CHAPTER 6 SEWAGE TREATMENT PLAN COMPONENT(2)

6.1 Basic Policy

The breakdown of the ratio of domestic wastewater load in the generation load in the Mar de Dentro area is estimated as follows: 20% for BOD, 13% for COD (Cr), 16% for TN, and 12% for TP. Although sewage treatment will not significantly contribute to the improvement of the water quality of Patos Lake, it is important to prioritize the treatment of domestic wastewater from urban areas located near the lake coast based on the reasons aforementioned in Chapter 5.

The basic policies for the treatment of urban domestic wastewater are formulated as shown below based on the treatment conditions and the existing treatment plan for the domestic wastewater from 5 of the municipalities stated in Chapter 2, and the results of the assessment of the sewage treatment methods detailed in **Table 5-2.**

(1) Service Population

The domestic wastewater from the 5 municipalities in the lake coast will be fully (100%) treated by 2010 in accordance with the objectives of the master plan regarding countermeasures against contamination by human excreta until 2010. This objective will be abided by in the case of an existing sewerage construction plan, and for areas that are not covered by an existing plan, a new plan will be made.

(2) Sewage Collection Method and Sewage Targeted for Treatment

As the majority of the existing sewerage is of a separate type sewerage system that is inexpensive in terms of pipeline installation, this system will be adopted. Collection covers municipal domestic wastewater (night soil + wastewater). Rainwater and industrial wastewater are not collected.

(3) Treatment Method

The oxidation ditch + wetland treatment method will be adopted in view of nutrient salt (including organic substances) removal efficiency, the natural purifying capability of the water resource, the comparatively inexpensive cost for the construction of the facilities required by this method (including facility site acquisition cost), easy and cheap facility operation and maintenance, and the possibility of mass production in the state where the facilities are being expanded (see **Figs. 6-1** and **6-2**). In addition, chlorination will be also adopted since it is easy to control and an inexpensive means of sterilization and also in consideration of the fact that Patos Lake is not used as a water supply source.

(4) Number and Scale of Treatment Plants

Since treated water will have very little effect on the quality of the water in the place where it will be discharged, distributed treatment which will allow the phased expansion of the treated volume of water will be basically adopted. Dispersed treatment will be planned with due consideration of the units and scale of the oxidation ditch and the target service population.

(5) Target Treated Water Quality

In consideration of the quality of the inflow raw water, the capability of the treatment method to be adopted to remove pollutants, and the use of the water area where treated water is to be discharged, the target BOD, TP and fecal coliform levels in the treated water are 30mg/l, 6mg/l and 3,000MPN/100ml, respectively.

