Present Conditions of Collection Services

At present, the collection and transportation of solid waste is carried out by two work teams. The first team is formed by the contractor and the other team is formed by

employees of the Municipal Secretariat of Urban Services. The contractor has 80 workers employed in this service and 6 compacting trucks (10 m³), and is responsible for 80% of the collection. The Municipal Secretariat team is formed of 30 workers utilizing compacting trucks and dumping trucks (12 m³). This last team is responsible for the removal of public solid waste, the selective collection and removal of solid waste from public buildings.

In the central zone and districts with intensive occupation (90% of the collected volume), the frequency of collection is daily. In other areas, the collection is carried out each other day. The daily collection of domestic SW is around 100 ton/day (**Table 10.3-1**). The composition of the domestic solid waste and the total collected solid waste is presented in the following tables.

Table 10.3-1 Daily Collected Solid Waste in Rio Grande Municipality

Category	Volume (ton)/day
Domestic Solid Waste	85
Streets sweeping, gardening residues, etc.	15
For recycling	5
Medical Services Solid Waste (aseptic)	Included in the domestic solid waste
Medical Services Solid Waste (septic)	Legally, it is responsibility of the medical services.
Industrial Solid Waste	Legally, it is responsibility of the industries.
T O T A L	100

Source: Municipal Secretariat of Urban Services, 1996

10.3.4 Present Conditions of the Existing Landfill

The Rio Grande solid waste landfill operation started around 1975 and it is now almost reaching its full capacity. The land was lend to the municipality by a private owner. The landfill site is located around 8 km from the city center, in the district of Carreiros. It is also very close to the estuary of the Patos Lake, just in front of the Marinheiros Island (**Fig. 10.3-1**).

The landfill is divided into two areas. One area (14 ha) is not being utilized any more and has reached the height of 6.00 m. The other one (9 ha) is still being utilized and its present height is around 4.00 m. However, this last area is almost reaching its full capacity. The earth for coverage is being brought from a mine 3 km far.

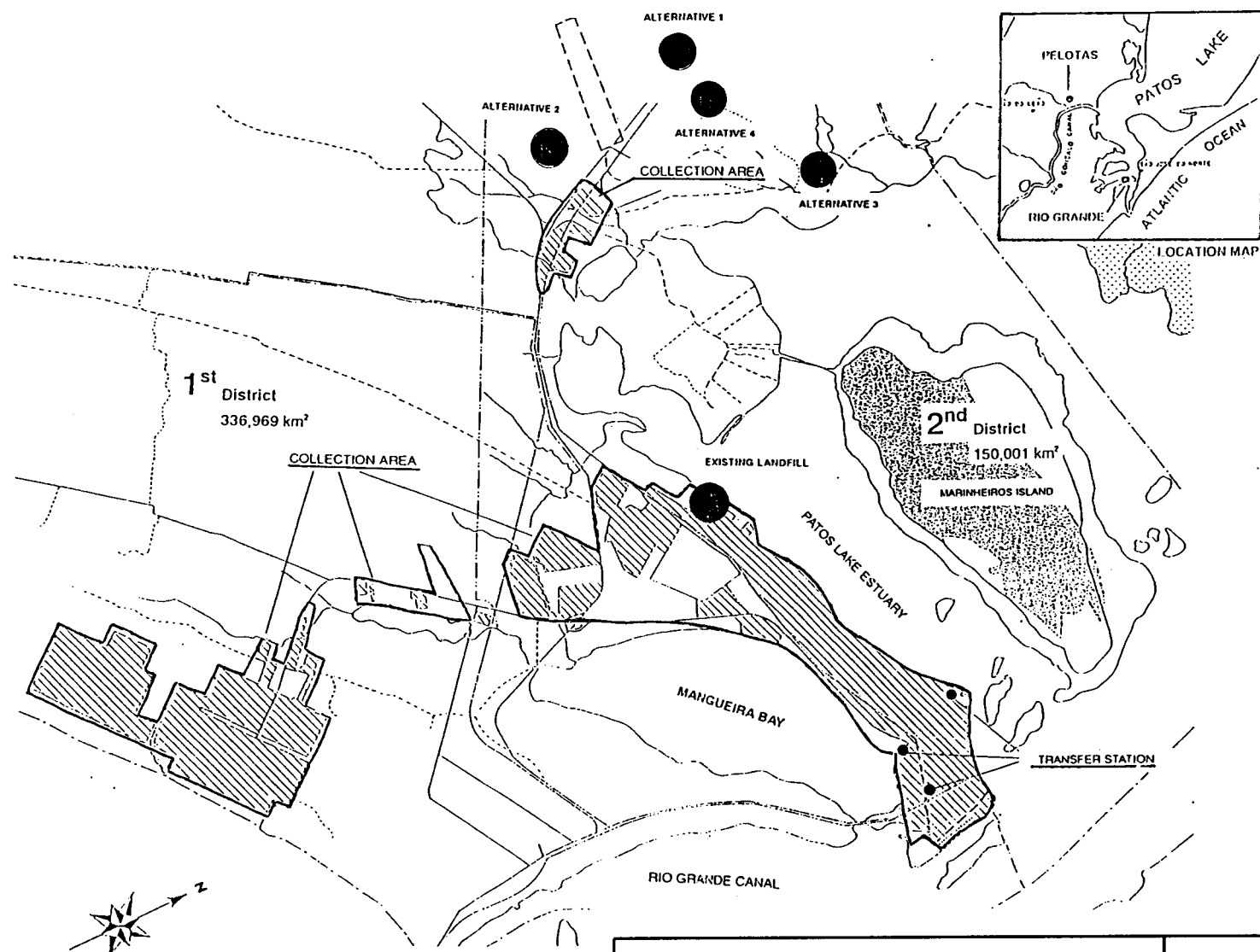
The solid waste being brought to this landfill is composed of domestic solid waste,

medical services solid waste (3 hospitals and some clinics), the result of urban cleaning and, occasionally, some fish processing industries residues (upon the authorization of the concerned official). The solid waste coming from these fish processing industries is insignificant. Sometimes, upon the authorization of the Municipal Secretariat of Health, some inert solid waste deriving from the port is also disposed on the landfill.

The conditions of the landfill are very problematic. There are no measures to prevent the leachate infiltration through the soil. There is no drainage of gases, and thus the area is dangerously subjected to fire. In the portion of the area destined to the medical services SW, the bottom is covered with a polypropylene sheet, as the only protection measure.

An sterilizing equipment (autoclave) shall be installed on the landfill for the medical services solid waste. Once sterilized, this waste shall be co-disposed with the domestic solid waste. This equipment already received a LI (Installation License) from FEPAM.

As for the licensing procedures for the installation and operation of a new sanitary landfill outside the urban area, according to the FEPAM responsible official, the Rio Grande officials are far behind in supplying the necessary information requested to complement the EIA-RIMA (Report on Environment Impact). If the information is not given in due time, the licensing process shall be interrupted. The same FEPAM official informed that the local government shall probably be sued by the Public Attorney Office in order to carry out the reclamation and closure of the present Dumping Site (Carreiros).



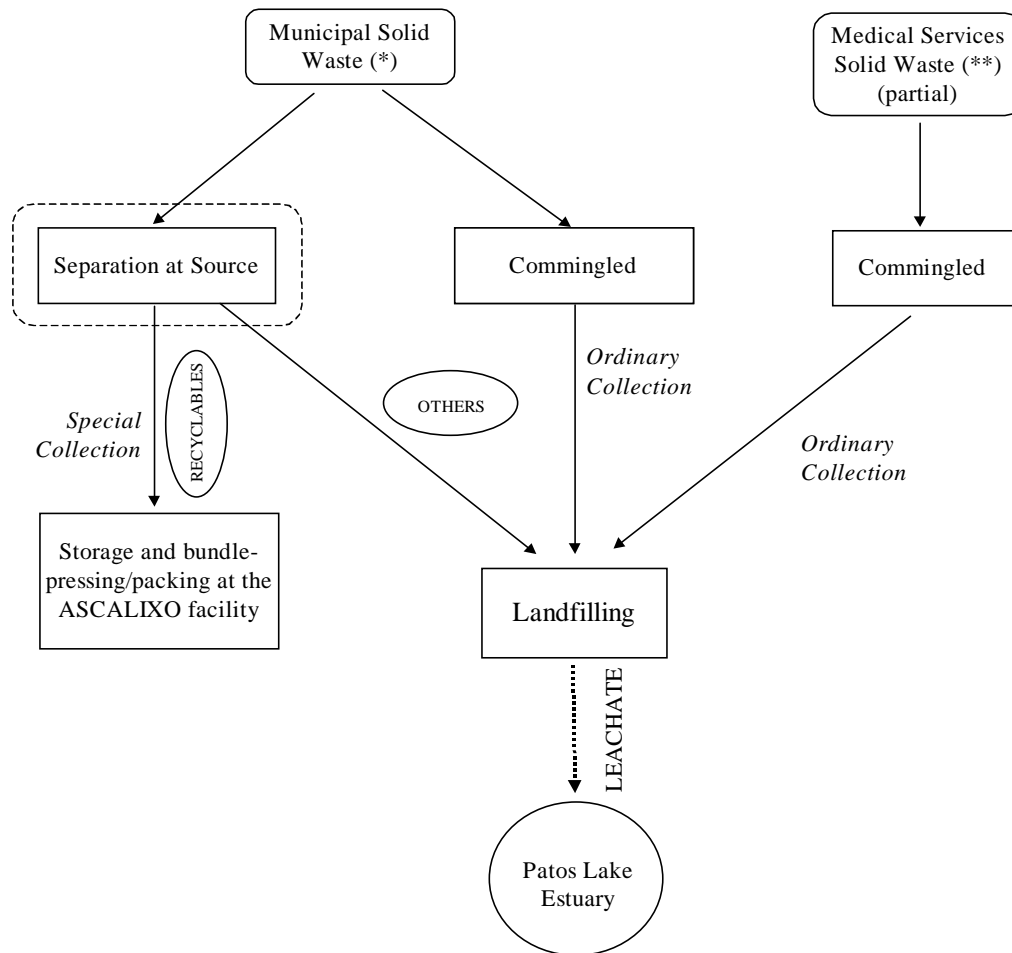
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Fig. 10.3-1

Location of Existing and Alternative
Landfill Sites in Rio Grande

The following figure presents the present stream of Solid Waste in the municipality of Rio Grande.



Destination of Domestic Solid Waste	
Recycled	0.5%
Composted	-
Incinerated	-
Disposed in the landfill	99.5 %

(*) The domestic solid waste collection system is available for 100% of the city. However, part of the solid waste is not properly disposed for collection (specially the big size solid waste). This portion is sometimes stored at the houses backyards, improperly thrown at drainage canals, water streams, etc., or at abandoned area land. This amount is not measurable.

(**) There is no data on medical services solid waste

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Fig. 10.3-2 Solid Waste Stream in the Municipality of Rio Grande

10.3.5 Budgetary Organization

The budget for the solid waste management is collected through a tax. Actually it represents a tiny small part of the Urban Territory and Construction Tax (IPTU). In actual figures it represents only R\$ 1.00/family.

Table 10.3-2 Comparison between SMSU and Municipal Budgets

ITEM	COST (R\$)	%
Total Budget of the Municipality	63,000,000	100.0
Total Budget of the Secretariat of Urban Services	6,133,804	9.7
Budget of the Public Cleaning Unit	4,430,104	7.0
• Direct Expenses (personnel, maintenance, etc.)	1,130,104	-
• Contracted Expenses (SW collection, streets sweeping, weeding)	3,300,000	-

Source: Municipal Secretariat of Urban Services (1999)

In terms of percentage, the Public Cleaning Unit of the Municipal Secretariat of Urban Services accounts on 7.0% of the Municipality Total Budget.

10.4 Solid Waste Management in São Lourenço do Sul

10.4.1 Institutional Framework

The responsible organization for the collection of domestic solid waste and urban cleaning is the Municipal Secretariat of Civil Works and Urbanism (SMOU). This secretariat is also responsible for several other services such as control of Use and Occupation of Land, control of Cesspools construction, application of the Code of Civil Works, etc.

The technical staff of the whole secretariat is composed of only 1 civil engineer, 2 architects, 1 inspector, 1 topographer, 1 draftsman, and 1 trainee.

10.4.2 Legal Framework

As for the national and state levels, please refer to item (1) in 10.2.2 – Legal Framework in Pelotas.

At the municipal level, there is the complementary Law no. 03/91 “Municipal Code of Urban Cleaning” (Nov 19th, 1990) which however was not yet detailed through a Decree. Another concerning law is the Law no. 1.646 (May 29th, 1990) that creates the Municipal Council of Environmental Patrimony (COMPAM).

10.4.3 Present Conditions of Collection Services

The collection services of domestic SW is carried out by a contracted firm. It is carried out in the whole urban area occupied with houses (40% of the total official urban zone) which encompasses 7,500 households and 76 km of streets. The collection frequency is mostly 3 times a week (90%) and once a week in low demographic density areas. Approximately 95% of the urban population are served by waste collection at their doors. The remaining 5% lives in streets that cannot be accessed by the collection trucks, however they can dispose the waste to be collected in nearby collection sites.

Four (4) small villages located in the rural zone are served with waste collection (once a week for two of them and when requested for the other two). These villages are officially considered as urban areas. The population of these villages varies from 300 to 500 inhabitants. The waste collection in the rural zone is also carried out at 3 schools where the surrounding inhabitants take their waste to be collected. The population served through these schools amounts to around 1,000 inhabitants (approx. 5% of the rural population).

During the summer season (December to March), the urban population increases in around 30% according to the officials. Weekends are critical in this season, regarding to waste generation. The estimated monthly amount of solid waste disposed in the dumping site can be seen in the following table. The daily amount is estimated in 10 to 11 ton/day.

Table 10.4-1 Estimated Amounts of Domestic Solid Waste Disposed in the Dumping Site

	Monthly Average	Year
Urban Zone	316.7 ton	3800 ton
Rural Zone	7.5 ton	90 ton
TOTAL	324.2 ton	3890 ton

Source: Municipal Secretariat of Civil Works and Urbanism, 1999.

As for the medical services SW, the local hospital (Santa Casa) pays for a private company to collect, seal, transport, and incinerate the waste in the nearby municipality of Viamão. The hospital receives a subsidy from the SMOU to pay for the services. Besides the hospital, 3 laboratories and 11 health posts utilize these services. The estimated collected amount is around 300 kg/day. The incineration equipment however is not licensed by FEPAM because this organization yet does not have established technical criteria for licensing this type of treatment procedure.

The collection of debris and large size waste is carried out usually on Fridays and Saturdays. Sometimes, the citizen makes a phone call to ask for the service that is free from charge.

10.4.4 Present Conditions of the Dumping Site (Lixão)

The present dumping site was lend by a private owner to the municipality around 20 years ago. It has around 2 ha and no protection measures against the hazards caused by the leachate or gases. The depth of accumulated solid waste is around 3 to 4 meters. It is located 2 km far from the urban perimeter (**Fig. 10.4-1**).

At the site, there are some scavengers separating recyclables for the owner of a recycling business. According to them, met during a visit to the dumping site, they separate around three full trucks of recyclables a day.

In another site, there was a landfill for debris started by the local government to allow the embankment of the area for a street extension. It was started around 2 years ago. However, besides the debris, the surrounding inhabitants started to dump domestic solid waste without waiting for the proper collection, transforming the site in a problem area. Therefore, the Public Attorney Office determined the reclamation and closing of this landfill and the elaboration of an environmental education program to be carried out by the local government during 4 years. The reclamation project is already being contracted by the SMOU.

As for the present dumping site, the local government was also sued by the Public Attorney Office in order to present a reclamation project for the area. A firm is being contracted to elaborate the reclamation project and to provide the proper license by FEPAM.

At present, there is an on going bidding process for a new contract for the collection, transportation and final disposal (in a sanitary landfill). The winner of this bidding shall perform the collection and the final disposal in a previously licensed area (by FEPAM), of own property as well as manage the sanitary landfill.

10.4.5 Budgetary Organization

The cost of solid waste and public cleaning management is covered with part of the municipal budget. There is not a special tax for the solid waste management or similar. In theory, this service should be partially covered by the IPTU (Territorial and Praedial Urban Tax). However, there is a high rate of non payment of this tax among the citizens.

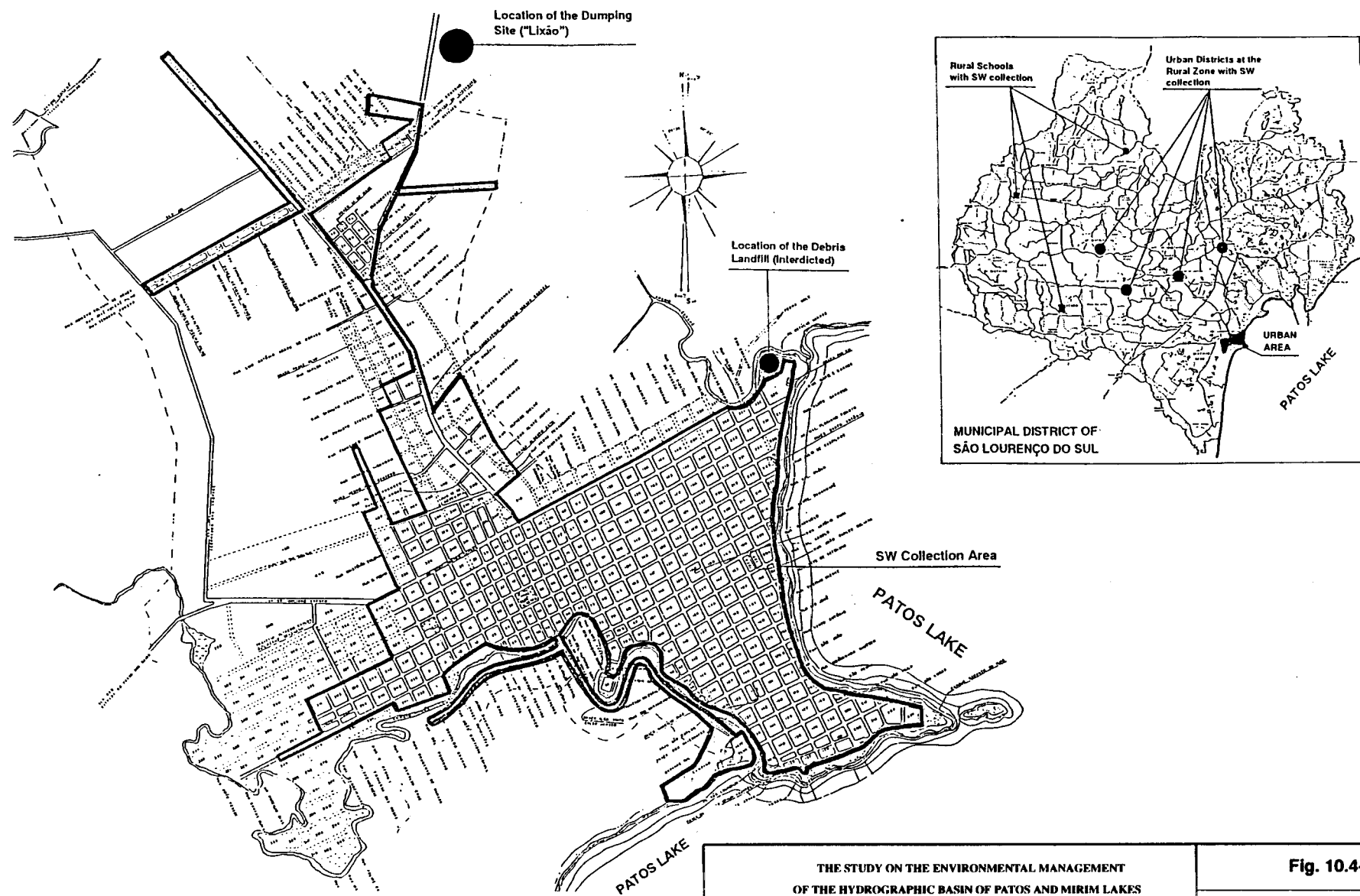
Table 10.4-2 Annual Expenses with Solid Waste Management System

ITEM	EXPENSES (R\$/Year)	%
Ordinary Collection (contracted)	114,000	9.0
Medical SW Collection, Transportation and Treatment (contracted)	36,000	2.8
Sweeping, and Cutting of Trees (direct)	36,000	2.8
Debris from Construction and Cleaning of Yards (direct)	18,000	1.4
Total	204,000	16.0
Budget of Secretariat of Civil Works and Urbanism (SMOU)	1,272,960	100.0
% of the Expenses with Solid Waste Management in relation to the Municipal Budget		1.4
% of the Budget of SMOU in relation to the Municipal Budget		9.0
Municipal Budget	14,144,000	100.0

Source: Secretariat of Civil Works and Urbanism (1999)

As we can see from the above table, the average expenses with solid waste management correspond to 16.0% of the SMOU budget and 1.4% of the Municipal Budget.

These expenses shall however increase with the contracting of the project, licensing and operation of the new Sanitary Landfill, reclamation of the present Dumping Site, and reclamation of the Debris dumping site within the urban zone with the provision of a technically appropriate new landfill for debris.



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Fig. 10.4-1

Collection Services Coverage,
Location of Dumping Site and other
Features in S. Lourenço do sul

10.5 Solid Waste Management in Camaquã

10.5.1 Institutional Framework

The services of collection, transportation and treatment and/or disposal of domestic solid waste are responsibility of the Municipal Secretariat of Civil Works and Traffic (SMOV). Furthermore they are also responsible for the cleaning of public ways and weeding of non utilized land, cleaning of ditches, gutters and drainage system, as well as its construction and maintenance. The Municipal Secretariat of Planning (SMP) is responsible for the licensing procedures of the new area for the sanitary landfill to be installed. The Municipal Secretariat of Health and Environment (SMSMA) is responsible for the final destination of public medical services solid waste.

10.5.2 Legal Framework

As for the national and state levels, please refer to item (1) in 10.2.2 – Legal Framework in Pelotas.

At the municipal level, the Law no. 19 (1949) - “Code of Dispositions”, in its Book XIX, establishes some procedures for the urban cleaning and waste collection. More recently, the Municipal Council of Environment Protection (COMDEMA) was created through the Law no. 005 (June 2nd, 1983).

10.5.3 Present Conditions of Collection Services

At present, the collection, transportation and final disposal of solid waste is carried out directly by the Municipal Secretariat of Civil Works and Traffic. The Secretary has the intention of contracting these services and is now preparing the contract terms for this purpose. The contract shall be enforced in the year 2000.

Table 10.5-1 Estimated Volumes of Solid Waste

	Daily	Monthly
Domestic Solid Waste	25.25 ton	757.8 ton
Urban Cleaning Solid Waste	0.33 ton	9.9 ton
TOTAL (disposed at the dumping site)	25.58 ton	767.7 ton
Medical Services Solid Waste	56 kg	224 kg

Source: Application document for the obtainment of LI for the Sanitary Landfill of Bonito – Camaquã (1999). Geologist L.C. Evangelista (GEO-AMBIENTE).

The collection is presently being carried out in the whole urban area as shown in the **Fig. 10.5-1**. The collection is carried out 6 times a week (except Sundays) in the downtown. In other districts of the urban zone, the collection varies from 2 to 5 times a week. Two rural districts - Banhando do Colégio and Vila Getúlio Vargas - also have collection 1 and 2 times a week, respectively. The collection in these rural districts is carried out by small trucks contracted for this purpose. A third rural district – Pacheca (80 to 100 households) - has collection services each 15 days, however the collected solid waste is dumped in a nearby dumping site and not taken to the main one. The total amount of solid waste disposed in the dumping site is approximately 25 ton/day (**Table 10.5-1**).

The Municipal Secretariat also executes the collection of debris and other large size solid wastes that are dumped on the streets and abandoned land, and can cause obstruction of the drainage system.

Table 10.5-2 Collection Equipment and Personnel (SMOV)

Type of Collection	Equipment	Personnel	No. of working teams
Domestic Solid Waste	5 compaction trucks	5 drivers 15 collection workers	5 teams
Debris and Large Size SW	4 dumping trucks 2 wheel tractors (for lifting)	4 drivers 2 tractor operators 4 collection workers	2 teams • 1 for the central zone • 1 for the outskirts

Source: Municipal Secretariat of Civil Works and Traffic, 1999.

As for the medical services SW, the SMOV lends a small truck to the SMSMA for the collection of solid waste from public health stations and others. Ultimately, this SW is sealed up inside special barrels and transported and incinerated by a contracted private company in another city. The incineration equipment however is not licensed by FEPAM because this organization yet does not have established criteria for licensing this type of treatment procedure.

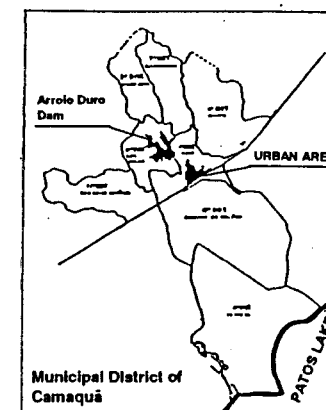
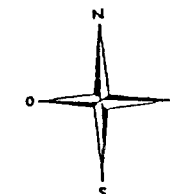
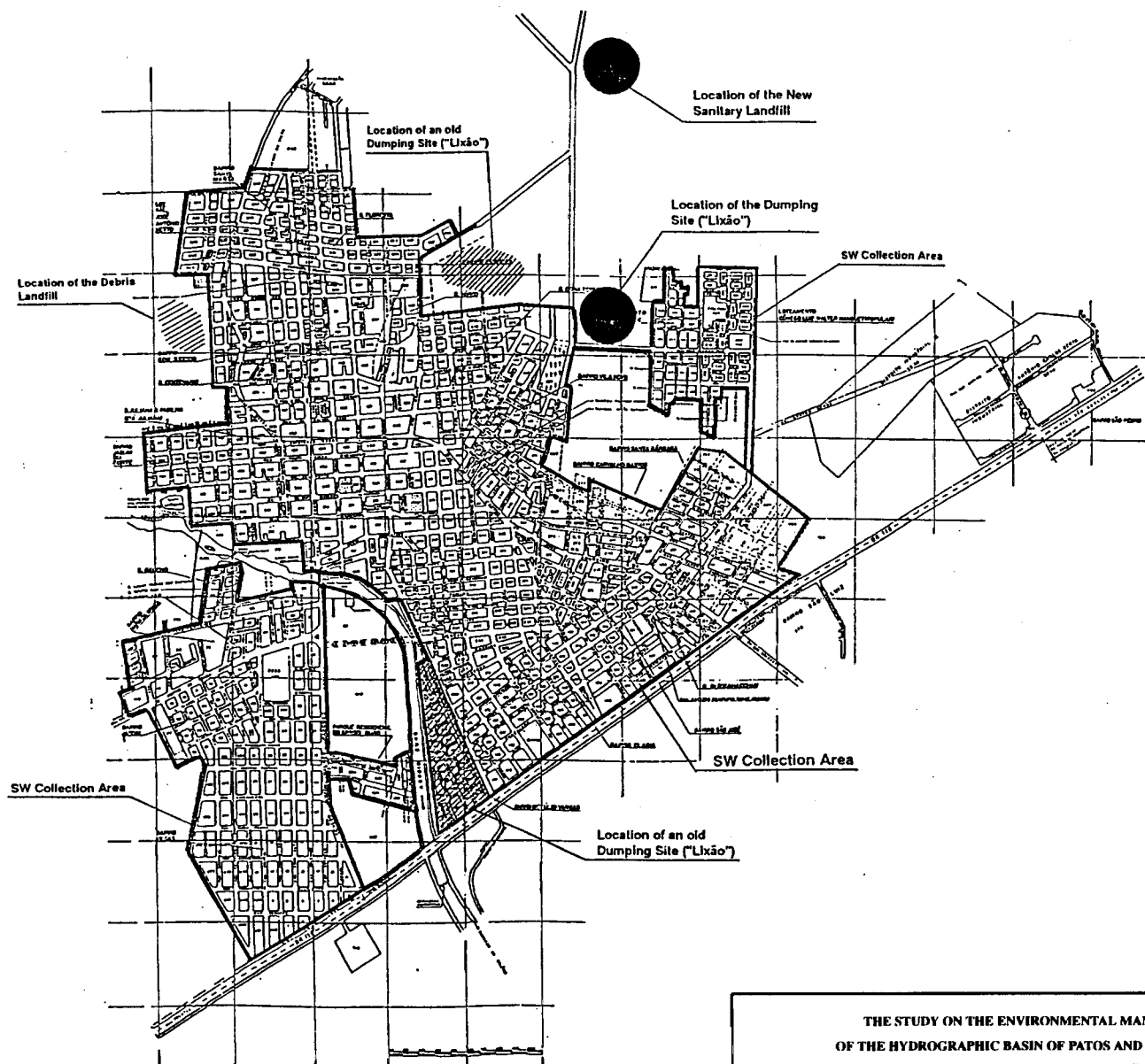
10.5.4 Present Conditions of the Existing Dumping Site (“Lixão”)

The Domestic SW of Camaquã is disposed in an ordinary dumping site without any environment protection measures for more than 10 years. The dumping site is located within the urban zone. Around 20 families (80 to 100 persons), some of them living nearby the site, live on scavenging the garbage in order to select recyclables for selling.

The Camaquã Justice Attorney Office has started a public process in which it elaborated an “Adjustment Compromise” (Aug 24th/99) with the local government in order to close and carry out the reclamation of the present utilized dumping site. The compromise includes the immediate elaboration of a technical project for the reclamation works to be submitted to FEPAM, as well as the immediate fencing of the area to impede the entrance of persons and animals. Meanwhile, the dumping site can still be utilized for 8 months counting from the issue of the LP (Previous License) until the issue of the LO (Operation License) of the new sanitary landfill. The work of scavengers shall be allowed only if they are supplied with Individual Protection Equipment. No children shall be allowed to work as scavenger. If any of the clauses of the before mentioned “Adjustment Compromise” is not fulfilled, the Municipal Power shall be fined and the value shall be deposited on the State Environment Fund (Law no. 7.347/85).

The Municipal Power already has the Previous License for the new sanitary landfill. The land is now in acquisition process and amounts for 8.19 ha. The documents for the obtainment of LI (Installation License) for the Sanitary Landfill are ready to be submitted to FEPAM as informed by the contracted geologist in charge.

It is worthy to mention that two other areas in the urban zone were utilized for solid waste dumping (including medical services waste) and are now being utilized as housing districts (Getúlio Vargas and Falcão districts). No reclamation measures were taken in these two areas except the coverage with earth (**Fig. 10.5-1**).



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Fig. 10.5-1

Collection Services Coverage,
Location of Dumping Site and other
Features in Camaquã

10.5.5 Budgetary Organization

The budget for the solid waste management is included in the budget of the SMOV. A more detailed breakdown of the expenses is shown in the following table.

Table 10.5-3 Annual Expenses with Solid Waste Management System

ITEM	EXPENSES (R\$/Year)	%
Ordinary Collection (direct)	286,680	11.0
Collection in Rural Districts (contracted)	10,920	0.4
Sweeping, and Cutting of Trees	-*	-
Debris from Construction and Cleaning of Yards (direct)	144,000	5.5
Rental of the dumping site	5,400	0.2
Total	447,000	17.1
Budget of Secretariat of Civil Works and Traffic (SMOV)	2,600,000	100.0
% of the Expenses with Solid Waste Management in relation to the Municipal Budget		2.2
% of the Budget of SMOU in relation to the Municipal Budget		13.0
Municipal Budget	20,000,000	100.0

Note: * The cost of these services is included in the total cost of personnel (60% of the total SMOV budget)

Source: Municipal Secretariat of Civil Works and Traffic (1999)

In terms of percentage, the expenses related to the collection, transportation and final disposal of solid waste represents around 17.1 % of the SMOV Budget and 2.2% of the Municipal Budget.

10.6 Solid Waste Management in Tapes

10.6.1 Institutional Framework

The responsible organization for the collection of domestic solid waste and urban cleaning is the Municipal Secretariat of Civil Works, Traffic and Transportation (SOVT).

10.6.2 Legal Framework

As for the national and state levels, please refer to item (1) in 10.2.2 – Legal Framework in Pelotas.

At the municipal level, the Law no. 1312 (Nov 9th, 1990) establishes the “Code of Dispositions” in which Chapter VI, the Public Cleaning Services are detailed.

10.6.3 Present Conditions of Collection Services

The collection services of domestic SW are carried out directly by the local government. Two trucks (compaction and dumping) are utilized for this service, with the employment of 2 drivers and 6 collection workers.

This service is carried out daily (Monday to Saturday) in the whole urban area. In the District of New Tapes, located by the highway BR-116, the collection is carried out 2 times a week in ordinary months, and 3 times a week during the summer season. During the summer season (Dec to March), the collection is carried out from Monday to Monday in the urban area. The total daily collected volume is around 7 ton/day (8 months), raising up to 10 ton/day (4 months, December to March) during the summer season (**Table 10.6-1**).

Table 10.6-1 Estimated Amounts of Domestic SW Disposed in the Dumping Site

	Daily Collection	Monthly Amount
Ordinary Month	7 ton	182 ton
Summer Season Month	10 ton	300 ton

Note: The officials say that during the summer season the urban population almost triplicates.

Source: Geni Zenker - Municipal Planning Advisor of Tapes

The local hospital has an incinerator that receives the waste from the two health posts of the city (State and municipal), besides from some pharmacies, etc. The collection of this type of waste is carried out by the local government without charge.

The local government also collects for free the solid waste of some shoemaking industries. The officials say it is a kind of incentive for these small industries.

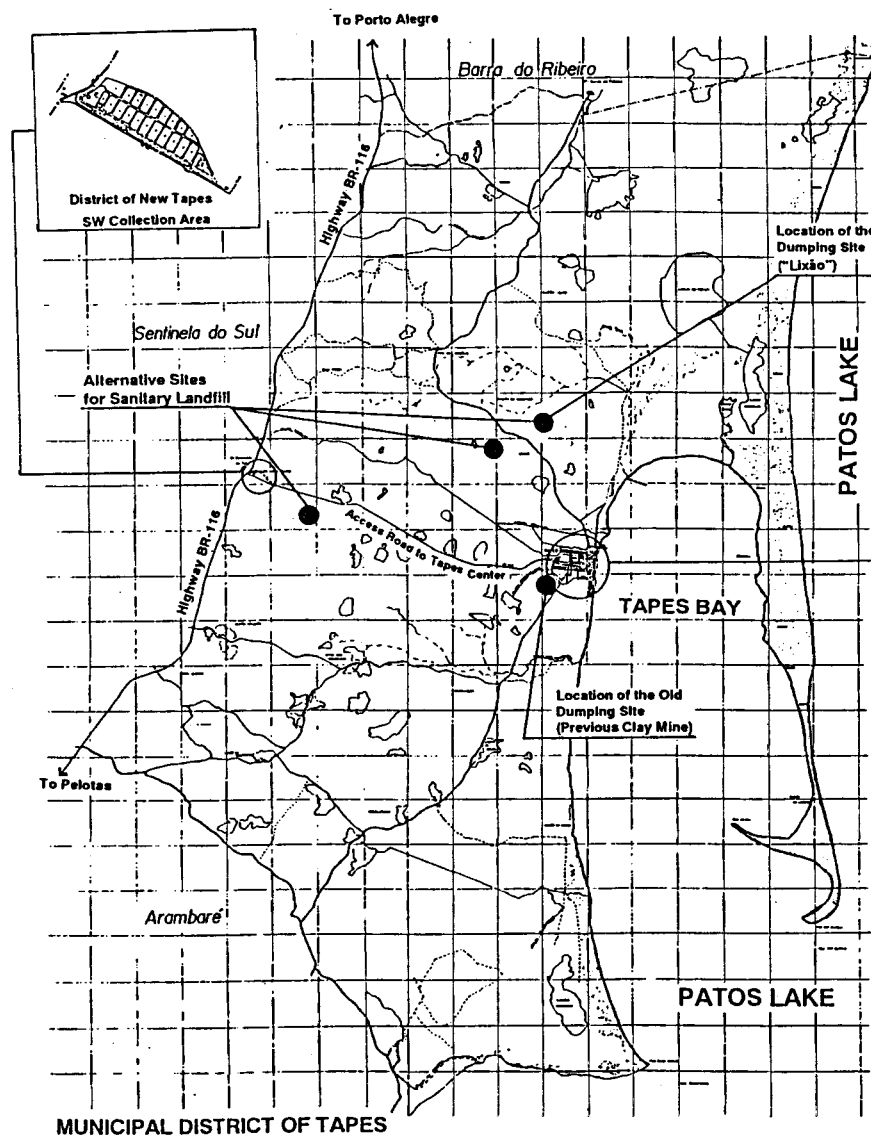
10.6.4 Present Conditions of the Dumping Site (Lixão)

The present dumping site was lent by a private owner to the municipality around 7 years ago. The area has 3.1 ha, though not completely covered with solid waste. No measures are being taken to protect the surroundings against leachate leakage or other sanitary problems (**Fig. 10.6-1**).