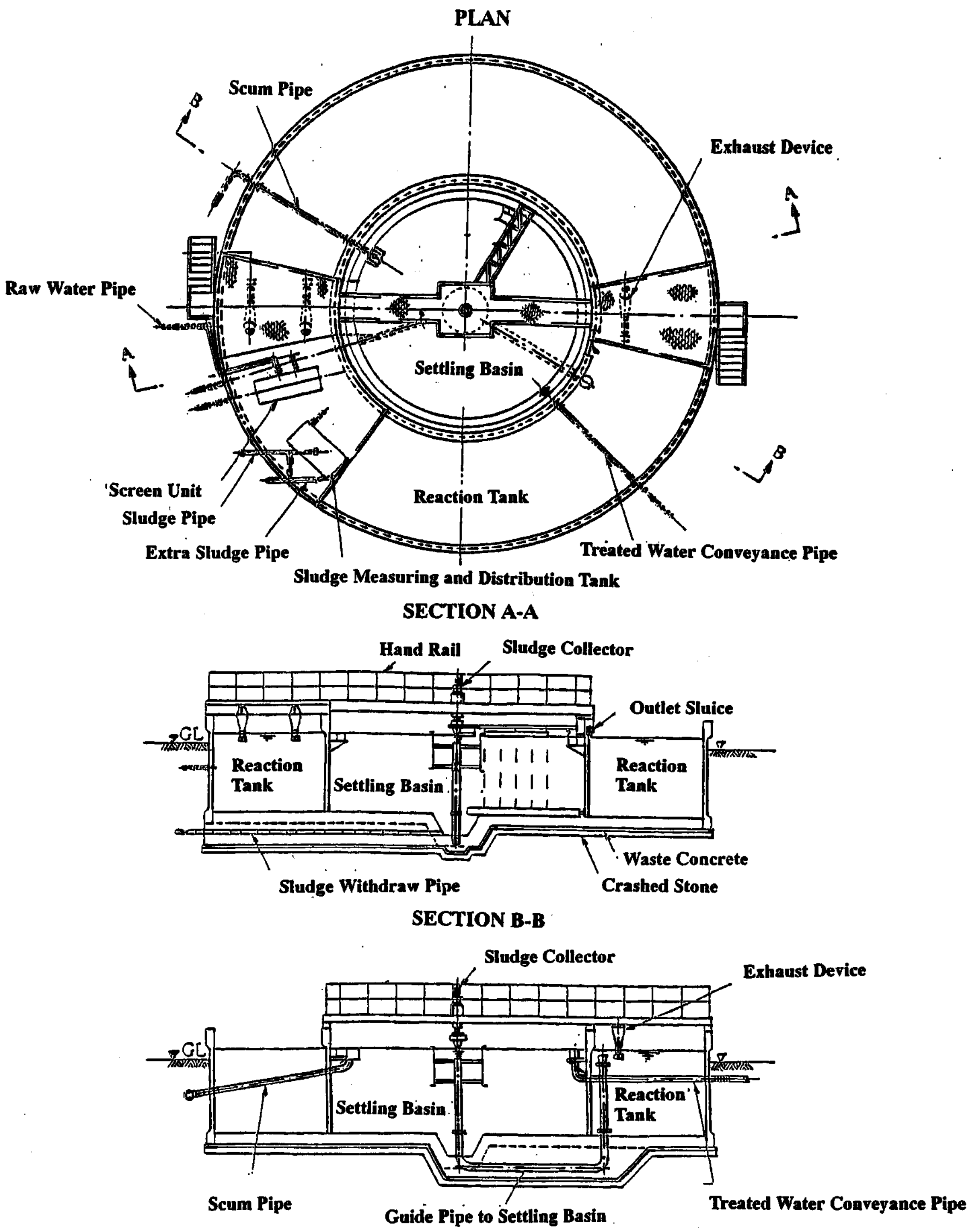
(6) Recovery of Investment Cost

Not only will the facility construction cost and operation and maintenance cost be kept to a minimum, but the beneficiaries will also be asked to share in the required expenses. Accordingly, water meters will be installed at every household, and the service households will be charged a sewage collection fee that is equivalent to the amount of water consumed.

Remarks

① Wastewater Pit
② Screen Unit
③ Aeration Tank
④ Aerator
⑤ Sedimentation Tank
⑥ Chlorination Chamber
⑦ Pump Pit
⑧ Sludge Storage Tank/Thickener
⑨ Dewatering Vehicle
⑩ Control Building

THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	**Fig. 6-1**
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	**Schematic View of a Sewage Treatment System by Combination of Oxidation Ditch and Wetland**



Original drawing is taken from [The Design and Planning Criteria for Sewage Facilities] prepared and printed by JAPAN Sewage Association 1n 1994.

THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 6-2
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	Schematic Structural View of an Oxidation Ditch

(7) Promotion of Environmental Education Programs

Environmental education programs or activities will be promoted as a means of making the residents understand the importance of environmental preservation and the need to share the costs for the sustainable operation of the system.

6.2 Basic Concept of the Sewage Treatment Plan for Pelotas

By 2010, the urban population of Pelotas is estimated to reach 325,200 (89,000 households). The sewage treatment facility that will be completed soon will cover the domestic wastewater of 78,000 (about 24,000 households) of the estimated population. The remaining 247,000 (about 65,000 households) will be considered as the target service population of the sewage treatment plan.

In consideration of the urban structure of the city of Pelotas, the target areas is divided into Area 1 and Area 2 and a treatment plant (adopting the oxidation ditch+wetland treatment system) will be constructed in each area.

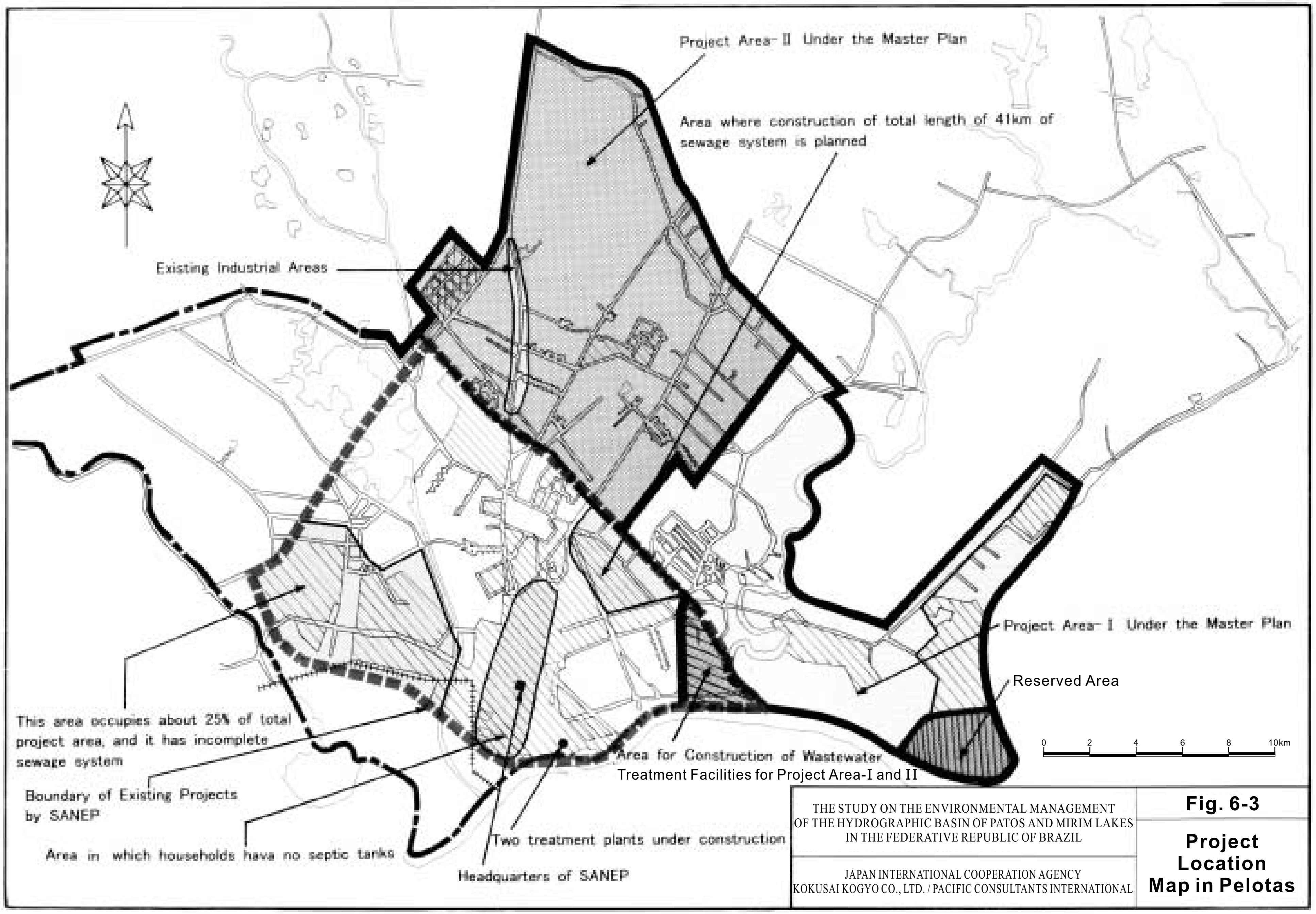
Fig. 6-3 shows the target areas and **Table 6-1** shows the specifications of the plan. The plan is roughly estimated to cost US$25,900,000 and therefore an annual operation and maintenance fee of US$23.2/household.