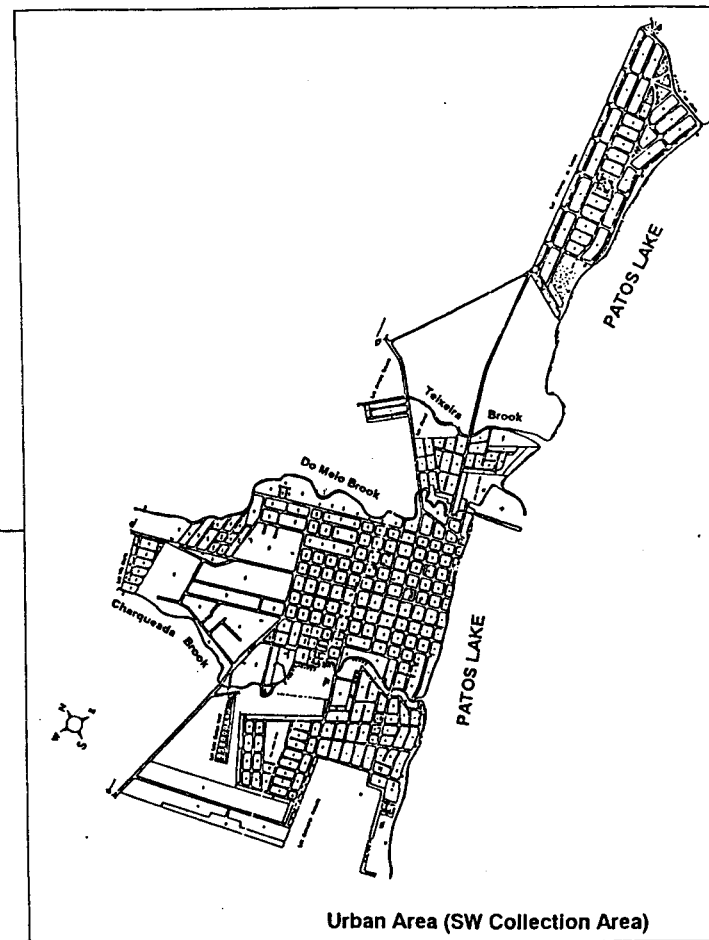
At the site, there are some scavengers separating recyclables for the owner of the dumping site himself. At the site, there is even a bundle press for the works. The scavengers live at the margins of the road that leads to the dumping site in an area called “Corredor do Butiá” (Butiá Corridor).

The Public Attorney established a deadline for the municipality to promote the reclamation and closure of the current dumping site. According to the FEPAM responsible official, there is no licensing process for a new sanitary landfill being analyzed by that institution. However, the Tapes local government officials declared they have already started the submission process at FEPAM, presenting 3 (three) optional areas for the new sanitary landfill location. Both information are incompatible.

Before starting using the present dumping site, another site was utilized for the same purpose for around 15 years. This site was previously a clay deposit and for removing the material 3 m deep wells used to be dig. These wells were then filled up with solid waste and only when full, they used to be covered with compacted earth (around 50 cm thick). This old dumping site is located very close to the urban area (approx. 150 m from the Charqueada Brook) and around 1.5 km from the Tapes Bay (within the Patos Lake). At that time, no protection measures were taken against leachate contamination.



MUNICIPAL DISTRICT OF TAPES



Urban Area (SW Collection Area)

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Fig. 10.6-1

Collection Services Coverage,
Location of Dumping Site and other
Features in Tapes!

10.6.5 Budgetary Organization

The cost of solid waste and public cleaning management is covered with part of the municipal budget. There is not a special tax for the solid waste management or similar. In theory, this service should be partially covered by the IPTU (Territorial and Praedial Urban Tax). However, there is a high rate of non payment of this tax among the citizens (around 60%).

Table 10.6-2 Comparison of Municipal Budget and SOVT Budget

	Annual Budget	%
Budget of Secretariat of Civil Works, Traffic and Transport	1,402,138	19.7
Total Budget of the Local Government	7,114,075	100.0

Source: Municipal Secretariat of Finance (1999)

Within the SOVT budget, it was not possible to separate the expenses with solid waste collection and urban cleaning only. Both the personnel and vehicles utilized in these services are also utilized in other activities by the Secretariat.

However, just for the purpose of comparison, we can make the following calculation. In 1998, during a period of 8 months, the collection was contracted for R\$ 8,200/month. The estimated collection amount in the contract was 150 ton/month. Utilizing the present budget of the SOVT (around R\$ 116,845/month) and of the Local Government (around R\$ 592,840/month), we could say that the contracted collection of solid waste represented 7% of the first and 1.4% of the second approximately.

10.7 Impact of Leachate from the Existing Waste Disposal Sites

10.7.1 Conditions of Solid Waste Disposal Sites

In the following **Table 10.7-1**, we present a summary of the conditions of the Solid Waste Disposal Sites in the five (05) municipalities surveyed for this Study.

As for the item “13” of the Table (Licensing Procedures by FEPAM), some explanations shall be made. The staff of the Urban Solid Waste Service (Domestic and Medical Services) responsible for the licensing of sanitary landfill and others is composed only by 2 chemical engineers, and 1 geologist (for field inspections). This unit belongs to the Environmental Sanitation Division (DISA) within FEPAM organization chart, and is

responsible for the follow up of 467 municipalities of Rio Grande do Sul State.

The licensing procedures can be summarized as follows:

- Elaboration of EIA-RIMA (Study and Report on Environmental Impact);
- Submission of the EIA-RIMA to FEPAM;
- FEPAM official inspects the proposed areas;
- Request of complementary information by FEPAM (when necessary);
- If the EIA-RIMA is approved by FEPAM, the local government shall publicize its contents to the society and make it available for public consultation for 45 days, after which a Public Meeting shall be carried out to discuss issues arouse by the society;
- If no problems arise in the Public Meeting, the LP (Previous License) is granted;
- The detailed design of the sanitary landfill is elaborated by the local government;
- If it is approved, the LI (Installation License) is granted;
- Upon the completion of the construction works, an inspection is carried out by FEPAM, and if there are no problems in the site, the LO (Operation License) is granted.

The elaboration requirement of the EIA-RIMA for sanitary landfills fulfills the following guidelines (Resolution no. 012/95-SSMA);

- Obligatory: municipalities with over 100,000 inhabitants (served);
- Depends on the judgment of FEPAM: for municipalities under 25,000 (which areas present some environmental restrictions), and for municipalities with population ranging from 25,000 to 100,000 inhabitants (served);
- Released: for municipalities under 25,000 inhabitants (served) if their areas do not present environmental restrictions.

Considering the limitation of the FEPAM staff for this matter, and sometimes the lack of qualification of local governments officials, the whole licensing process can take long time, sometimes, years to come to a completion.

Table 10.7-1 Conditions of the Solid Waste Disposal Sites in the 5 Municipalities of the Study

	Items	Municipality				
		Pelotas	Rio Grande	Tapes	Camaquã	S. Lourenço do Sul
1	Type of disposal site	Controlled landfill <ul style="list-style-type: none"> Daily coverage with earth Drainage for leachate Drainage for gases Compacted turf as bottom liner (40 cm) 	Controlled landfill <ul style="list-style-type: none"> Daily coverage with earth only. No drainage for leachate nor gases. No bottom liner 	Open dumping (“Lixão”) <ul style="list-style-type: none"> No protection measures against contamination 	Open dumping (“Lixão”) <ul style="list-style-type: none"> No protection measures against contamination 	Open dumping (“Lixão”) <ul style="list-style-type: none"> No protection measures against contamination
2	Present Status	Closure process A temporary sanitary landfill is planned to be installed at a nearby site on an emergency basis until the definite site of the sanitary landfill is approved by FEPAM. The area belongs to the local government and the operation shall be carried out by a contracted company (now in bidding process). This landfill shall not be licensed by FEPAM because of its location. The same contract shall foresee the reclamation of the “Controlled Landfill” (4.5 ha) now in closure process.	In use The local government is being sued in order to carry out measures for the environmental reclamation of the area.	In use The local government is being sued in order to carry out measures for the environmental reclamation of the area.	In use The local government is being sued in order to carry out measures for the environmental reclamation of the area.	In use The local government is being sued in order to carry out measures for the environmental reclamation of the area.
3	Time of utilization	More than 17 years	More than 20 years	Approximately 7 years	More than 10 years	More than 20 years
4	Area	3 ha (already closed) 1.5 ha (closure process) 11 ha (temporary sanitary landfill)	14 ha (already closed) 9 ha (in utilization)	approx. 3 ha (no compaction, scattered)	approx. 3ha (no compaction, scattered)	approx. 2 ha (no compaction scattered)
5	Height	4 to 5 m at the closure of the landfill.	6 m (closed area) 4 m (in utilization)	No estimation	Approx. 3 to 4 meters (not even)	Approx. 3 to 4 meters (not even)
6	Disposal Volume	150 ton/day	100 ton/day	7 ton/day 10 ton/day (Dec to March)	25 ton/day	10 ~ 11 ton/day 14 ton/day (Dec to March)
7	Location of the disposal site	Within the urban zone	Within the urban zone	Approx. 6 km from the urban perimeter	Within the urban zone	Approx. 2 km from the urban perimeter
8	Distance from Patos Lake in a straight line	Approx. 11.4 km	Less than 60 cm	Approx. 4 km	Approx. 40 km	Approx. 3 km

Table 10.7-1 Conditions of the Solid Waste Disposal Sites in the 5 Municipalities of the Study (continuation)

	Item	Municipalities				
		Pelotas	Rio Grande	Tapes	Camaquã	S. Lourenço do Sul
9	Distance from nearby water stream	1.0 km from Santa Bárbara Canal 3.6 km from São Gonçalo Canal Beside the Matadouro Brook	-	4.5 km from Teixeira Brook	1.2 km from Sanga do Passinho (Passinho brook)	Arroio Carahá (Carahá brook) is just beside the dumping site
10	Drainage and treatment of leachate	Drainage and treatment in stabilization ponds (4 in a sequence). The Matadouro Brook (Sanga do Matadouro) is the recipient water body after the treatment in the stabilization ponds. The leachate is analyzed in a monthly basis by SANEP.	NO	NO	NO	NO
11	Co-disposal of Medical Service Solid Waste	YES The collected medical services solid waste is disposed in ditches lined with plastic sheet and covered with lime.	YES They received the LP and LI for the installation of an Auto-clave at the dumping site to sterilize waste from medical services. After sterilization, the waste shall be disposed together with domestic solid waste.	NO The medical services solid waste is incinerated in the local hospital. This waste comes from some pharmacies, and 2 health posts (municipal and state).	NO The medical services solid waste is collected, transported and incinerated by a private company in another city.	NO The medical services solid waste is collected, transported and incinerated by a private company in another city.
12	Presence of scavengers at the site	NO	YES (several)	YES (several)	YES (several)	YES (several)
13	Licensing Procedures at FEPAM (Installation of a Sanitary Landfill)	The EIA-RIMA (Report on Environmental Impact) was elaborated. However FEPAM requested further information to complement the analysis. The Pelotas officials are organizing the necessary further information.	The EIA-RIMA (Study and Report on Environmental Impact) was elaborated. However FEPAM requested further information to complement the analysis. If the Rio Grande officials do not respond the request in time, the licensing process shall be interrupted.	According to the FEPAM responsible official, there is no licensing process for a new sanitary landfill being analyzed by that institution. However, the Tapes local government officials declared they have already started the submission process at FEPAM, presenting three alternative areas for the new sanitary landfill location. Both information are incompatible.	The area for the new sanitary landfill already received a LP (Previous License) by FEPAM. The local officials shall submit a detailed design of the sanitary landfill to obtain the LI (Installation License). The area is already being purchased by the local government.	The LP shall be granted to an area owned by a private company who intends to operate the Domestic Solid Waste management system (collection, transportation, and final disposal). At present, in bidding process.

10.7.2 Quality and Quantity of Leachate

(1) Quality of Leachate

According to R. Stegman¹, leachate quality is to a high degree dependent upon the kind of processes that take place in a landfill. Another important aspect in the formation of leachate is the contents of organic matter in the solid waste disposed in the landfill. For more information on leachate, please refer to **ANNEX WAS**.

Among the 5 municipalities surveyed in this Study, the only one with some protection measures is the Pelotas landfill. At the “controlled” landfill site (it can not be considered a fully developed sanitary landfill because it does not fulfill all the technical requirements for so), there are four stabilization ponds in a sequence for the treatment of the drained leachate. **Table 10.7-2** presents some characteristics of the leachate generated in the controlled landfill of Pelotas. *Organic matter contents accounts for approximately 47% of the total solid waste disposed in the Pelotas landfill.*

Although it is not located in the Patos and Mirim Lakes Basin area, the Sanitary Landfill of Porto Alegre (Extrema) give us some parameters on leachate production and characteristics that are shown in **Table 10.7-3**. *The organic matter contents accounts for approximately 53% of the total solid waste disposed in this sanitary landfill.*

¹ Institut für Stadtbauwesen, Technische Universität Braunschweig, Germany

**Table 10.7-2 Characteristics of the Leachate in the Controlled
Landfill of Pelotas**

Origin of the sample: Controlled Landfill "COLINA DO SOL"						
Date of the Collection: November 11 th , 1998						
Collected by: Eng. Edson Plá Monterosso Chief of the Solid Waste Final Destination Division (SANEP)						
1. Physical-chemical Analysis						
Parameter	Unit	Collection Site				
		1 st pond	2 nd pond	3 rd pond	4 th pond	Recipient Water Body
PH		7.8	7.7	8.0	7.3	6.9
Total Phosphorus	mg/l PO ₄ ⁻³	29.91	0.76	7.35	6.78	19.53
Ammoniac Nitrogen	mg/l NH ₃	1,713.69	540.34	157.34	157.34	99.87
Consumed Oxygen	mg/l O ₂	330.0	66.0	44.0	70.0	24.0
COD	mg/l O ₂	1,615.35	346.14	230.76	153.84	115.38
BOD ₅	mg/l O ₂	700.0				
Sedimentable Solids	mg/l	0.1	4.0	0.1	0.1	1.2
Total Solids at 105°C	mg/l	5,999.0	4,898.4	882.4	811.6	399.4
Fixed Solids at 600°C	mg/l	4,494.8	1,009.4	568.8	530.6	226.8
Volatile Solids	mg/l	1,504.2	3,814.6	305.9	280.2	171.8
Total Suspended Residue	mg/l	404.0	3,620.2	66.6	48.4	50.2
Fixed Suspended Residue	mg/l	401.8	74.4	7.7	0.8	6.6
Volatile Suspended Residue	mg/l	2.2	3,545.8	58.9	47.6	43.6
Total Dissolved Residue	mg/l	5,595.0	1,278.2	815.8	763.2	349.2
Fixed Dissolved Residue	mg/l	4,093.0	1,009.4	568.8	530.6	220.2
Volatile Dissolved Residue	mg/l	1,502.0	268.8	247.0	232.6	129.0
II. Bacteriological Analysis:						
Total Bacteria Contents		8.4 x 10 ⁴	6.4 x 10 ⁴	3.6 x 10 ⁴	4.3 x 10 ⁴	1.8 x 10 ⁵
Total Coliforms Index/100ml		4.9 x 10 ⁵	4.9 x 10 ⁵	1.3 x 10 ⁶	2.3 x 10 ⁶	2.3 x 10 ⁶
Fecal Coliforms Index/100ml		1.7 x 10 ⁴	1.7 x 10 ⁴	4.9 x 10 ³	1.1 x 10 ⁴	2.3 x 10 ⁶

Source: Eng. Edson Plá Monterosso – Solid Waste Processing Dept. (SANEP)

**Table 10.7-3 Characteristics of the Leachate in the Porto Alegre
Sanitary Landfill**

Origin of the sample: Sanitary Landfill “Extrema” – Porto Alegre			
Gross Leachate		Effluent of the Anaerobic Filter	
Collection Date: 21/June/1999		Collection Date: 16/September/1999	
Temperature of the sample: 27°C		Temperature of the sample: 21°C	
Air Temperature: 17°C		Air Temperature: 25°C	
Parameter	Unit	Gross Leachate	Effluent of the Anaerobic filter at the bottom of the landfill after re-circulation
Conductivity	µmho/cm	13,200.0	
Redox Potential	mVolts	- 192	
PH		6.2	7.6
Total Alkalinity	mg/l CaCO ₃	11,610.0	
COD	mg/l O ₂	31,200.0	2,600.0
BOD ₅	mg/l O ₂	16,500.0	1,780.0
Phenols	mg/l C ₆ H ₅ OH	4.6	
Total Phosphate	mg/l PO ₄ ⁻³	83.7	36.2
Total Phosphate	mg/l P	27.3	
Volatile Sebacic Acid	mg/l HAC	10,200.0	
Sulphate	mg/l SO ₄	630.0	
Sulphide	mg/l H ₂ S	0.2	
Nitrate	mg/l NO ₃	16.0	6.8
Nitrite	mg/l NO ₂	0.07	0.1
Total Nitrogen	mg/l N	1,834.0	
Organic Nitrogen	mg/l N	350.0	126.0
Ammoniac Nitrogen	mg/l N	1,484.0	2,100.0
Aluminum	mg/l Al	1.89	
Lead	mg/l Pb	0.41	
Copper	mg/l Cu	0.05	
Total Chromium	mg/l Cr	0.31	
Cadmium	mg/l Cd	0.04	
Total Iron	mg/l Fe	365.0	
Manganese	mg/l Mn	52.0	
Mercury	mg/l Hg	0.004	
Nickel	mg/l Ni	0.3	
Zinc	mg/l Zn	1.48	
Fixed Total Solids	mg/l	14,090.0	10,090.0
Total Solids at 105°C	mg/l	29,020.0	12,460.0
Heterotrophic Bacteria	UFC/ml	7,000	
MPN* of Fecal Coliforms	NMP/100 ml	2	

Note: * Most Probable Number

Source: Division of Solid Waste Final Disposal – DMLU – Porto Alegre.