6.3 Basic Concept of the Sewage Treatment Plan for Rio Grande

By 2010, the population of Rio Grande is estimated at 185,900 (59,300 households). The existing sewerage construction plan targets 2030 and the treatment of the domestic wastewater of approximately 80% of the population. The remaining 20% of the population (36,500 = 10,000 households) is the target service population for the plan. The implementation of the existing sewerage construction plan that targets 2030 should be expedited in accordance with the water quality control plan; the completion of this plan by 2010 is most desired.

Only one treatment plant will be constructed, and the oxidation ditch + wetland treatment method will be adopted.

Fig. 6-4 shows the target areas and **Table 6-2** shows the plan specifications. The plan is roughly estimated to cost US$5,500,000 and therefore an annual operation and maintenance fee of US$23.2/household.



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

JAPAN INTERNATIONAL COOPERATION AGENCY
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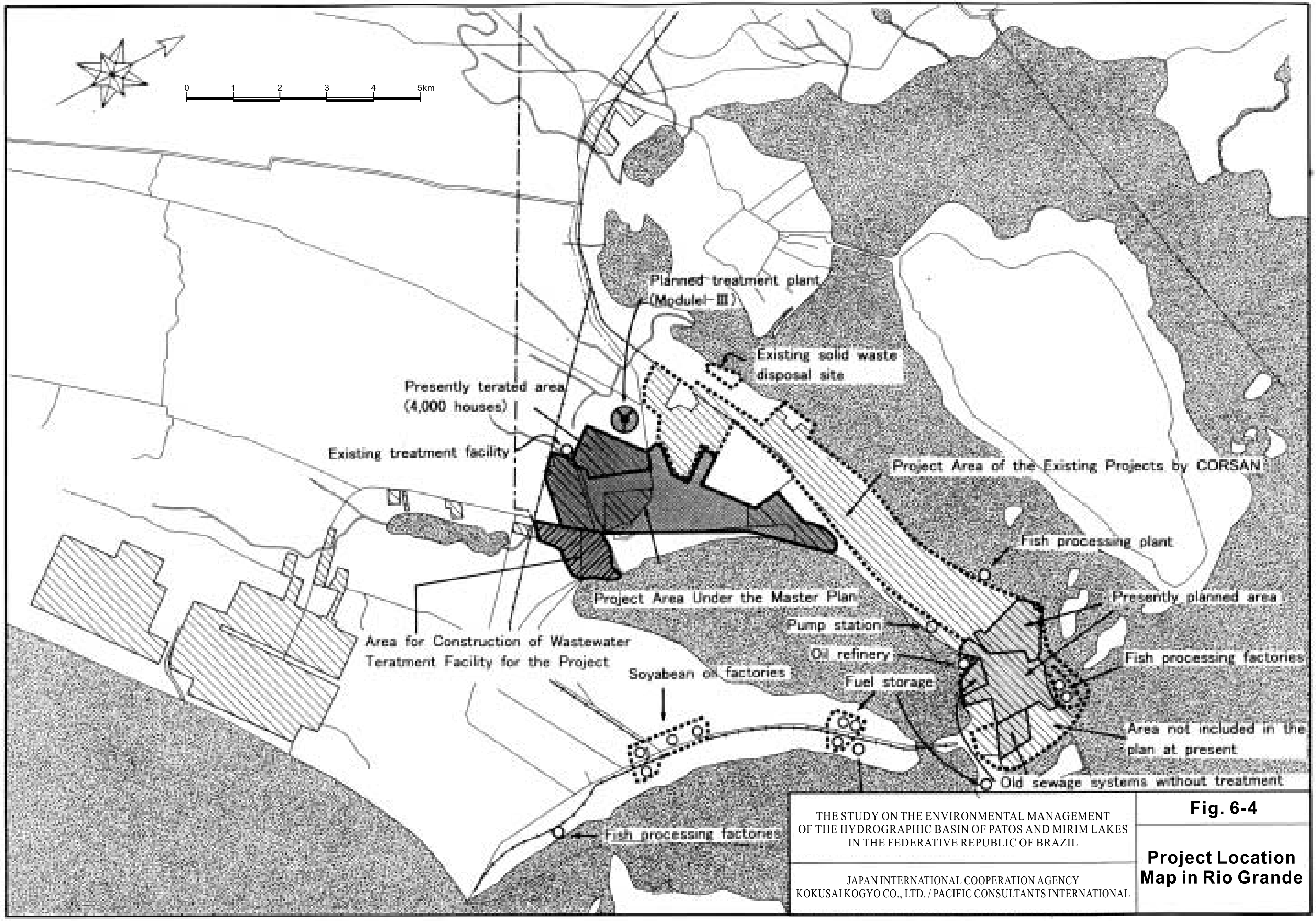
Fig. 6-3