(2) Quantity of Leachate

The amount of leachate produced in landfills depends on several factors such as rainfall in the landfill site, superficial runoff and/or underground infiltration, natural humidity of the garbage, organic matter contents, compaction level, and water retention capacity of the soil, among others. The quantity of leachate formed depends basically on the rainfall on the landfill site. According to Knoch², several studies estimate that 24 to 44% of the rainfall becomes leachate. Other authors³ estimate this production in 25 to 33% of the rainfall.

The annual rainfall in Pelotas varies between 1,350 to 1,550 mm, with excess in June, July, August, and September, and scarcity of rain in November, December, January, February and March. No specific data on leachate production in the Pelotas' landfill is available.

In a very rough calculation, considering an average annual rainfall of 1,450 mm in Pelotas, and the landfill area (4.5 ha), we have a total volume of rainfall at the landfill site of around 65,250 m³ in a year, i.e., around 178 m³/day. If we apply the minimum and maximum percentages found by Knoch (24 to 44%), we could say that the daily leachate production in Pelotas could vary from 42 to 78 m³/day.

Table 10.7-4 Summary of Pelotas and Porto Alegre SW Landfills

Municipality	Landfill Site	Area covered with SW	Height	Disposal	Load of Leachate
Pelotas	Colina do Sol	4.5 ha	6 m	150 ton/day	Approx. 42 to 78 m ³ /day
Porto Alegre*	Extrema	5.0 ha	30 m	600 ton/day	60 m ³ /day

Note: The information on the Extrema sanitary landfill was provided by DMLU – Division of Final Disposal of Porto Alegre local government. The total area of the Sanitary Landfill is 12 ha.

² “Effluents of controlled landfills”, São Paulo, 1978 (in “The Problem of Leachate Treatment of Sanitary Landfills, Waquil D.D., Freitas A.R.; 1983”)

³ Boyle and Ham, Washington, 1974 (in “The Problem of Leachate Treatment of Sanitary Landfills”, Waquil D.D., Freitas A.R.; 1983)

10.7.3 Impact by Leachate

Leachate is a very fetid liquid, very much similar to the domestic sewage, however much more concentrated and with an oxygen biochemical demand (BOD) of around 20,000 mg/l while the BOD of domestic sewage ranges from 100 – 400 mg/l. In young landfills (less than 5 years), the BOD can reach 50,000 mg/l, which represents approximately 500 times the concentration in domestic sewage.

When the landfill does not have an appropriate bottom liner, the leachate can infiltrate through the soil and contaminate the groundwater. Even if the impermeability of the soil is good, but the leachate is not collected for treatment, it can also run-off to a nearby water body contaminating it. Leachate contamination can compromise for long time the water quality, causing many hazards for the fauna and flora, besides for the human health if water is collected for drinking purposes or for irrigation at the surroundings of the landfill.

10.8 Existing Plans and Programs

10.8.1 Expansion of the “Adopt a School” Program

SANEP, in Pelotas, is already carrying out a recycling program called “*Adopt a School*” *Program*. Within this program, educational campaigns are carried out in the participant schools with their teachers and students. When the program is well understood, the students and the school’s neighbors start to bring recyclables to the school. At present, this material is precariously stored at the schools facilities (classrooms, toilets, etc.). Once or twice a week, this material is collected by SANEP. Then the collected material is bundle pressed and sold at SANEP facilities. The collected money is given to the school. At present, there are 40 schools participating in the program.

SANEP intends to expand the program for a total of 206 schools, including those located in the rural zone. Each school will have an appropriate container or recipient for the temporary disposal of collected recyclables. Besides that, the program also foresees the construction of a Recycling Center. This Center is divided into three modules: (1) a shed where all the collected material will be gathered, separated, and bundle pressed, (2) a storage shed where the bundle pressed material will be stored until be sold, and (3) a two store building for administration and classrooms for workshops and lectures on environmental issues.

The general objectives of the program are as follows;

- to propitiate to the teachers and students the opportunity to discuss environmental and social issues brought up by the solid waste and the alternatives for this problem.
- to propitiate higher resident’s awareness about the problem, creating new habits and attitudes towards the generation and disposal of solid waste.
- to propitiate to the schools a source of revenue through the commercialization of recyclables.
- to make available to the Pelotas’ children a playing room furnished with toys made of recyclable material.
- to extend the “Adopt a School” program for all the schools in the municipality of Pelotas.
- to create a Center for the Recycling and Reutilization of Solid Waste.

The total cost of this Program is as follows;

1. Collection at Schools (in US\$)				
Item	Type	Quantity	Unit Cost	Total
1.1 Container	2,540 l	27	570	15,390
1.2 Small recipients	250 l	179	140	25,060
1.3 Portable scale	Hook type	9	120	1,080
1.4 Collection trucks		6	20,000	120,000
T O T A L				161,530

2. Equipment for the Recycling Center (in US\$)				
Item	Type	Quantity	Unit Cost	Total
2.1 Bundle press	for Metal	2	3,500	7,000
2.2 Bundle press	for Paper and Cardboard	1	2,900	2,900
2.3 Bundle press	for Plastic	2	2,000	4,000
2.4 Metallic hopper	3 m ³	1	3,700	3,700
2.5 Conveyor belt	for Sorting	10	2,030	20,300
2.6 Conveyor belt	for Rejects	1	6,900	6,900
2.7 Wheelbarrow	for Recyclables	30	220	6,600
2.8 Container	for Rejects	2	1,000	2,000
T O T A L				53,400

3. Construction of the Recycling Center (in US\$)	
Item	Total
3.1 Installation of construction site and earth movement	13,320
3.2 Foundation	16,120
3.3 Structure	56,920
3.4 Walls and fences	26,750
3.5 Roofing	24,690
3.6 Water proofing	400
3.7 Pavements	57,600
3.8 Lining	9,090
3.9 Framework and Metalwork	9,030
3.10 Metalwork for the Frames	1,830
3.11 Glasswork	620
3.12 Painting	6,970
3.13 Special facilities (telephone network, gas, etc.)	2,000
3.14 Hydro-sanitary facilities	21,830
3.15 Electric facilities	28,400
3.16 Completion services	9,030
T O T A L	284,600

TOTAL COST OF THE PROGRAM (in US\$)	
Item	Total
1. Collection at Schools	161,530
2. Equipment for the Recycling Center	53,400
3. Construction of the Recycling Center	284,600
T O T A L	499,530

The total costs do not include the land acquisition cost because the land is already available for the Program. The following table presents the facilities areas share.

TABLE OF AREAS	
Land Area	1,700.00 m ²
Administration Building	590.43 m ²
Recycling Plant	914.00 m ²
Metal Processing Unit	738.00 m ²

Figures 10.8-1 to 10.8-8 present the design of the facilities.

BOM JESUS

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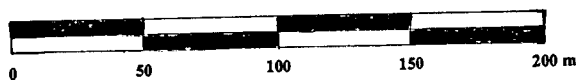
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THE STUDY ON THE ENVIRONMENTAL MANAGEMENT
OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
IN THE FEDERATIVE REPUBLIC OF BRAZIL

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Fig. 10.8-1

Recycling Center
Location Plan

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Fig. 10.8-2
Recycling Center
Site and Roof Plan

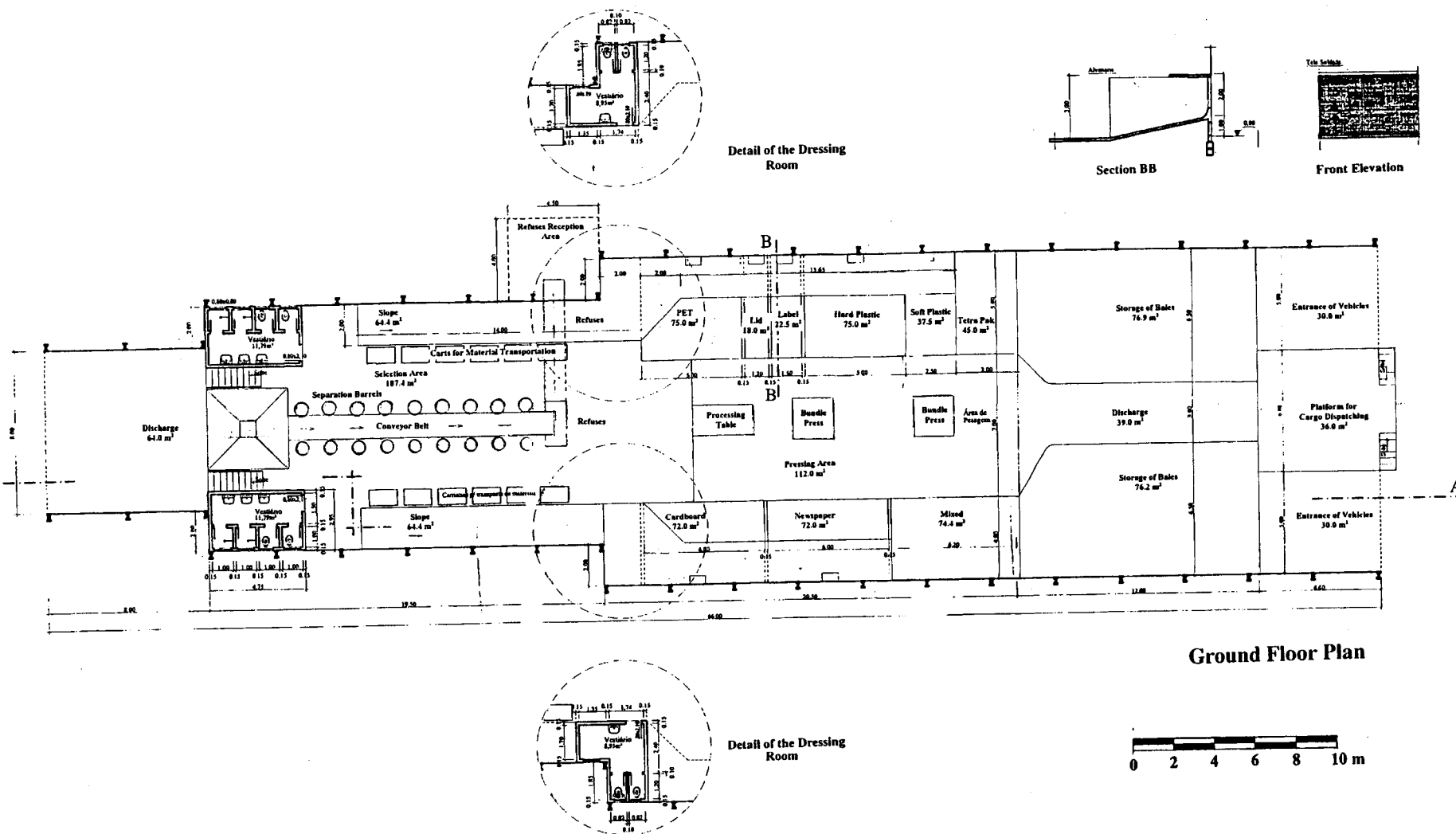
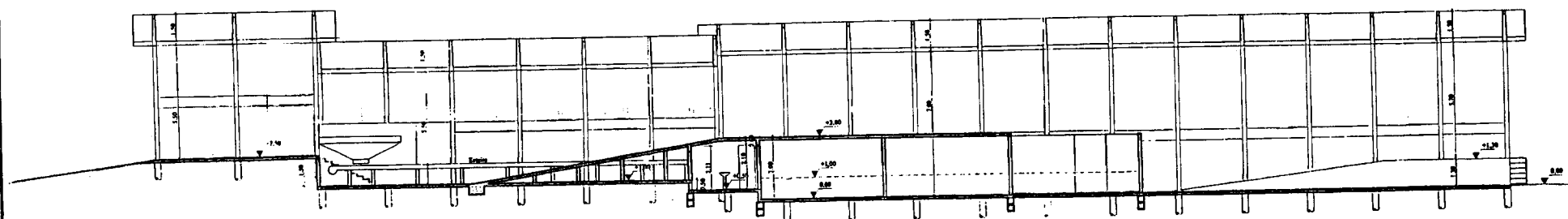


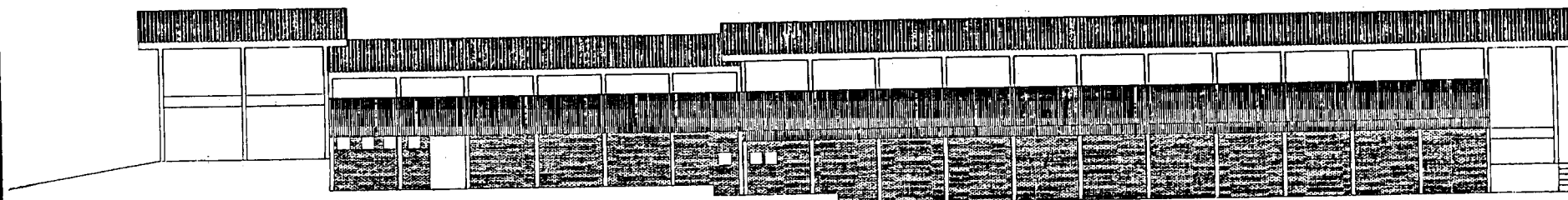
Fig. 10.8-3

Recycling Center Paper and Plastic Processing Unit (1)

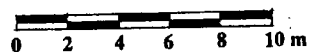
<p>THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL</p>
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Section AA



Lateral Elevation

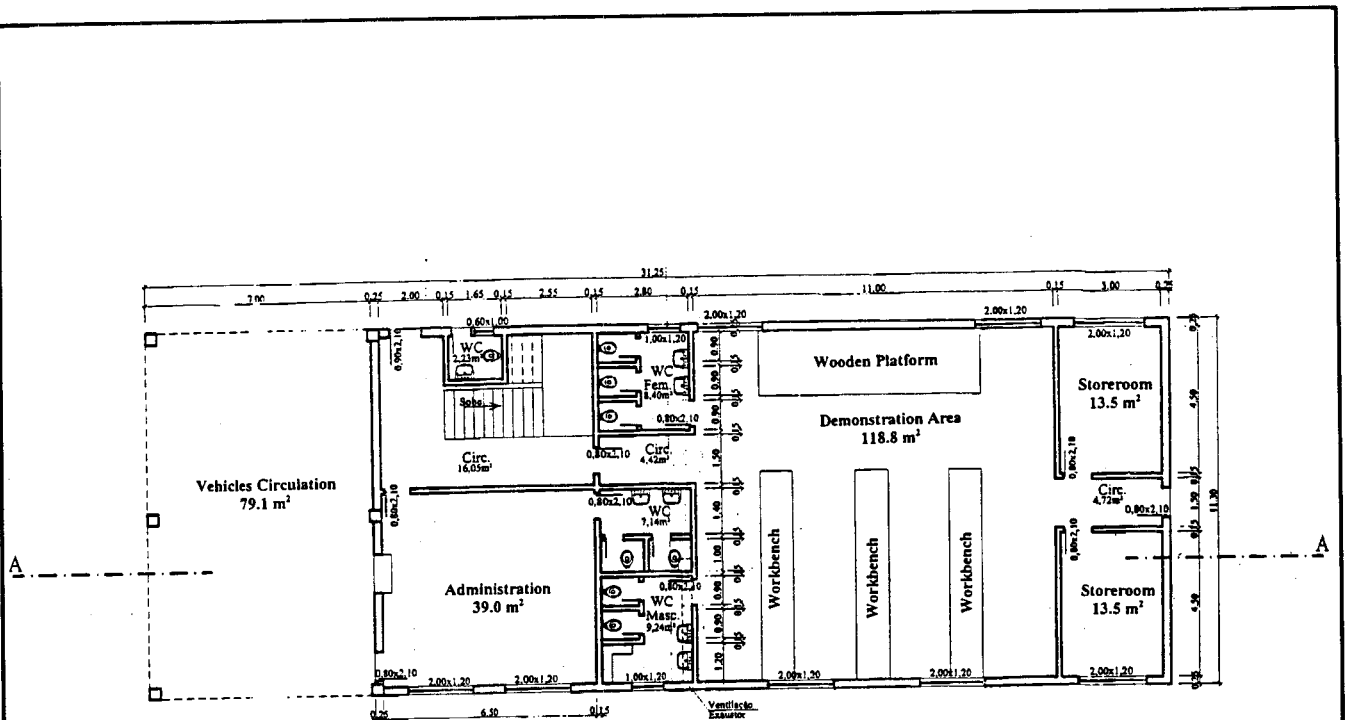


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IN THE FEDERATIVE REPUBLIC OF BRAZIL

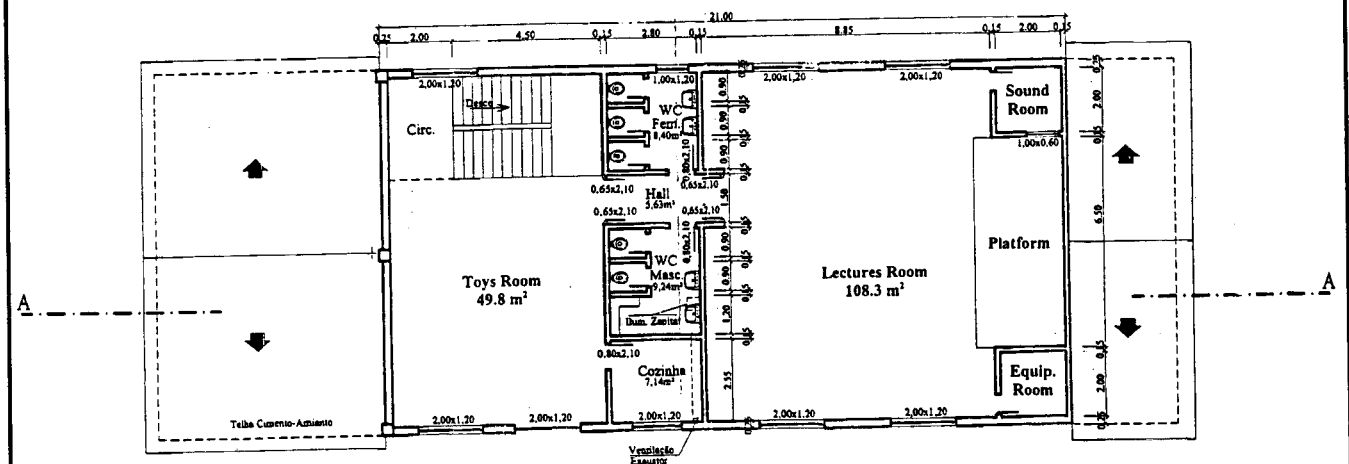
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Fig. 10.8-4

**Recycling Center
Paper and Plastic
Processing Unit (2)**



Ground Floor Plan



1st Floor Plan

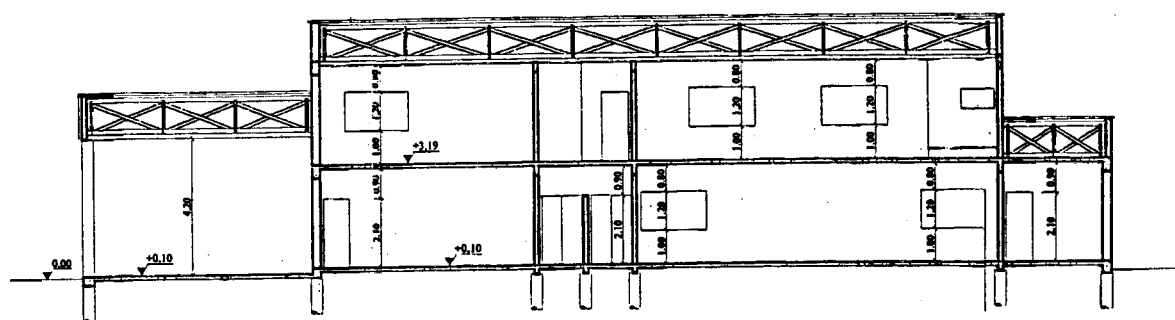


THE STUDY ON THE ENVIRONMENTAL MANAGEMENT
OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
IN THE FEDERATIVE REPUBLIC OF BRAZIL

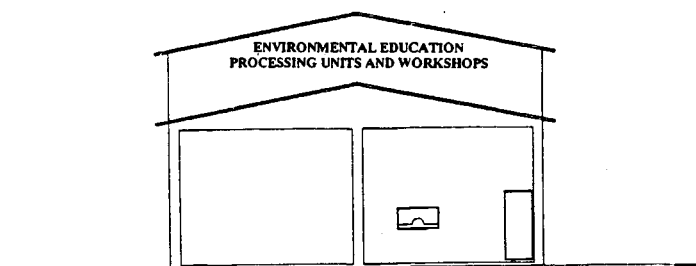
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Fig. 10.8-5

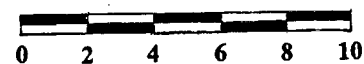
Recycling Center
Administration and Pedagogic
Workshop (1)



Section AA



Front Elevation

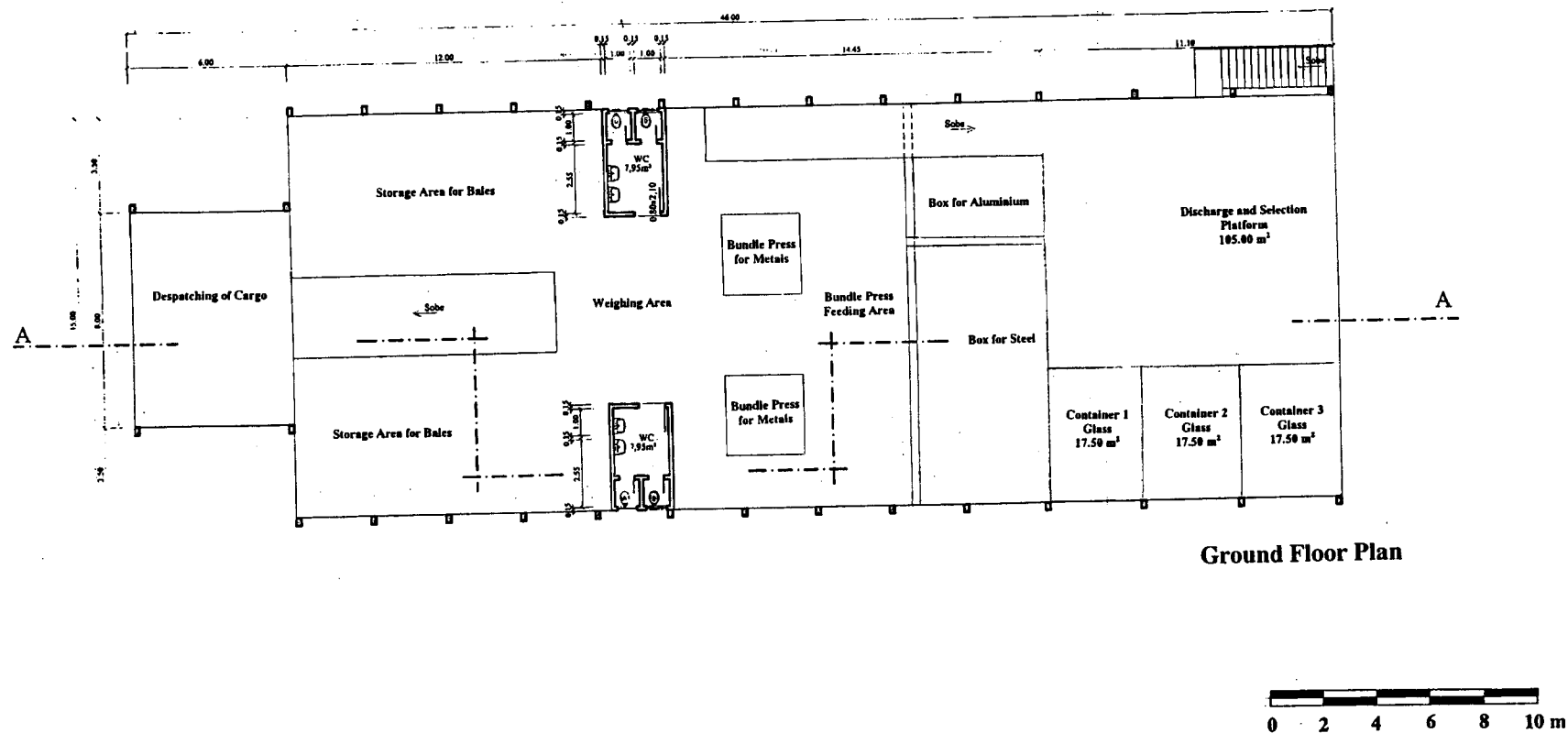


THE STUDY ON THE ENVIRONMENTAL MANAGEMENT
OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
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Fig. 10.8-6

Recycling Center
Administration and Pedagogic
Workshop (2)

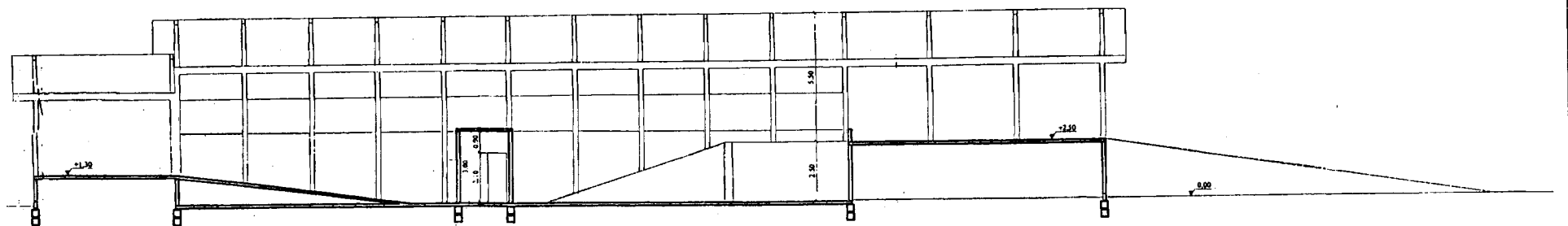


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OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
IN THE FEDERATIVE REPUBLIC OF BRAZIL

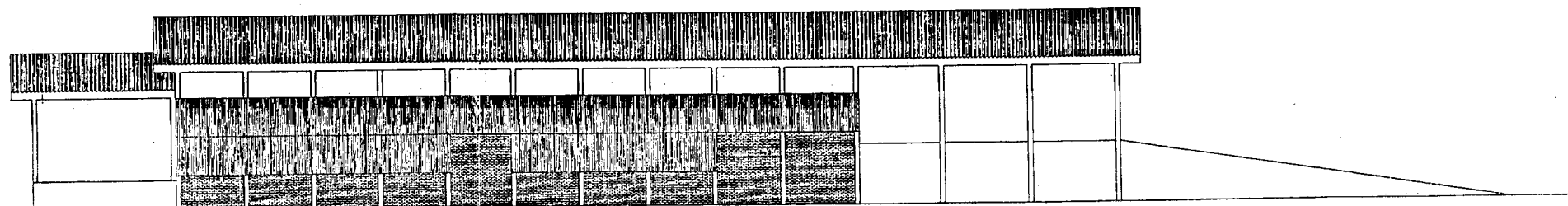
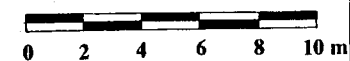
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Fig. 10.8-7

Recycling Center
Metal and Glass
Processing Unit (1)



Section AA



Lateral Elevation

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

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Fig. 10.8-8

Recycling Center
Metal and Glass
Processing Unit (2)

10.8.2 “Health is a Clean City” Program

This Program, whose responsible agency is the Municipal Secretariat of Health of Pelotas, encompasses several issues such as solid waste and its educational aspect, the housing sanitation, the proliferation of diseases transmitting vectors and reservoirs of transmittable diseases. The last but not the least, it focuses the problems in a global way, involving the several actors acting in this context.

The Municipal Secretariat of Health shall count on the support of other concerned organisms such as; Municipal Secretariat of Urban Services, Municipal Secretariat of Education and the Solid Waste Processing Department of SANEP (Pelotas Autonomous Sanitation Service).

(1) Program Justification

The whole municipality of Pelotas (urban and rural areas) is lacking urgent and effective measures regarding to the solid waste generated and accumulated at the communities, the housing sanitation, as well as control of diseases transmitting vectors, reservoirs of transmittable diseases and Sinanthropic and poisonous animals.

These diseases transmitting vectors and reservoirs of transmittable diseases, as well as the Sinanthropic and poisonous animals are responsible for serious public health problems. The consequences are noticeable in the life quality level, work yield, learning capability, leisure and health of the population.

The participation of the community in each step of the program, as well as an integration of all concerned institutions is expected. The program steps are the following: the sanitation of the house and the environment; reduction, reutilization and recycling of domestic solid waste and urban cleaning solid waste; control of diseases transmitting vectors, zoonosis and Sinanthropic and poisonous animals; and the reduction of water borne diseases.

(2) Objectives

- (a) Information to the community about basic notions of environmental sanitation (housing sanitation, domestic and urban cleaning solid waste), control of diseases transmitting

vectors, zoonosis, Sinanthropic and poisonous animals;

- (b) Promotion of housing sanitation at low income population urban and rural zones in the municipality of Pelotas;
- (c) Cleaning of streets and avenues, gutter, drainage system, canals and ditches at the urban zone of Pelotas;
- (d) Reduction of solid waste production and focuses of solid waste produced by the communities;
- (e) Control of diseases transmitting vectors and reservoirs of transmittable diseases at the level of the house, neighborhood and public ways;
- (f) Reduction of the occurrence of water borne diseases, directly or indirectly caused by the solid waste;
- (g) Reduction of the solid waste deposited at the landfill, increasing its life span; and
- (h) Sustainable development of communities through the reutilization and recycling of solid waste, generating income and environmental improvement.

(3) Activities to be implemented

A. Environmental Education

- (a) Production of printed and audio-visual educational material about environmental sanitation (housing sanitation, domestic and urban cleaning generated solid waste), food quality, hygiene basic measures, control of diseases transmitting vectors, zoonosis, Sinanthropic and poisonous animals. This material shall be distributed and explained to the community;
- (b) Production of similar teaching material to be utilized at the school program;
- (c) Development of teaching schedule concerning to formal, informal and non formal environmental education concerning to the same items;
- (d) Schedule and development of educational lectures about environmental sanitation; and
- (e) Orientation, at the house level, about environmental sanitation measures.

COMPONENT “A” COST

Necessary Material	Quantity	Cost (US\$)	
		Unit	Sub-total
60,000 Folders			2,100
30,000 Brochures			1,500
6,000 Posters			1,400
TV sets (29”)	2	450	900
Video decks (04 heads)	2	160	320
OHP	5	220	1,100
Slides projectors (80 slides)	3	420	1,260
Video cameras	2	400	800
Computer sets (Pentium 200 MHZ MMX)	3	1,320	3,960
Printer – HP Laserjet 6L Monochromatic 6 PPM	1	450	450
Printers – HP Deskjet 692C Color 5 PPM	3	280	840
Cameras	2	100	200
TOTAL COST			14,830

B. Housing Sanitation

- (a) Promotion of collective activities by the community for the cleaning of yards and vacant lands;
- (b) Promotion of collective activities by the community for the cleaning of water reservoirs and septic tanks;
- (c) Promotion of removal of garbage, debris, gardening residues and other useless objects for the residents from their houses and lands;
- (d) Promotion of the combat against domestic focuses of mosquito in its adult and larval form carried out by the residents themselves; and
- (e) Orientation about the domestic solid waste separation at the source.

COMPONENT “B” COST

Necessary Material	Quantity	Cost (US\$)	
		Unit	Sub-total
Individual Protection Equipment (600,000 for the protection of hands)			17,500
Plastic bag – 100 l (300,000 units for the storage of SW)			17,500
02 Small truck (diesel)	2	17,500	35,000
TOTAL COST			70,000

C. Urban Cleaning

- (a) Cleaning of public ways, gutters, drainage system, canals and ditches at the coverage area;
- (b) Removal of garbage and garbage focuses, debris, gardening solid waste and other objects unwanted by the communities;
- (c) Clearance of canals and ditches;
- (d) Clearance of public ways; and
- (e) Removal of dead animals from the public ways and lands.

COMPONENT “C” COST

Necessary Material	Quantity	Cost (US\$)	
		Unitary	Sub-total
Trucks	4	34,000	136,000
Rear excavator tractor	2	37,000	74,000
Loader tractor	1	57,000	57,000
Leveler tractor	1	92,000	92,000
Man/month	40	160	6,400
Boots	40	5	200
Gloves	40	1	40
Caps	40	3	120
Rain coats	40	5	200
Hoes	20	4	80
Squared Shovel	10	4	40
Cutting Shovel	10	8	80
Forks	5	4	20
Hooks	5	4	20
TOTAL COST			366,200

D. Control of Diseases Transmitting Vectors and Poisonous Animals

The sub-components are presented as follows:

PEDICULOSIS	
(a)	Presentation of the program and guidance to the school direction board about its execution;
(b)	Treatment through: inspection, application of medicine, revision, second application, and new revision;
(c)	Collection of information at the schools, one month after the last application, about re-incidence of the problem;
(d)	Orientation to the children and their relatives about the procedures to avoid the re-infestation.
MOSQUITOES (ARTHROPODS)	
(a)	Combat the adult mosquitoes (winged form) through the fumigation with applied pyrethroid: daily at night at the public ways (with thermic sprayer); and during the day at the gutters and urban focuses (tire repair workshops, deposits of swap iron, landfills, cemeteries and car dismantling workshops), with portable thermic sprayer;
(b)	Combat the larval forms of mosquitoes through the application of biological larvicide weekly at the ditches, canals and hydric focuses, utilizing rear machines.
OTHER ARTHROPODS	
(a)	Combat the flees, cockroaches, fleas, ants, termites, arachnids, caterpillars and scorpions through: disinfection carried out after the orientation about necessary previous measures and local inspection at public institutions, schools, day-care centers and residences; information about the control and combat against diseases transmitting vectors.