Project Location Map in Pelotas

Table 6-1 Basic Design Parameters of the Wastewater Treatment Plan for Pelotas

Design Parameters	Wastewater Treatment Plan under the Master Plan		Existing Sewage Improvement Projects
Target Area	Area-I	Area-II	No comprehensive sewage treatment projects that cover the whole area of Pelotas exist. However, 2 treatment plants by anaerobic method are now under construction. Operation of the plants will start in 2000. With completion of the plants, the wastewater from about 24,000 households (accounting for 27 % of the total households in the urban area of Pelotas) will be brought under treatment. The total project cost is estimated at R$5,000,000. The project is being executed by SANEP.
Target Year	2010	2010	Operation will start in 2000.
Target Population	115,000	132,000	(78,000)
Number of Household	30,000	35,000	
Deign Wastewater Discharge (l/day/person)	200	200	
Design Daily Treatment Discharge (m^3/day)	23,000	26,400	
Peak Treatment Discharge (l/sec)	320**	370**	
Quality of Wastewater Flowing to Treatment Facility (BOD, mg/l)	300	300	300
Total Nitrogen Contained in Wastewater into Treatment Facility (mg/l)	60	60	-
Total Phosphorous Contained in Wastewater into Treatment Facility (mg/l)	10	10	-
SS Contained in Wastewater into Treatment Facility (mg/l)	224	224	-
Colifom Contained in Wastewater Flowing into Treatment Facility (MNP/100 ml)	5 x 1o^6 – 2 x 10^8	5 x 1o^6 – 2 x 10^8	
Design Water Quality of Discharged Water After Treatment (BOD, mg/l)	30	30	30
Coliform Level After Treatment (MNP/100 mg)			
Total Nitrogen Level After Treatment Mg/l)			
Total Phosphorous Level After Treatment (mg/)			
Wastewater Treatment Method	Combination Method of Oxidation Ditch and Wetland	Combination Method of Oxidation Ditch and Wetland	Anaerobic Method Number of Treatment Facility: 2

Note: ** Peak treatment discharge was estimated 1.2 times of the amount of average daily wastewater treatment.



THE STUDY ON THE ENVIRONMENTAL MANAGEMENT
OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
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Fig. 6-4

Project Location Map in Rio Grande

Table 6-2 Specifications of the Sewage Treatment for Rio Grande

Design Parameters	Wastewater Treatment Plan under the Master Plan	Existing Sewage Improvement Projects
Target Area		No comprehensive sewage treatment plans exist which cover the entire urban areas of Rio Grande. However, As a part of the integrated sewage improvement project, Phase-I sewage expansion project is in progress. With completion of the project in 2001, the wastewater from the households of about 25,000 in Rio Grande will be brought under treatment. The said integrated sewage expansion project is divided into three phases. The second phase of the project will be completed in 2015 and the third phase in 2030. With completion of the third phase project, the wastewater from about 80 % of the total households in Rio Grande will be brought under treatment. The treatment plant designed for the project is divided into 3 modules and each module responds the phase-wise wastewater treatment amount. The said project is being executed by CORSAN.
Target Year	2010	Operation will start in 2000.
Target Population	36,500	(78,000)
Number of Household	10,000	
Deign Wastewater Discharge (l/day/person)	200	
Design Daily Treatment Discharge (m^3/day)	7,300	
Peak Treatment Discharge (l/sec)	100**	
Quality of Wastewater Flowing to Treatment Facility (BOD, mg/l)	300	300
Total Nitrogen Contained in Wastewater into Treatment Facility (mg/l)	60	-
Total Phosphorous Contained in Wastewater into Treatment Facility (mg/l)	10	-
SS Contained in Wastewater into Treatment Facility (mg/l)	224	-
Colifom Contained in Wastewater Flowing into Treatment Facility (MNP/100 ml)	$5 \times 10^6 - 2 \times 10^8$	$5 \times 10^6 - 2 \times 10^8$
Design Water Quality of Discharged Water After Treatment (BOD, mg/l)	30	30
Coliform Level After Treatment (MNP/100 mg)	3,000	
Total Nitrogen Level After Treatment Mg/l)	10	
Total Phosphorous Level After Treatment (mg/)	6	
Wastewater Treatment Method	Combination Method of Oxidation Ditch and Wetland	Acoding to the COESAN's plan, the treated, the wastewater discharged from the treatment plant will be guided into the artificial pond constructed by lowering the ground level by excavation, where nitrogen and phosphorous contained in the treated water are absorbed by aquatic plants.

Note: **Peak treatment discharge was estimated at 1.2 times of average daily wastewater treatment.