COMPONENT “D” COST

Existing Material	Necessary Material	Quantity	Cost (US\$)	
			Unit	Sub-total
02 thermic-sprayers	thermic-sprayers	4	2,500	10,000
35 back rear machines				
	liters of Icon	350	27	9,450
	liters of Teknar	500	20	10,000
02 portable thermic-sprayers	portable thermic-sprayers	6	860	5,160
	small trucks w/ cabin (diesel)	2	17,500	35,000
	small truck (diesel)	1	17,500	17,500
	gallons (50 l) of Permetrin (1%)	900	350	315,000
	portable sprayers for louse	3	20	60
	consumption material			1,800
	office material			2,860
TOTAL COST				406,830

E. Control of Zoonosis and Sinanthropic Animals

The sub-components are presented as follows:

LEPTOSPIROSIS
(a) Laboratory diagnostic about Human Leptospirosis in Pelotas;
(b) Epidemiological investigation of Human Leptospirosis occurrences in Pelotas;
(c) Spacial characterization of Human Leptospirosis occurrences in Pelotas;
(d) Identification of risk areas of Human Leptospirosis in Pelotas, in order to give priority to the control of rodents;
CONTROL OF RODENTS
(a) Inspection of rodents focuses in public, philanthropic and associative institutions at the coverage areas in order to orient about measures to be carried out to avoid (environmental measures) and to eliminate (combat measures) the rodents;
(b) Inspection of rodents focuses, before the demand of the population, in order to orient about measures to be carried out to avoid (environmental measures) and to eliminate (combat measures) the rodents;
(c) Inspection of rodents focuses, in hazardous areas for the Human Leptospirosis in Pelotas, in order to orient about measures to be carried out to avoid (environmental measures) and to eliminate (combat measures) the rodents;
URBAN HYDROPHOBIA
(a) Control of the dogs and cats population through the systematic capture of these animals;
(b) Observation of aggressive animals or animals subjected to aggression;
(c) Animal diagnosis;
(d) Vaccination of dogs and cats in areas of occurrences of Urban Hydrophobia.
BATS
(a) Investigation of focuses, before the demand of the population;
(b) Orientation about measures to be taken.
OTHER ZOONOSIS
(a) Diagnosis of the situation, through the active search in hospitals, medical clinics and clinical analysis laboratories, in order to obtain epidemiological data concerning to Zoonosis in Pelotas.

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Chapter 11

Environmental Education

CHAPTER 11 ENVIRONMENTAL EDUCATION

11.1 Introduction

11.1.1 Background

The target of the environmental education is to disseminate the knowledge and the concern globally on the environmental management issues.

The Brazilian Constitution of 1988, Art. 225 of the Environment, it highlights the necessity to promote the environmental education in the whole education levels and raise public awareness for the preservation of the environment. The State Government of Rio Grande do Sul fully recognizing the constitutional precept and the importance of environmental education is enforcing environmental protection programs. In consideration of the above, several State organizations and non-governmental organizations (NGO's) are reported to have carried out educational programs.

Given this stance, the Secretariat of Coordination and Planning (SCP) requested the implementation of environmental education programs in this Study. Consequently, the Team proposed to launch a series of environmental educational pilot projects that aim toward a better understanding and appreciation regarding the environmental issues by the community and school children through the introduction of educational workshops in two municipalities located in the hydrographic basin of Patos and Mirim lakes.

11.1.2 Organizations in Charge of Environmental Education

There are several organizations dedicated to carry out environmental education in Brazil. They can be mentioned among other the following organizations:

The environment Ministry (MMA), the Ministry of Education and Sport (MEC), the Brazilian Institute of Environment and the Renewable Natural Resources (IBAMA), Special Secretariat of Environment (SEMA), State Organizations of the Environment (OEMA), and several Non Government Organizations (NGO's).

OEMA introduces programs of environmental education in the State, at municipalities level through the "Municipal Secretariat of Environment" which develop non-formal

environmental education activities among other functions.

On the other hand, together with the Study is carrying an environmental education program called “Pró Mar de Dentro”. “Pró Mar de Dentro” is a program of the State of Rio Grande do Sul, which is being executed by SCP. The program aims at the ecologically sustainable development of the hydrographic basin of Patos and Mirim lakes through the reclamation of degraded natural resources and the creation of the required conditions for the environmental management of the covered area.

The main objectives of “Pró Mar de Dentro” are the followings:

- Environmental reclamation: regional micro-basins reclamation, protection of flora and fauna, as well as population distribution and economic activity survey.
- Environmental management: environmental parameters monitoring, basic sanitation, environmental education and environmental preservation.
- Economical development: infrastructure improvement, fishing activities re-structure, and paddy fields adaptation and eco-tourism development.

“Pró Mar de Dentro” will involve regional public administrations, non-governmental organizations (NGO’s), unions, resident associations, social movements, as well as scientific community working together for the construction of socio-environmental quality.

11.2 Environmental Education

11.2.1 Objectives

The ultimate goal of the Study is to formulate water quality and environmental management plan to strengthen water quality monitoring and wetland conservation targeting Patos and Mirim lakes.

Considering the above, the main objective of the environmental education is to raise consciousness of inhabitants on environmental concern through the knowledge of environmental issues transferred by workshops, lectures, visual information and observation in situ. In order to raise interest, knowledge and capabilities of the community and students an environmental problem approach and a common

responsibility for sustainable development and particularly for the protection and preservation of the lake environment will be promoted in cooperation with citizens.

The objective of the environmental education will be concentrated in developing an integrated understanding of the environment in its multiple and complex relationships, involving practical, physical, socio-economic, cultural and ethical aspects by means of the following aims:

- To aware the individuals and the peoples for the integral perception of the environment in their social, cultural, biological, physical and economic dimensions.
- To integrate the individuals and the peoples in processes for the construction of social values, knowledge, abilities and attitudes toward the environmental preservation and the ecologically sustainable development.
- To stimulate the individuals and the communities for the collective and solidary construction of a society to lives in harmony with the environment.

For the implementation of the environmental education programs the following shall be carried out:

- Production of environmental education materials (booklets, educational panels, video production, etc.).
- Practical activities involving community, schoolchildren and teachers
- A series of meetings and workshops.

11.2.2 Relevant Organizations

(1) Roles of Relevant Organizations

The environmental education program shall be planned and implemented by SCP with the cooperation of related institutions. The JICA Study Team will support SCP in the plan, as well as supervise and evaluate the project.

The main roles of the relevant organizations in the environmental education program are shown in **Table 11.2-1**:

Table 11.2-1 Roles of Relevant Organizations in the Environmental Education Program

Organizations	Roles
JICA	<ul style="list-style-type: none"> • Approval of the plan. • Allocation of budget for a part of the environmental education program.
SCP	<ul style="list-style-type: none"> • Planning and preparation of the environmental education program. • Implementation of workshops on environmental education and request cooperation from the state, local and NGO agencies and residents in the environmental activities. • Drafting public education programs and video production.
Other Related Organizations: CEA, CMP, CORSAN, EMATER, EMBRAPA, FEPAM, FURG, FZB, GEEPA, IBAMA, NEMA, PMPel, PMRG, SANEP, SPRG, UCPel, UFRGS, UNISINOS	<ul style="list-style-type: none"> • Support and cooperate in the activities to be conducted by the SCP.
JICA Study Team	<ul style="list-style-type: none"> • Preparation, supervision and evaluation of the project. • Support SCP in the conduct of environmental education program.
Citizens	<ul style="list-style-type: none"> • Cooperation in environmental activities.

(2) Responsibilities for the Environmental Education Pilot Project

Active participation/burden sharing and leadership by the Counterpart in the environmental education program are indispensable for the sustainable development on the environmental issues and to visualize the effect of the education programs in improving the environmental aspects of Pelotas and Rio Grande in the hydrographic basin of Patos and Mirim lakes.

In this context, the environmental education program shall be conducted with the role assignment of both sides, in which leading roles by SCP and supporting roles by the JICA Study Team are planned and summarized in **Table 11.2-2**:

Table 11.2-2 Responsibilities for the Environmental Education Program

Item	SCP (Pró-Mar de Dentro)	JICA Study Team
Environmental Education Program	<ol style="list-style-type: none"> 1. Planning and design of environmental education tools (educational booklets and panels, banner, video production). 2. To support the planning of the video to be produced by JST 3. To Implement workshops on environmental issues. 4. To request community cooperation for environmental education activities. 	<ol style="list-style-type: none"> 1. To support the planning and design to be prepared by SCP. 2. To provide environmental education tools (educational booklets and panels, banner). 3. To produce and provide an educational video. 4. To support the arrangement of workshops on environmental issues.

11.2.3 Environmental Education Methods

(1) Community Training

The environmental education pilot project to be developed it will be focused especially on the environmental management of the hydrographic basin of Patos and Mirim Lakes through work meetings and workshops in the community.

Environmental education is extremely important for adults as well as for children, and it is naturally regarded significant as one of the modern themes in lifelong learning. It is adults that have destroyed the environment, and solving environmental problems is a big challenge loaded on adults. However, the warning that should be directed to adults are often given to children. It is often pointed out that children today are not meeting with nature. This tends to be regarded as the children's problem. However, it is the society created by adults that has deprived children of the life and the playground, where they have direct contact with nature, and that has compelled them to adapt to the deformed modern society with technological development. First of all, it is necessary for adults to reflect on this fact and think about global, regional and community environment together with children. Therefore the education program proposed is focused on community residents and schoolchildren through of work meetings and workshops.

The objectives and scopes of environmental education program may be listed as the following points:

- **To change people's attitudes on environmental issues from indifferent to very concerned.** Environmental education should change the attitude on environmental issues from indifferent to very concerned.
- **To promote understanding of the function of the nature.** Awareness of the limitation of natural resources, realize the magnitude of the impacts of human activities on the environment, learning about origins of pollution, and the kinds and affects of diseases caused by pollution.
- **To increase knowledge of basic natural principles.** Environmental education should and could present the basic natural principles, which we must adapt, if we want a sustainable development.
- **To encourage problem oriented method of teaching and learning.** Environmental education should be problem oriented, as the practical application of the education would focus on problems. The problems should be well defined, quantified and the possible solutions to the problems discussed with viewpoints from several angles.
- **To reveal people's dependence on nature.** Environmental education should reveal the people complete dependence on nature and the vulnerability of the modern society to any changes in the basic properties of the environment.

(2) Environmental Education in Schools

As previously stated, the objectives and scopes of environmental education program are mostly the same points mentioned in community training.

The major target of environmental education should be a child because they are more receptive than the adults are.

Teaching materials for the environmental education programs are very important. Experiences gained from several campaign projects suggested a variety of promising methods and techniques to be used for schoolchildren training, as follows:

- Illustrative materials or audio-visual: pictures, videotape, slides, educational panels, real cases, constructed cases, booklets, etc.
- Equipment: OHP, TV, video, experiment measuring tools, etc.
- Places: parks, watershed, governmental offices, rural communities, urban communities, schools, dumpsites, lakes/rivers, etc.
- Promoting outdoor activities, site visits, ecological march, etc. (students could learn to observe, investigate, and appreciate important environmental concepts such as ecological systems, environmental deterioration and pollution sources, and conservation strategies through site visits).
- Planning for follow-up activities and close monitoring after implementation of pilot projects such as pro-environmental activities, training, and others.

These methods, techniques and other complementary tools should be planned, designed and implemented by the Counterpart as much as possible, with the support of the study team. Because, it is an absolute necessity that the counterpart side participate actively (and the community and schoolchildren involved), if the abatement of the environmental issues is going to be successful.

(3) Educational Workshops

In making the educational workshop for environmental education, it is necessary to select the more appropriate materials to get joint participation of the whole community population. In order to achieve the objectives of environmental education the following workshop materials are proposed:

- Environmental education materials: educational booklet, educational panels, banners and educational video.

The implementation of workshops in the whole hydrographic basin areas should be recommendable; however, because of time constraints this implementation may be done in areas favorable for the educational workshops and where experiment is practically and technically applicable.

11.3 Planning for the Environmental Education Workshops

11.3.1 Purposes of the Workshops

The workshops to be implemented in Pelotas and Rio Grande, consists of a group discussion devoted to environmental subjects where all the participants discuss and develop actions to reach such issues as: community awareness, sanitation, recycling, cleansing maintenance, protection and preservation of wetlands, preservation of the regional fishing potential, occupation and land use, among others. Essentially, the workshop consists on carrying out practical activities with the involved community (fishermen/schoolchildren). Therefore, all the participants including trainers, instructors and receivers must participate actively in the development of the workshop. It may be noted here that the visit by hierarchical persons and witness authorities to this workshop will be limited, since it would disturb the normal development with the student or fishing community. The visit of these personalities will be acceptable whenever the same ones participate and cooperate with the activities to be developed

The planning and the development of the workshops should be carried out keeping in mind the target groups: fishermen community and school children. Considering these groups the duration of each workshop should be limited to a reasonable time for the realization of workshops.

These workshops should be conducted within a month by the counterpart and the study team, and should be reinforced through education materials and additional publicity means.

11.3.2 Identification of Areas for the Environmental Education Pilot Project

To identify the pilot project areas for the educational workshops, a field survey was carried out in cities, “*bairros*” and “*colonias*” around the lakeshore of Patos Lake.

The cities of Tepes, Camaquã, São Lourenço do Sul, Pelotas, Rio Grande and Palmares do Sul were surveyed, intensifying the investigation in *bairros* or *colonias* and identifying favorable areas for the implementation of the educational workshops where the more environmental impact can be achieved through the environmental education pilot project.

The areas surveyed on July 26, 27 and 28, 1999, are shown in **Table 11.3-1**:

Table 11.3-1 Area Surveyed

Municipality	Area Surveyed
Tapes	General reconnaissance
Camaquã	General reconnaissance
São Lourenço do Sul	General reconnaissance
Pelotas	<ul style="list-style-type: none"> • Praia do Laranjal: Santo Antonio and Valverde spas, Pontal da Barra, Balneario dos Prazeres (Barro Duro) • Colonia Sao Pedro (Colonia Z-3) • Landfill controlled by SANEP • Sewage treatment plant and anaerobic reactor of fluidized bed (under construction)
Rio Grande	<ul style="list-style-type: none"> • Praia do Cassino • Vila São Miguel • Carreiros solid waste disposal site • Sewage treatment plant • Lakeshore of Saco da Mangueira
Palmares do Sul	City reconnaissance, Bairro Agreste

Among the municipalities surveyed, two sites were identified by the Counterpart as possible areas to implement the environmental education workshops and promote public awareness involving the community and relevant organizations. These areas are Colonia Z-3, located at the northeast of Pelotas City and Vila São Miguel located at the west of Rio Grande, and other sites such as illegal dumping areas in Barro Duro (Pelotas) and occupied settlement areas along the Saco da Mangueira (Rio Grande), where sanitary and environmental problems are found among the peripheral areas surrounding the Patos Lake.

The lake, wetlands and streams around the Patos Lake are fundamental importance for the preservation of local ecosystem as well as for the life quality improvement and fishing. Therefore, the above *colonia* and *bairro* as well as other settlement areas are towns of fishermen, which economically depend on fishing and a clean lake environment.

To secure the success of the experimental workshop, a detailed survey was carried out in September 1999 to verify problems related to environmental issues and the lifestyle of basin inhabitants (fishermen) and other related environmental issues. Also the people interest and willingness to cooperate in the environmental education issues and the

community wishes to participate actively in the workshops proposed by the Counterpart and JICA Study Team were surveyed.

11.3.3 Outline of the Environmental Education Pilot Project

Table 11.3-2 Outline of the Environmental Education Pilot Project

Programs in the Community		
1.	Implementation Period :	During the implementation of campaign project
2.	Targets :	Fishermen community and children
3.	Methods :	Work meetings, workshops, lectures, booklets, educational panels; banner s and clean-up operation.
4.	Sponsor :	SCP, regional and local governments, NGO, municipal governments, people's organizations

School Programs		
1.	Implementation Period :	During the implementation of campaign project. After the implementation of campaign project: every year
2.	Targets :	Teachers, students, parents.
3.	Methods :	Lectures, textbooks, pictures, video presentation, slides, educational panels, OHP, site visits ("ecological march").
4.	Sponsor :	SCP, Ministry of Education, school establishments

Pilot Project Promotional Campaign		
1.	Implementation Period :	October 1999. After the implementation of campaign project: any time in any other community
2.	Targets :	Every member of the society
3.	Methods :	Poster slogan contest, stickers, banners, leaflets, pamphlets, educational panels, broadcast canvassing, etc.
4.	Sponsor :	SCP and related organizations

11.3.4 Target Groups

To understand the background of active response of citizens, the Team surveyed several *bairros* and schools in Pelotas and Rio Grande.

In Pelotas and Rio Grande, the Counterpart and the Team visited a town and an elementary school, and observed the high interest and motivation of the involved community on the environmental issues. After the survey, the participants unanimously concluded that the major target of the environmental education should be the community residents and specially a child because they are more receptive than adults are.

Therefore, the target group shall be essentially a fishermen community and schoolchildren. However, the workshops will not restrictive only for that group but also focused in a general way for all the inhabitants of the hydrographic basin of Patos and Mirim lakes.

Meetings (Pelotas)

Several meetings were hold before the implementation of the workshops. These meetings were carried out in the fishermen community of the Colony Z-3 in Pelotas and Dr. Rui Poester Peixoto municipal school in Rio Grande.

The meeting in Alm. Raphael Brusque municipal school on October 7 in Colonia Z-3 was hold with the purpose of explaining the objectives of the workshops to the municipal authorities of Pelotas and particularly to the fishermen community, leaders and residents of Colonia Z-3. Later, a general meeting was hold with the participation of about 100 people among children and adults. The large concurrence of people that attended the meeting (in spite of the rain) demonstrates the high interest of the community toward the environmental problems.

11.4 Production of Environmental Education Materials

11.4.1 Design and Production of Education Materials

As previously mentioned, in making the educational workshop for environmental education, it is necessary to select the more appropriate materials to get joint participation of the whole community population. In order to achieve the objectives of environmental education the following workshop materials were proposed by the Counterpart: educational booklet, educational panels, banners and educational video as shown in **Table 11.4-1**:

Table 11.4-1 Environmental Education Materials

Education Material	Specification	Quantity	Remarks
Educational Booklet	B5 size, “Ecograph” paper, approx. 20 pages (printed on environment-friendly material)	6,000	Complementary tool for use in education programs for schoolchildren and in community lectures.
Educational Panel	1.50 x 0.90, expanded PVC panel, aluminum frame	10	Educational panels on environmental issues for use in workshops, seminars and other environmental or cultural events to enhance public awareness through knowledge on environmental issues.
Banner	3.50 x 0.90, vinyl sheet	4	To be used in outdoor activities to promote the environmental education pilot project
Video Production	Video tape (10) Production, edition (1set) Duration (20 min)	1 set	Production of a video on the region environmental issues for use in workshops, seminars, conferences and environmental education programs targeting a general audience.