CHAPTER 7 SOLID WASTE MANAGEMENT PLAN COMPONENT(3)

7.1 Basic Policy

Uncollected waste littered in the urban areas makes up a part of the point source load of urban origin. In addition, the disposal site that is not properly managed becomes a powerful point source of very thick concentrations of leachate and organic substances. Uncollected solid waste in the towns, streets and cities also contribute to the deterioration of the sanitary environment as they clog rivers and canals, ruin the beautiful scenery created by wetlands and marshes, and endanger animals in the area.

Domestic solid waste in the 5 municipalities in the Mar de Dentro area are managed as indicated in Chapter 2. Based on the problems in the management system and the residents' strong demands for complete collection and treatment of solid waste, the basic policy for the management of solid waste in urban areas is as follows.

(1) Development of a Sanitary Landfill Site

None of the municipal disposal sites are developed as sanitary landfill sites as stipulated by the law. The closure of these sites, therefore, should be hastened and the development of a sanitary landfill site equipped with leachate treatment facilities and gas removal facilities should be expedited.

(2) Reduction of Disposal Amount

In order to lengthen the life span of a final disposal site, separate collection should be carried out completely and recycling and composting of organic waste should be developed.

(3) Management of Medical Waste

For medical wastes, the contents and degree of risk should be studied sufficiently and the separate collection depending on the degree of risk should be carried out.

(4) Improvement of the Collection System

To increase the collection rate of bulky wastes and street sweeping wastes, a collection system that can cope with future increase in waste volume will be established.

(5) Beneficiaries' Share in the Operation and Maintenance Cost

The cost for daily collection and disposal of solid waste should be covered by the tariff paid by the beneficiaries depending on the amount of solid waste..

(6) Resident Participation Management

The cooperation of the residents is indispensable to separate collection, recycling, and cost-sharing. A solid waste management plan based on resident participation will be prepared and the willingness of the residents to participate will be increased by promoting waste related environmental education activities.

7.2 Basic Concept of the Solid Waste Management Plan for Pelotas

The population of Pelotas in 1999 was approximately 310,000. The solid waste generation amount was estimated as follows: 81,258m^3/y (0.5kg/day/head) for domestic solid waste, 3,086m^3/y 1999 for sand, 2,248m^3/y for medical waste, and 42,236m^3/y for street sweeping waste. The population of Pelotas is forecast to annually increase by 1.0%. With these figures, the future generation amount was forecast and the scale of a final disposal site (operating from 2004; minimum life span of 20 years) was calculated, assuming that one will be developed.

Based on the results, the following were decided: a sanitary landfill site of 28ha (a total of 70ha when sites for the recycling/composting plant, leachate treatment facilities, etc. are included. **Fig. 7-1** shows the layout of the sanitary landfill site, while **Fig. 7-2** shows the site structure. The development of the site is estimated to cost a total of

US$4,112,000. A 1% annual increase in recycling rate and the continuous composting of organic wastes are considered to extend the life span of the landfill site to 30 years.

The present disposal site (11ha) in Pelotas only has 2 to 3 more life years left. At the present, a candidate disposal site (see **Fig. 7-3**) is being prepared at the outskirts of the city, and this will be developed into a disposal site once approved by FEPAM.

7.3 Countermeasures against Leachate from the Rio Grande Existing Disposal Site

Although the existing disposal site (23ha) of Rio Grande directly faces Patos Lake, the site is not equipped with leachate treatment facilities and gas removal facilities, and medical wastes are disposed together with general wastes. These bring about worries concerning the contamination of the lake and fire outbreaks at the disposal site, and even the residents demand that countermeasures should be taken.

Moving the whole amount of waste accumulated at the existing disposal site to the new sanitary landfill site would be incredibly difficult as this involves a huge amount of money. Instead the existing disposal site will be improved based on the following procedures.

(1) Studies:

Topography, amount, type and distribution of solid waste, leachate analysis, analysis of water quality of surrounding water areas and groundwater, development of leachate diffusion model.

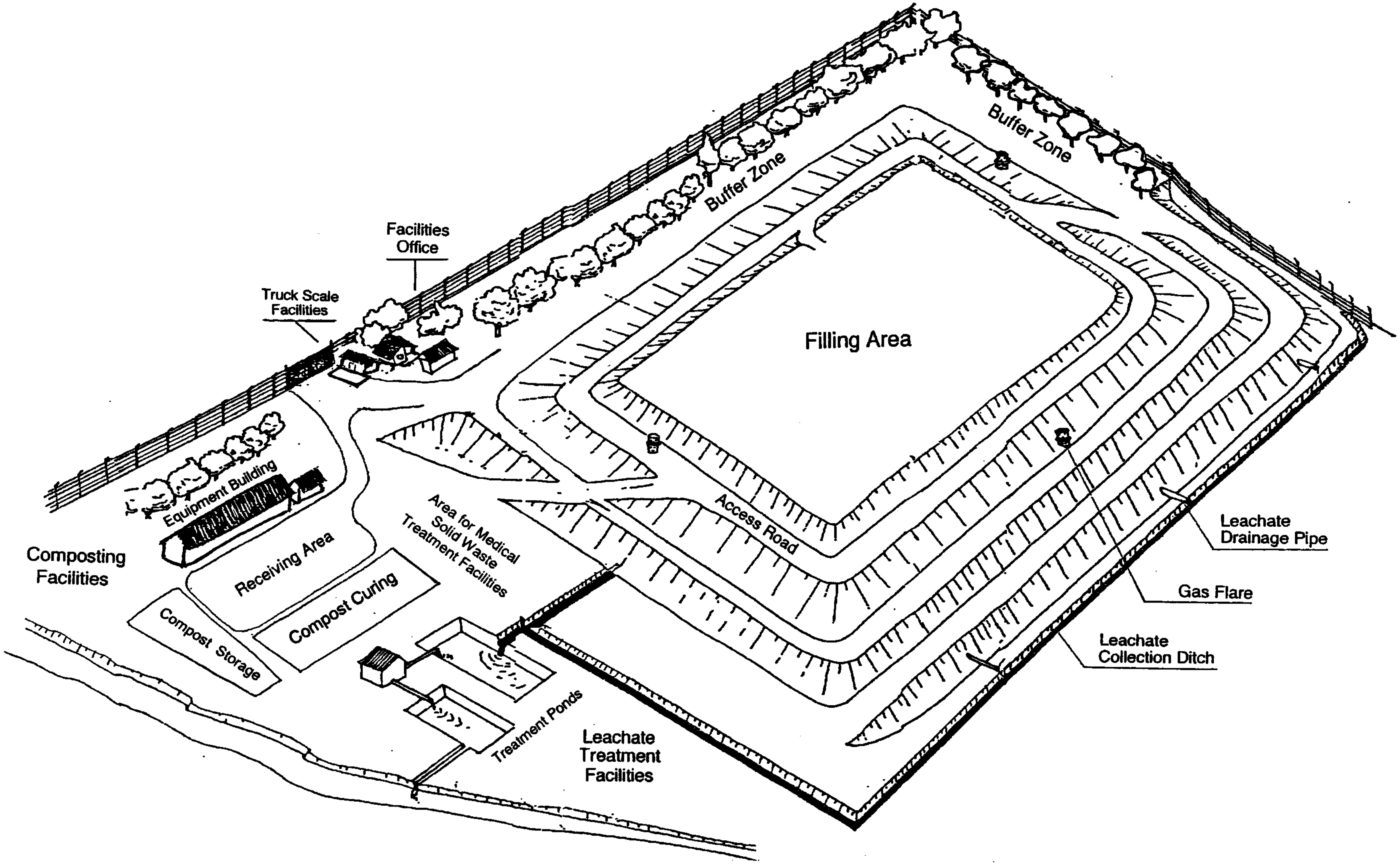
(2) Planning of countermeasures:

Formulation of countermeasures against the contamination of the soil, groundwater and surface water by leachate, based on the study results.

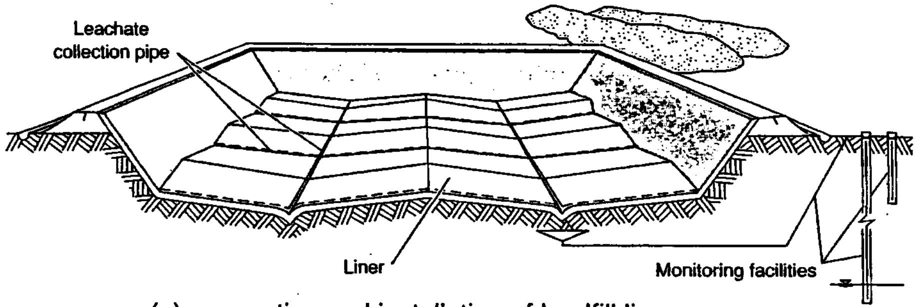
(3) Implementation of projects:

Use of water barriers (e.g. intake conduits, cut-off wall, etc.) to mitigate adverse impacts on the water quality of surrounding water bodies.

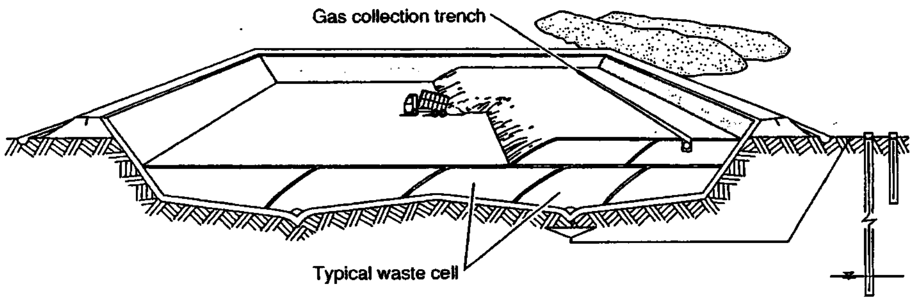
Although **Fig. 7-4** shows one of the countermeasures, it is primarily important to understand actual conditions through surveys.



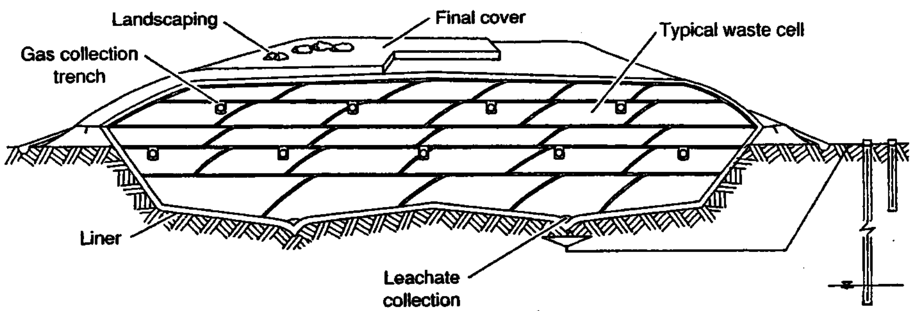
THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 7-1
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	**General View of a Solid Waste Sanitary Landfill**