11.4.2 Educational Booklet

As part of the environmental education program, an education booklet was planned by the Counterpart and supported by the Team targeting community residents, and especially schoolchildren of the hydrographic basin of Patos and Mirim lakes.

This booklet intends to motivate residents and children interests and concerns with the

socio-environmental problems and their active participation's in local and regional collective projects for the protection and preservation of the natural resources and improvement of the life quality of the population. The booklet was designed considering the following aims:

- To raise consciousness of inhabitants on environmental concern through knowledge's on environmental management issues.
- To change people's attitudes towards the environment and nature from indifferent to very concerned.
- To improve the people's life quality.

In this booklet illustrated and explanatory messages are presented to the basin residents and especially to children, who will surely promote toward the roads for a better environment.

The design of the booklet was taking the following factors into consideration:

- Simple, brief, colorful, and made of environment-friendly paper.
- To encourage people's for reading and keeping.
- Format with little text and many illustrations to attract the attention of the residents and children.
- Text with general vocabulary not limited to defined group: age, gender, social status, etc.

It is expected that the presented messages will direct important steps and develops attitudes, and practices for the contribution of an appropriate and better environment in the near future and will contribute to create a closed loop society.

Details of the content of the booklet are described in **Annex ENV-T-1**.

11.4.3 Educational Panel

Together with the booklet, ten educational panels on environmental issues have been planned and designed by the Counterpart with the support of the Team targeting the

general audience.

These panels were not only prepared for use in the workshops carried out in Pelotas and Rio Grande, but also for use in future environmental activities such as seminars, conferences and environmental or cultural fairs in the whole hydrographic basin of Patos and Mirim lakes.

General environmental aspects are described and illustrated in the panels considering the following items:

- (1) Introduction of the Program of Pró-Mar de Dentro and their objectives
- (2) Environmental education definitions and objectives
- (3) Experiences of environmental education in Pelotas and Rio Grande
- (4) Water
- (5) Solid waste
- (6) Drainage, basic sanitation, vectors and zoonosis
- (7) Ecological management of basins, sub-basins and micro-basins
- (8) Ecologically sustainable development
- (9) Cultural and environmental patrimonies
- (10) Heading for a healthy and socially fair environment

Details of the content of the educational panels are described in **Annex ENV-T-2**.

11.4.4 Educational Video

(1) Objectives of the Educational Video

The aim of the educational video consists of the production of one video of approximately 20 minutes. The content and message should have the capability to raise awareness on the inhabitants of the hydrographic basin of Patos and Mirim lakes on environmental issues, as well as all the local and regional authorities and organizations

surrounding the lakes.

The content and messages of the video will be focused on the importance of the waters and the preservation of the environment. The video considers a series of factors of environmental degradation such as the inadequate management of solid waste and wastewater, unplanned urbanization, pollution by industries, use of agricultural chemicals, deforestation, erosion, drainage of wetlands, etc. and its impacts on the quality of the waters and the life in general.

The visual input must incite self-motivation in the inhabitants regarding the appropriate environmental management of the hydrographic basin.

The housewife, the businessman, the fisherman, the farmer and the children, that is to say all the inhabitants of the basin are the main actors of the video, emphasizing the relation between the basin environment, the lake and the people.

Together with the educational booklet and panels, the video will reinforce the transfer of messages in the workshops to be implemented in Pelotas and Rio Grande.

This educational video intends to begin an innovative process of community education, encouraging the residents to adopt better habits and to be respectful of the living environment. This process includes two main stages:

1. Mass dissemination information by the documentary
2. Use of information and educational materials previously prepared for the Counterpart and the Team, which support and secure the knowledge learned from the documentary

(2) Target Group

The target group shall be essentially the community residents. However, the video will not be restrictive only for that group but also focused in a general way for all the inhabitants of the hydrographic basin of Patos and Mirim lakes.

(3) Video Script

As mentioned in the objectives of this report, the ultimate goal of the Study is to

formulate water quality and environmental management plan to strengthen water quality monitoring and wetland conservation targeting Patos and Mirim lakes. And, the video production is to provide visual documentation of the environmental issues and raise consciousness of inhabitants (participation, cooperation, action, etc.) in the hydrographic basin of Patos and Mirim lakes, and to recognize the importance of aquatic environment preservation.

Therefore, the idea of the educational video is to summarize into the video the environmental problems caused by people, how to preserve the aquatic environment, and current measures undertaken by people and its organizations and introduce additional countermeasures to be undertaken for the wetland and lake water quality conservation.

Some main scenes of the script considered in the video are the followings:

1. Scene of a housewife throwing daily kitchen waste, how people is generating and discharging the waste/wastewater.
2. Involvement of businesses (businessmen, farmers and fishermen, etc.) in the environmental issues.
3. How the waste is collected and where is destined (dumpsite), and how the wastewater is discharged (sewage treatment plant or directly into canals)?
4. How the waste is treated or not in the dumpsite, unaesthetic view, existence of rodents (rats) and infectious vectors (fly, mosquitoes), and especially the incidence of leachate in the groundwater, wetland and the lake?
5. How wastewater is treated, and how a large amount of wastewater is discharged in canal and rivers?
6. General view of problematic areas caused by waste/wastewater, illegal dumpsites, polluted canals, rivers and the lake.
7. Lack of fauna and flora in the surroundings of wetlands, rivers and lake.
8. What people can do to solve the inadequate management of solid waste and wastewater, unplanned urbanization, pollution by industries, use of agricultural chemicals, deforestation, erosion, drainage of wetlands. What people can do to improve the present conditions?

9. What the organizations can do to improve the present conditions?

Details of the video script are described in **Annex ENV-T-3**.

11.5 Implementation of Environmental Education Workshops

The workshops carried out in Pelotas and Rio Grande consisted of group discussion on environmental issues where all the participants discussed and developed actions to reach such issues as: community awareness, basic sanitation, recycling, cleansing maintenance, preservation of the regional fishing potential, occupation and land use, among others. Essentially, the workshop consisted on carrying out practical activities with the involved community (fishermen/schoolchildren). Therefore, all the participants including trainers, instructors, receivers participated actively in the development of the workshop. It was suggested that the visit of hierarchical persons or authorities was limited as much as possible since, since it would disturb the normal development with the student or fishing community. The visit of these personalities was acceptable whenever the same ones participate and cooperate with the activities to be developed.

These workshops were carried out using booklets, educational panels and educational video mentioned previously. Also, outdoor activities such as clean-up of the neighborhood and beaches and ecological march they were carried out using complementary tools as banners to promote the education environmental pilot project campaign (See **Annex ENV-T-4**). Images of the workshops, clean-up activities and the ecological march carried out respectively in Pelotas and Rio Grande are shown in **Annex ENV-T-5**.

11.6 Evaluation of Environmental Education

The goal of the environmental education is to develop a society that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skill, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.

Similar to all other programs, environmental education programs need to be evaluated so that their successful aspects can be reused or reproduced and some can be refined, modified, improved, revised or eliminated before the next attempts.

Due to the time limitation, the evaluation of the environmental education project's achievement was made, by means of the results of workshops, observation in situ and questionnaire.

11.6.1 Results of the Workshops

The problem-solving approach is a distinguishing feature of environmental education. To solve the problems, it is necessary first to know and understand the environment and associated problems and then to apply necessary thinking skills in application, analysis and evaluation in order to take required actions.

An element of the objectives for environmental pilot project is the involvement of the local residents in the identification of solutions to the environmental problems. During the period of the pilot project, the meetings and workshops were encouraged to promote local resident's participation in the environmental educational activities. As a result, this gave the residents a favorable influence in terms of realizing the local environmental problems. The pilot project involved institutions, community leaders, teachers and school children on environmental education activities towards the maintenance of healthy environment. This motivated many residents to join the activities, such as ecological march and cleaning activities organized by the SCP and other relevant organizations.

Using the local language, focused group discussion was conducted in each of the pilot project sites (Colonia Z-3/Pelotas with fishermen community and Vila Sao Miguel/Rio Grande with students).

(1) Workshop in Pelotas (Colonia Z-3)

Discussion with selected community members and school teachers revealed that residents were aware of environmental problems in their community, but that the majority of them were yet to show willingness and commitment to initiate actions against those problems.

The workshop in Colonia Z-3 was carried out according the following program:

Table 11.6-1 Environmental Education Workshop in Pelotas

Topic: Community Involvement on Environmental Issues

October 16, 1999, Colonia Z-3, Pelotas

Participants: Fishermen community and children of Colonia Z-3

Place: “Cooperativa Maritima”, Colonia Z-3

Organizers: SCP (Programa Pro-Mar de Dentro) / JICA

Moderator: Elisabete Ferreira

Time	Program	Person / Speaker
9.00 – 9.20	Welcome remarks Introduction for the Pilot Project	SCP
9.20 – 9.40	Presentation and discussion of the educational booklet “Changing for a Better Environment”	Elisabete Ferreira - SCP Masaharu Kina - JST
9.40 – 10.20	Presentation of educational panels	Elisabete Ferreira - SCP Masaharu Kina, JST
10.20 – 10.40	Presentation of the video (“Life from Water”)	JST
10.40 – 12.00	Discussion on environmental issues, Question & Answer	Community, cooperating institutions, Pro-Mar de Dentro and JST
12.00	Lunch	
14.00 – 16.00	Clean-up operation	The community, institutions, schools, etc.
16.00 – 16.10	Closing remarks	Community members, SCP, JST

As a perspective for future extension of the study and Pro-Mar de Dentro Program, it was prepared an educational booklet (“Changing for a Better Environment”) and distributed to the community and schools in Pelotas. The booklet introduced environmental problems in easy language and calling the attention of the importance of the water bodies preservation as a source of revenue to the majority of residents. Therefore, encouraging the citizens to know their environment and implement environmental policies and actions, which take into consideration public participation in environmental preservation through civic education programs. It will be used widely in schools, but may also be used for the general public.

Also, several panels were prepared to support the environmental education. They are generally used as additional activities to the more general audience, school agenda and curriculum.

The workshop executed in Colonia Z-3 involved also, clean-up activities towards the maintenance of a sound environment. The clean-up project organized by SCP was attended at the beginning for only a few numbers of residents (approximately 20 people). However, in the course of the activity, a large number of residents were joined to the activity, including community leaders and school children, totaling more than 120 persons. The clean-up activity causes positive impacts in the residents of the community, increasing their awareness of environmental problems. The residents understood the causes of those problems to a considerable extent through the project activities. However, there is yet a great deal of work to be done to bring about attitudinal changes of the residents so as to minimize problems of the environment.

(2) Workshop in Rio Grande (Barrio Sao Miguel)

The workshop in Rio Grande was carried out according the following program:

Table 11.6-2 Environmental Education Workshop in Rio Grande

Topic: Children Involvement on Environmental Issues

October 19, 1999, Vila Sao Miguel, Rio Grande

Participants: Pupils, parents, and teachers

Place: EM Dr. Rui P. Peixoto, Rio Grande

Organizers: SCP (Pró-Mar de Dentro)/Dr. Rui Poister Peixoto School/JICA

Moderator: Marilane Machado de Almeida, Director of Dr. Rui Poester Peixoto School

Time	Program	Person / Speaker
13.30 – 13.50	Welcome remarks Introduction for the Pilot Project	SCP
13.50 – 14.10	Presentation and discussion of the educational booklet “Changing for a Better Environment”	Elisabete Ferreira - SCP Masaharu Kina - JST
14.10 – 14.30	Presentation of educational panels	Elisabete Ferreira - SCP Masaharu Kina - JST
14.30 – 14.50	Presentation of the video (“Life from Water”)	SCP, JICA
14.50 – 16.00	Experiences on Environmental Education by cooperating organizations	NEMA CEA Pastoral dos Pescadores ASCALIXO EMATER SANEP
16.00 – 17.00	Eco-march: “For a Better Quality of Life”	All participants
17.00 – 18.00	Musical event by students	Students
18.00 – 18.10	Closing remarks near the lakeshore (water analysis)	FURG, SCP

In spite of the limitations of time and in the application of teaching methods, the counterpart and teachers agreed that the students who participated in the workshops achieved:

- Motivation and consciousness about environmental problems.
- Knowledge on the lake ecosystems, surrounding ecosystems and their interactions.

All these achievements generated attitudinal changes of the students, who showed more interest and respect to natural and social environments.

1. Continuous activities for the upgrading of schoolchildren may cause a considerable change in the several view of environmental problems on a regional basis in the Patos and Mirim Lake basins, with important effects in other municipalities of Rio Grande do Sul State.

2. Same as in Pelotas, an educational booklet (“Changing for a Better Environment”) was distributed to schools in Rio Grande. The booklet introduced environmental problems in easy language and calling the attention of the importance of the water bodies preservation as a source of revenue to the majority of residents. And encouraging the children to know their environment and implement actions for the environmental preservation. The booklet can be used widely in schools, but may also be used for the general public.
3. Use of pictures and writings (“Social Environmental Vision of Mar de Dentro by the Pupils of Rio Grande and Pelotas”) and other means to activate the creativity of children seems to give an incredible interest particularly by small children for the environment.
4. Several panels were prepared to support the environmental education. They are generally used as additional activities to the more general audience, school agenda and curriculum.
5. The workshop executed in Rio Grande included an ecological march ("For a Better Life Quality") consisted of a recognizance of the environment, natural and cultural aspects and environmental situation around the Patos Lake.
About 200 to 300 people, including students, parents, the community of fishermen and non-governmental organizations were participated in the ecological march. All the participants were very cheerily, being the children the most enthusiasts. The result of this activity was very positive, being achieved one of the main objectives of the environmental education: to raise consciousness of inhabitants on environmental concern and change people's attitudes towards the environment and nature from indifferent to very concerned.

11.6.2 Evaluation

The activities in the environmental education in Pelotas and Rio Grande were mostly concerned with the environmental conservation of the Patos Lagoon and Mirim Lake, and its basin, and successfully enhanced understanding of the environment and developed good attitudes toward environmental issues in students, teachers and related community people.

In spite of the limitation of the time, the objectives of the environmental education were

successfully attained.

It can be concluded that the environmental education pilot projects in Pelotas and Rio Grande achieved its objectives, which included:

- Making the youth more concerned with environmental problems.
- The schools involved in the environmental education pilot projects were more aware to see environmental problems in their communities with a sense of concern and become more ready to assist in solving the problems.
- Community members around the pilot project areas become more aware of the environmental education activities. This resulted in serious concern about environmental problems such as water pollution caused by the disposal of household wastes into streams in the communities.

11.6.3 Findings

The students were very enthusiastic during the workshops, and participated actively in the classroom and field sessions. They confirmed that they found most of their lesson real and stimulating.

Assessment of artistic expressions on social environmental issues indicated that the students had acquired expected knowledge base.

Furthermore, observation of school children through their participation in outdoor activities showed that they had the attitude to share their knowledge with community members. The involvement of communities in outdoor activities, e.g. clean-up exercises to keep the community environment free of wastes, demonstrated their attitudes to work together with adults to cope with environmental problems.

11.6.4 Constraints

Even if every possible measure is taken in the fields of technology, law, politics and economy, regional environmental problems cannot be solved, nor can the sustainable society be established, unless the life style of the people undergoes significant changes. Thus, the importance of environmental education has increased, and the progress of

environmental education will play a significant role in human efforts to prevent environmental disruption.

(1) Social Considerations

To achieve a proper environmental management system, cooperation from the communities and private/public sectors is required. It depends to a large degree on the cooperation of the people, whether or not plan will succeed or not. The targets of social participation are:

- Public awareness
- Redress of social inequities

1) Public Awareness

An important aspect in promoting public participation on environmental management issues, is to increase the citizen understanding and awareness regarding matters related to water, domestic wastewater, solid waste (clandestine disposal areas), irregular occupations (illegal settlements) and its relation to public health and preservation of the environment.

2) Redress of Social Inequities

It is required that the sanitation and the environment around irregular occupations is improved. In this kind of areas, cooperation with community is needed for water supply, wastewater and solid waste collection, at the same time the public sector need to pay more enhanced attention to take proper measures and/or extend services in the area.

(2) Other Identified Major Constraints

Identified major constraints to the development of environmental education and the recommended remedies are as follows:

1. At the basic education level, educational materials are currently organized around disciplines and not much emphasis is laid on problem-solving approach. There is a need for the educational sector to adopt this non-traditional approach in the environmental education in schools and out-of-school situations.
2. Another constraint is the shortage of classroom teachers who are prepared to effectively integrate environmental education into the school education system. It is needed for the State to embark on training a staff of teachers, whose role is not to lecture about the environment but to guide students to the development of an environmentally literate citizenry.
3. Teachers are loaded with crowded school curricula and have difficulty in dealing with extra work. Efforts should be made to integrate environmental matters with other subjects so that the existing curricula are enriched without creating additional teachers work.
4. There is a lack of appropriate teaching/learning materials. Materials to be developed should include environmental education textbooks, visual aids and basic equipment and tools.

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Chapter 11

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Chapter 12

*Financial Conditions in the State of
Rio Grande Do Sul*

CHAPTER 12. FINANCIAL CONDITIONS IN THE STATE OF RIO GRANDE DO SUL

12.1 Introduction

12.1.1 Generalities

In the same situation of other Latin American countries, the financial issue in Brazil is chronically exposed to the public as a controversial matter, inquiring proper measures to solve the problem at its basis. In the past, Brazil had experienced many times of financial crisis, particularly in the 1970's and 1980's where the annual inflation rate was at about 200 percent. And recently this matter is still making hard negotiations between Brazil and IMF for appropriate relief measures to the federal financial deficit, on one hand, and between the federal government and local governments for the application of an appropriate system of subsidies to local governments, on another hand.

Based on its administrative system, the public budget in Brazil is made also by a 3-layer system: Federal Budget, State Budgets and Municipality Budgets. A healthy situation in public finance, therefore, is a simultaneously satisfactory condition for all these 3 budgetary systems. In fact, there is always an unsatisfactory condition in these 3 budgetary systems up to now.

In principle, the federal annual budget is mainly made by the federal taxes. After the deduction of the portion for public debts, this collected amount will be used for 3 aspects: 1. Expenses for the Federal Government (about 45 %), 2. Financial assistances to all 26 States and 3. Financial assistances to all Municipalities in the whole country. About 55 % of the collected amount, therefore, are used for the last two items. For the part of Federal Government, it will be used for paying personnel fees and funding operations of all Ministries and related agencies of the Federal Government.

In terms of utilization purposes, the portion of after-debts-payment (presently about one half of the total federal budget amount), in principle, is used for two (2) purposes: 1. For Routine Public Costs (40 %) and For Development Investments (60 %) in all sectors including works for environmental management in the whole country

However, in the recent situation of revenues, the federal annual budget is made by two main resources: 1). The federal taxes as up to now and, 2). The financial assistances

including loans from other countries. The ratio of these two parts has been recently turned around 50:50. The requirement of a high part of foreign assistances including loans from other foreign countries is due to the large portion of payment for previous foreign debts, on one part, and the slow recovery of the national economy in the present world economic situation, on another hand.

According to IBGE (Brazil in Figures), of the total annual expenditure from the present federal annual budget (about R\$ 300 billion), the main items are listed as the repayment of public debts accounting for its 45 %, the direct transfers to individuals (retirement benefits, pensions, insurances etc.) for its 24%, and the remaining 30 % is shared by the health, education, science and technology sectors including environment, the Army, the Legislative, the Judicial Power and the administration itself.

Also according to IBGE, the number of civil servants in Brazil is not large. The total number of civil servants, Federal, States and Municipalities, represent only 11% (or a total of about 6.6 million persons) of the total employed population (about 60 million persons). This number is distributed as 2% for Federal Public Sector (about 1.2 million), 5 % for 26 States (about 3 million) and 4% for Municipalities (about 2.4 million).

Despite the number of federal servants is not so high, but apart from salaries for active servants, a large amount for paying retirees and pensioners is needed. The annual amount for direct transfers to individuals, therefore, is observed very high (about R\$ 60 billion or 1/5 of the federal annual budget), causing a great burden in the present federal budgetary system and an obstacle to the socio-economic development for the whole country.

12.1.2 Financial System from Federal to Local Governments

Basically, Brazil, in administration as well as in national economy, is made of a two-tiers structure based on the Federal Government and its 26 States. However, due to the socio-economic disparities among the States in Brazil are so enormous that a constant financial assistance from the Federal Government to marginal States and Municípios, particularly for the underdeveloped States and Municípios in the North and Northwest, has been occurred up to now. This has caused an incremental financial deficit in the federal budget and, therefore, frequently causing a destabilization in the public finance and, as per consequence, a chronic obstacle to the total development of

national economy.

Concerning this matter, most states and municipalities have been reportedly receiving a financial assistance from the federal budget. This insists that the fiscal revenues of many states and municipalities are still depending on the transfer of funds from the National Treasury, where some states and municipalities have this revenue up to 60-70% of its annual budget. Despite the transfer of National Treasury fund to the State of Rio Grande do Sul is presently observed very low, the federal fund transfer to the Municipalities in this State is found still high, ranging from 13 % to 100 %.

12.1.3 Basic Problems in Federal Budget

Due to the lack of effectiveness in financial stabilization program in long term, a remarkable fluctuation has been found in the performance of the federal budget since 1994. It was started by a fiscal budget in black, with revenues exceeding total expenditures in 1994. But the situation was found on the adverse effect in 1995 and further deteriorated in 1996, where the cash deficit was almost tripled to the figure of previous year. This exposed a situation of out-of-control in financial adjustment for balancing revenues and expenditures, particularly for the portion of previous debts repayments etc. This has been finally resulted in the relief measures such as emergency taxes, public-spending squeeze, selling federal securities in large scale etc. to avoid the large deficits in federal annual budgets.

Therefore, except for relief purpose in public finance and sound development projects, the Federal Government has recently placed tight limits on borrowing by states and municipalities (as well as the federal government). The Fiscal Responsibility Law, on another hand, forbids the federal Government from bailing out states and municipalities in financial trouble. It forbids also the local governments to spend more than 60% of their revenues on wages; if not, to risk losing federal financial assistances.

However, along with the present regulations for large individual transfers, particularly for retirees and pensioners, and the financial assistances as subsidies to marginal States and Municipalities, the trend of national financial deficit as being observed in the present days, will be continued. This situation, therefore, has caused a consistent public-sector borrowing requirement, inquiring further negotiations for public borrowings as essential relief finances, expecting in the range of 2 - 5 % of its GDP.

In this framework, further basic reforms on the aspect of public finance such as cutting high salaries of public servants, cutting their generous pensions, checking revenues-taxes of all subjected citizens, checking public financial books on revenues and expenses at all levels etc. are considered very necessary to be carried out systematically

12.2 Financial Conditions of the State of Rio Grande do Sul and Municipalities

12.2.1 Generalities

As other states in Brazil, the State budget of Rio Grande do Sul is basically composed of 2 parts, the state tax collection and other supporting financial sources. The state tax collection consisting of both direct taxes and indirect taxes, where the indirect tax collection makes the major part with ICMS (Merchandise and Service Circulation Tax) playing the most important role.

In Brazil, the total amount of collected ICMS generally accounts for 60% of total national revenues, far higher than the federal income taxes. The ICMS system has been enacted since 1988 by the Constitution for all states in the whole country to help them facilitating their budgetary arrangements. Since the ICMS system offers a flexible tax rate for a subjected item to be decided by each local government, the amounts collected by this tax system have been resulted in large differences among the local governments.

Even with the implementation of this tax system, due to the disparity in economic development among the states, the fiscal capacity has been found in a different gap between states of good financial performance and bad financial performance. The federal government, therefore, has had to allocate subsidies to states of bad financial performance through the constitutional provision. This has become the main source in the supporting financial part for state budget which some states have this federal fund transfer up to 60 - 70% of the state budget such as Tocantins, Para, Amazonas etc..

Concerning the subsidies from the federal government to the state government, there are 2 kinds: 1). the transfer of funds from the National Treasury to the subjected states and, 2). the federal funding for specific projects/programs including those belonged to the scope of environmental management of the local government based on negotiations

between the local government and the federal government. In principle, the latter is distributed according to the needs and maturity of the subjected projects, but in case of different political parties between both sides, these negotiations would be found in some difficulties.

For the transfer of substantial subsidy (based on ICMS index) from the federal government to local governments, this has been carried out on the basis of a calculation formula of population and average income per capita (**FIN-T-1** and **FIN-T-2**).

12.2.2 Financial Conditions in Rio Grande do Sul

The present situation of public finance in Rio Grande do Sul as notified in the State Annual Budget envisaged for 2000 is showed in the following table:

Item	Amount (R\$ million)	Percent
Total Budget	8,800	100 %
1. Transfer to Municip.	1,700	20 %
2. Transfer to Other Agencies	935.4	12 %
Legilation	257.8	
Judicary	532	
Public Min.	146.6	
3. Public Debts	400	4.5%
4. Personnel Fees	4,600	52 %
5. Investments	750	8.5%

Source: Prestacao de Contas do Governo do RS/1999

In general, of the annual state budget of Rio Grande do Sul (about R\$ 9 billion), about 75 % are used for paying routine direct costs (personnel salaries and O.M. costs). Only its 25 % (about R\$ 2.25 billion) are used for annual development investments of the whole State, mainly through 12 Secretariat Offices (**FIN-F-1**). Therefore, each Secretariat, in principle, has an annual budget of more or less 2 % (about R\$ 200 million), depending on its scale of activities. At present, in comparison to the newly established SEMA, the Secretariats for large public services such as Health, Education etc. have a larger annual budget.

Through the hearings of local voices in Participatory Budget Program, (Municipality Assemblies), the development investments are made in the following priority: 1). Agriculture, 2). Education and 3). Public Health. The budget allocations in 2000 for

these 3 sectors are envisaged as follows:

- * Agriculture: R\$ 222.6 million (This showed a 50 % up from the figure of last year)
- * Education: R\$ 1,913 million (This is calculated as 35 % of the amount of collected taxex as defined by the Constitution)
- * Public health: R\$ 416 million (This showed a 50 % up from the last year, calculated as 10 % of the collected taxes as defined by the Constitution)

In fact, as being made up to now, a large portion from these allocated amounts will be used for the payment of personnel costs. The portions for investments in corresponding development of projects/ programs, therefore, will be very limited. This is the same situation for implementing the projects/programs of environmental management.

Concerning the aspect of environmental management, from this year of 2000, the Secretariat of Environment (SEMA) was established to cover its affiliated organization FEPAM for controlling the public environmental aspects (**FIN-F-2**) . Its present budget allocation is reportedly about 1.3 % (about R\$ 130 million) for implementing the environmental management related programs/projects in Rio Grande do Sul. Assuming 60% of this allocated budget (or about R\$ 80 million) to be used for the payment of personnel costs, only R\$ 50 million would be remained for the investment in development of programs/projects related to the environmental management etc.

From the present financial conditions, the State is found in basic difficulties for implementing an environmental management project of large scale without the financial assistance from some other financial source(s).

In the administrative procedure of the State, the proceedings for financial allocation of a new project/program is proceeded as follows:

**FINANCIAL PROCEEDING PROCEDURE
FOR A NEW PROJECT/PROGRAM
(Principles for Project-Budget Allocation)**

**Planned and requested
Project Budget
From each Project-Unit**

**Department / Division
Elaborates the whole Dept./Division Budget and requests to the Corresponding Secretariat**

**Each Secretariat
Elaborates its Secretariat Annual Operation Budget
And requests to the State for Budget Allocation**

**With the verification from Finance Secretariat
The State readjusts the whole Budget and sends to
The State General Assembly for Approval**

**With approved Budget Allocation , each Secretariat contacts the Finance Secretariat Office
For Payment Disbursement upon Utilization/State Financial Situation**

(Source: Office of Programa Mar de Dentro)

In case of an approved project/program of large scale needing the financial assistance from other sources i.e. Federal transfer budget etc., it will be basically subjected to negotiations between the state and the Federal Government for transferring a subsidy from the federal budget or, in case of available facilities, requesting to an ODA financial source for implementing the subjected project. This framework, however, is definitely depended on the capacity of federal budget and the priority of urgency of the project/program. This factor, therefore, inquires the prior elaboration on the scale of financial assistance formulated in the project/program plan.

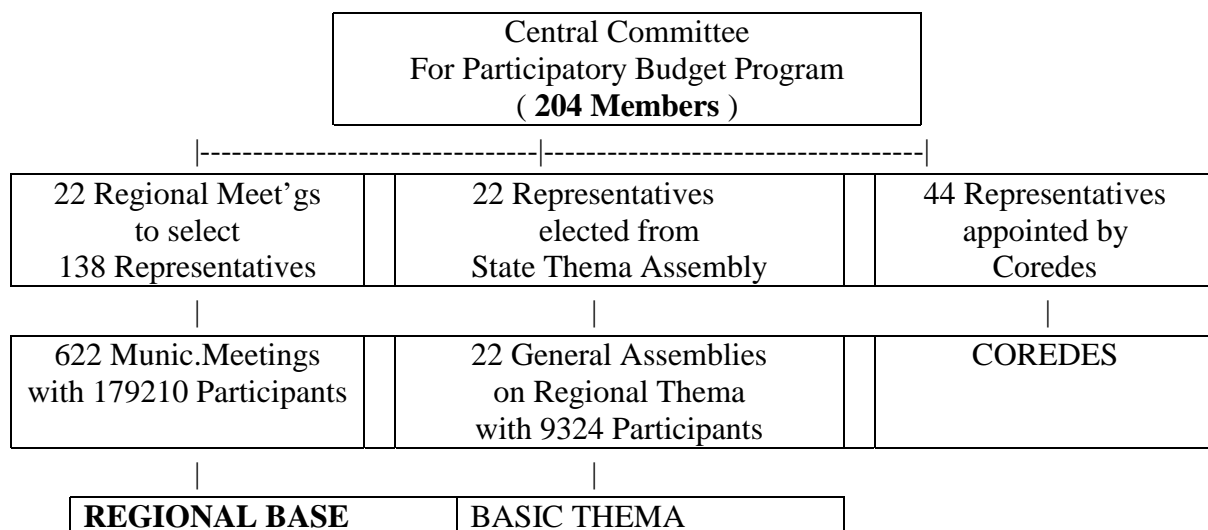
12.2.3 Participatory Budget in Rio Grande do Sul

With the present State Government, a new system, called the Participatory Budget, has been applied in the State of Rio Grande do Sul and some Municipalities related (about 10 % of all Municipalities) to make the local population have a voice in local development projects. This is a new approach for local participation in the implementation of local projects/programs.

The basic principle for this budgetary system is, apart from essential projects/ programs of Secretariats etc., an amount (10 %) of the State/Municipality budget will be used for local development projects via this system.

Through the concerned meetings, the local people will give their opinions for priority projects and select their representatives for central meetings. With this procedure, the proposed projects will be arranged for implementation.

In Rio Grande do Sul, the meetings are carried out through the 22 Micro-regions (**FIN-F-3**) as per the following procedure for selecting the central committee members (204 persons) for the Participatory Budget Program:



(Source: Orcamento Participativo RS)

From this selection procedure, the results obtained in Rio Grande do Sul for 1999 are as follows:

Collective Results based on Regional Selection	
1. Agriculture	29.65 %
2. Education	23.10 %
3. Health	19.97 %
4. Transport	12.73 %
5. Job Generation	7.69 %
6. Sanitation	2.68 %
7. Security	2.64 %
8. Habitation	0.84 %
9. Social Assistance	0.38 %
10. Energy	0.28 %
11. Culture	0.03 %

Collective Results based on Thema Selection	
1. Agriculture	41 %
2. Job and Income	36 %
3. Transport	8 %
4. Environment	5 %
5. Communications & Transport	3 %
6. Tourism	3 %
7. Soil Occupation	2 %
8. Solid Residues	1 %
9. Energy	0 %

(Source: Orcamento Participavito RS)

Through this procedure, the sector of agriculture has been selected and endorsed by local inhabitants as the most important aspect to be developed for improving their living conditions. The obtained result insists the needs for establishing the proper methodology for small farm techniques and management along with related administrative proceedings to be carried out parallelly at all stages throughout the procedure from farmland preparation, distribution until supplies of techniques, inputs, marketing facilities etc..

12.3 Framework of Mar de Dentro Program in Participatory Budget

In the framework of participatory budget, the following priority programs and selected thema from the micro-regions of **Programa Mar de Dentro** are obtained throughout the local meetings :

RESULTS OF PRIORITY THEMA	
Region	Priority
CAMPANHA	Supports to Coops and Professional Associations
	Agrarian Reform
	Integration of small properties for economic development
DELTA	Strengthening of micro, small, medium firms
	Continuat'n of Pro-Guaiba & Mar Dentro
	Program for habitation of social interests
CENTRAL SUL	Agrarian Reform
	Infrastr. Programs for regional impacts
	Supports to micro, small, medium firms
R.PARDO	Agricultural credit
	Supports to Coops & Professional Associat'n
	Technical supports to Municipios. Roads
SUL	Supports to production network
	Supports to Coops & Professional Associat'n
	Actions for Constr. & Mainten. Of Ports
LITORAL	Supports to Coops & Professional Associat'n
	Actions for agro-ecology
	Actions for Sanitation & Sewage Treatment

(Source: Orcamento Participavito RS)

Through the obtained results as mentioned in the above, despite of their diversified priority aspects, the aspect of supporting professional groups i.e. small farms, fishermen, business/firms etc. is basically considered. Through the implementation procedure, the

supports on agrarian reforms, finance, techniques etc., if so required, should be orderly prepared to carry out accordingly. This would induce these works under the control and management of Programa Mar de Dentro acting as a media on needs and responses between the local people and the State Government.

In order to realize this concept, Programa Mar de Dentro should establish clearly this facility in its annual action plan with an effective scope of works to be orderly implemented by a specific working group.

On another hand, the Master Plan is formulated with the 8 following diversified components as priority projects/programs corresponding to the framework of environmental management in the Study area:

No	Priority Project/Program	ForPurpose/Objective	Coverage
1.	Water Monitoring Program	To Check Water Quality etc.	For 6 monitoring items
2.	Basin Erosion Management	To Prevent Erosion & Sediment	For severe erosion parts
3.	Sewerage Treatment Sys.	To Treat Domestic Sewerage	For 5 main cities
4.	Solid Waste Treatment Sys.	To Treat Domestic Solid waste	For mainly Pelotas etc.
5.	Pollutants Load Control Sys	To Control Aquatic Environm.	For the whole Study area
6.	Wetland Management	To Maintain Eco-resources	For 4 conservation areas
7.	Environmental Education	For Environmental Management	For the wwhole Study area
8.	Information Management	For Information Management .	For the whole Project.

From the 8 priority projects mentioned in the above, the proposed priority project of Information Management System is very important. It should be formulated for the purpose of integrating the control of information of all other related projects . Therefore, this project will be placed in a core position to function its management duties. This project, despite of its very low initial investment amount (with an estimate of US\$ 35,000 for establishing the working station and information network), inquires routine technical works in information management from a professional staff. Therefore, an annual O.M. cost of US\$ 150,000 is estimated for the payment of personnel costs (4 persons) and operation costs.

This priority project is considered very necessary for the management of information on environmental management in the Study area. As a matter of fact, Programa Mar de Dentro, as per its present status and capacity, is considered suitable for taking in charge of this priority project for a proper implementation, along with its other assigned tasks and facilities.