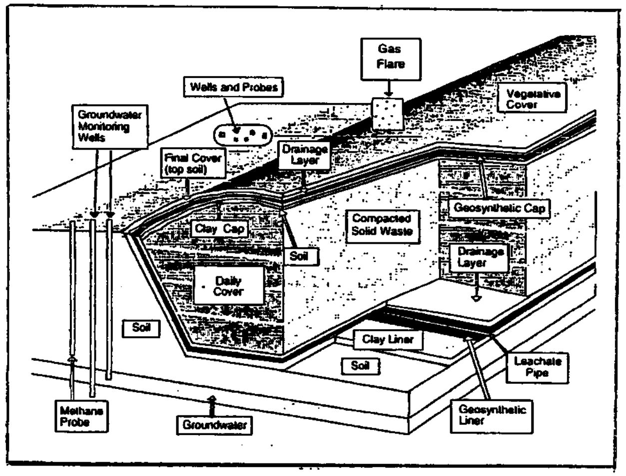
(a) excavation and installation of landfill liner



(b) placement of solid waste in landfill

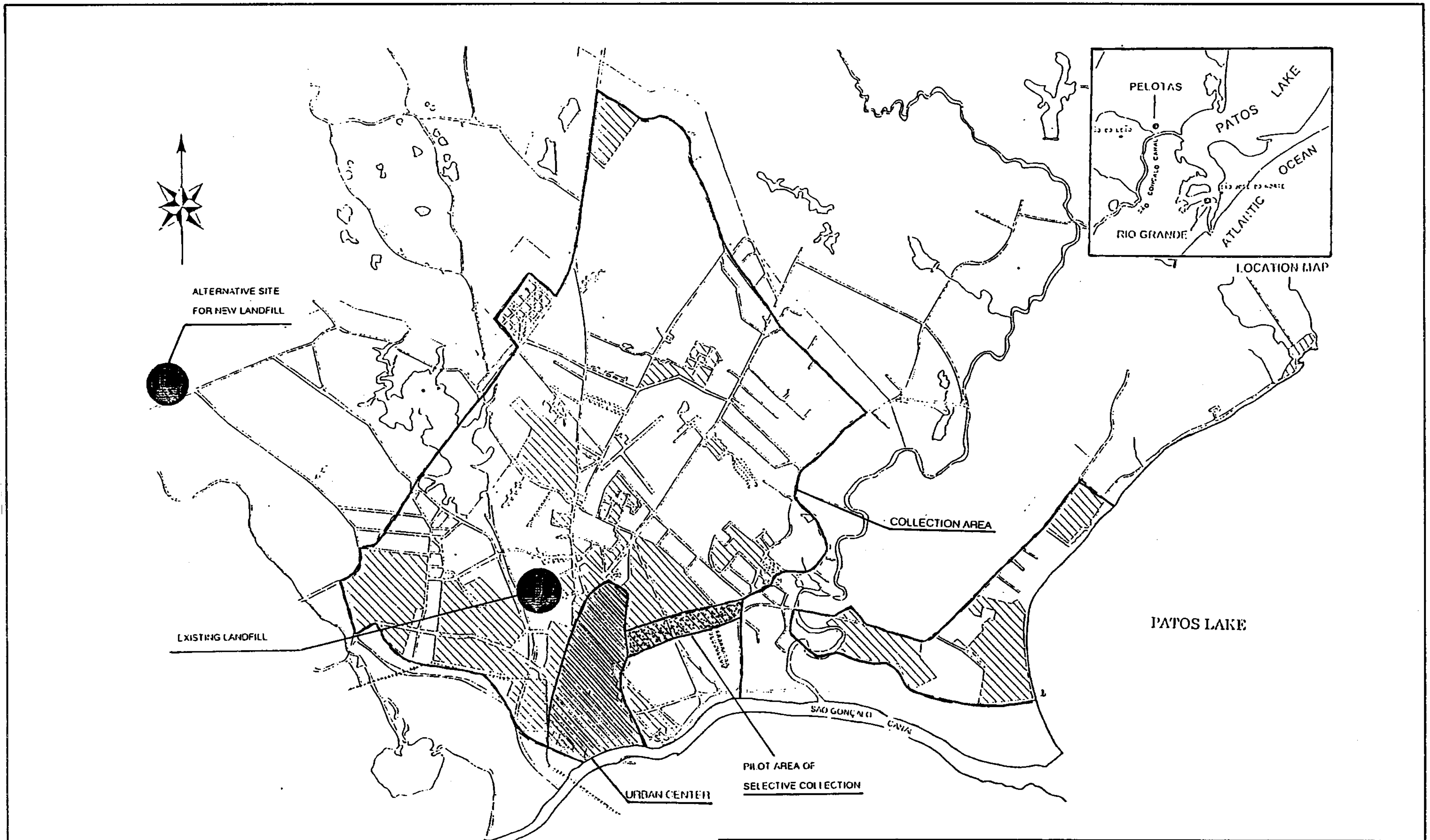


(c) cutaway through completed landfill

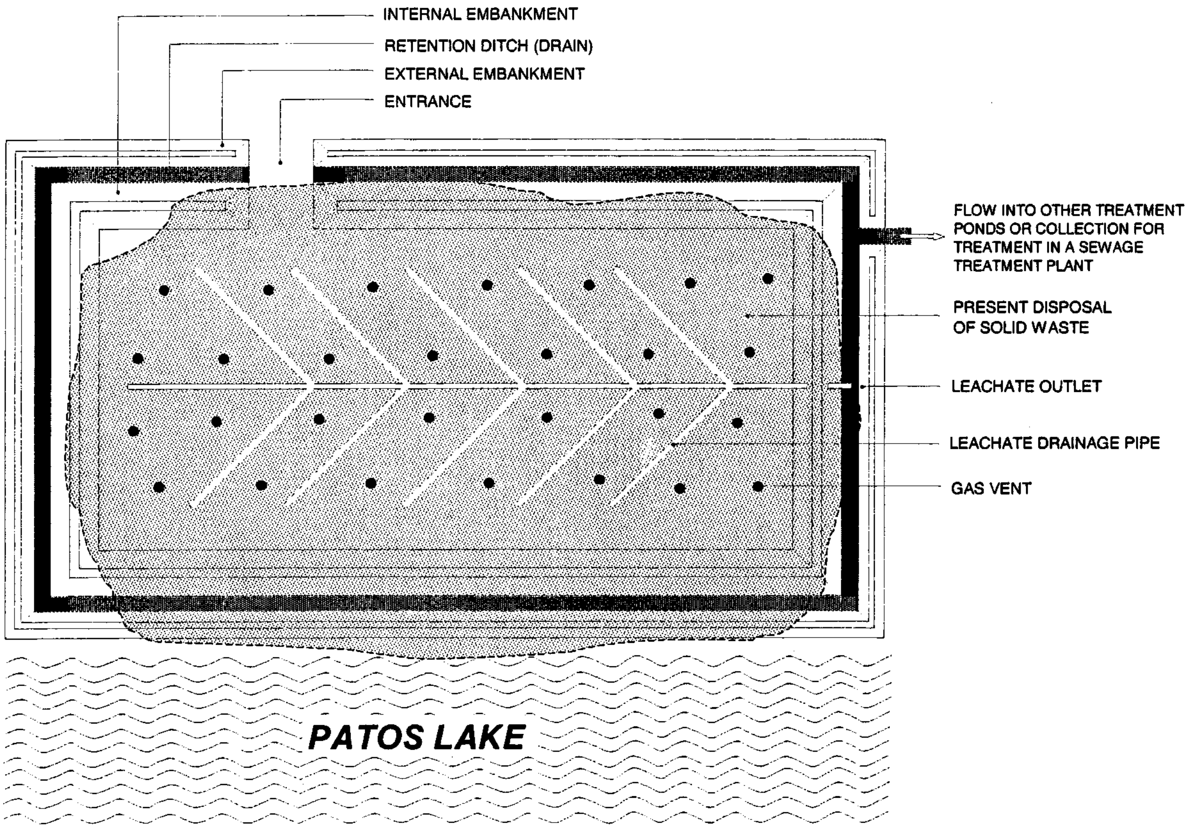


Detail of a Sanitary Landfill Construction

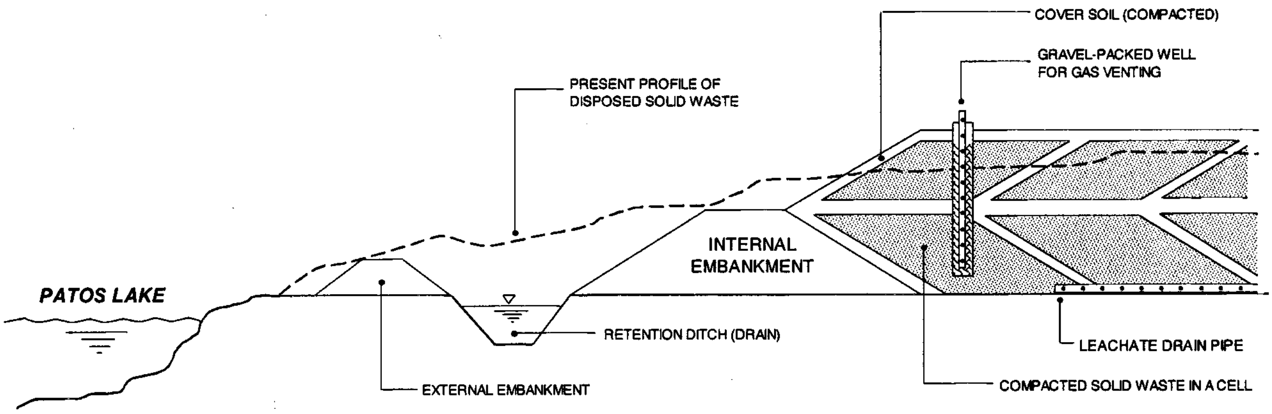
THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 7-2
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	**Development and Completion of a Solid Waste Sanitary Landfill**



THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES	**Fig. 7-3**
IN THE FEDERATIVE REPUBLIC OF BRAZIL JAPAN INTERNATIONAL COOPERATION AGENCY	**Location of Existing and Alternative Site for New Landfill in Pelotas**



SCHEMATIC LAYOUT



LATERAL SECTION (PARTIAL)

THE STUDYON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 7-4
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD./ PACIFIC CONSULTANTS INTERNATIONAL	**Schematic Layout of Mitigation Measures for the Rio Grande Disposal Site**