

## 2) Location of MSWM Facilities

The location of MSWM facilities proposed in the Master Plan are presented in Fig.4.3-1.

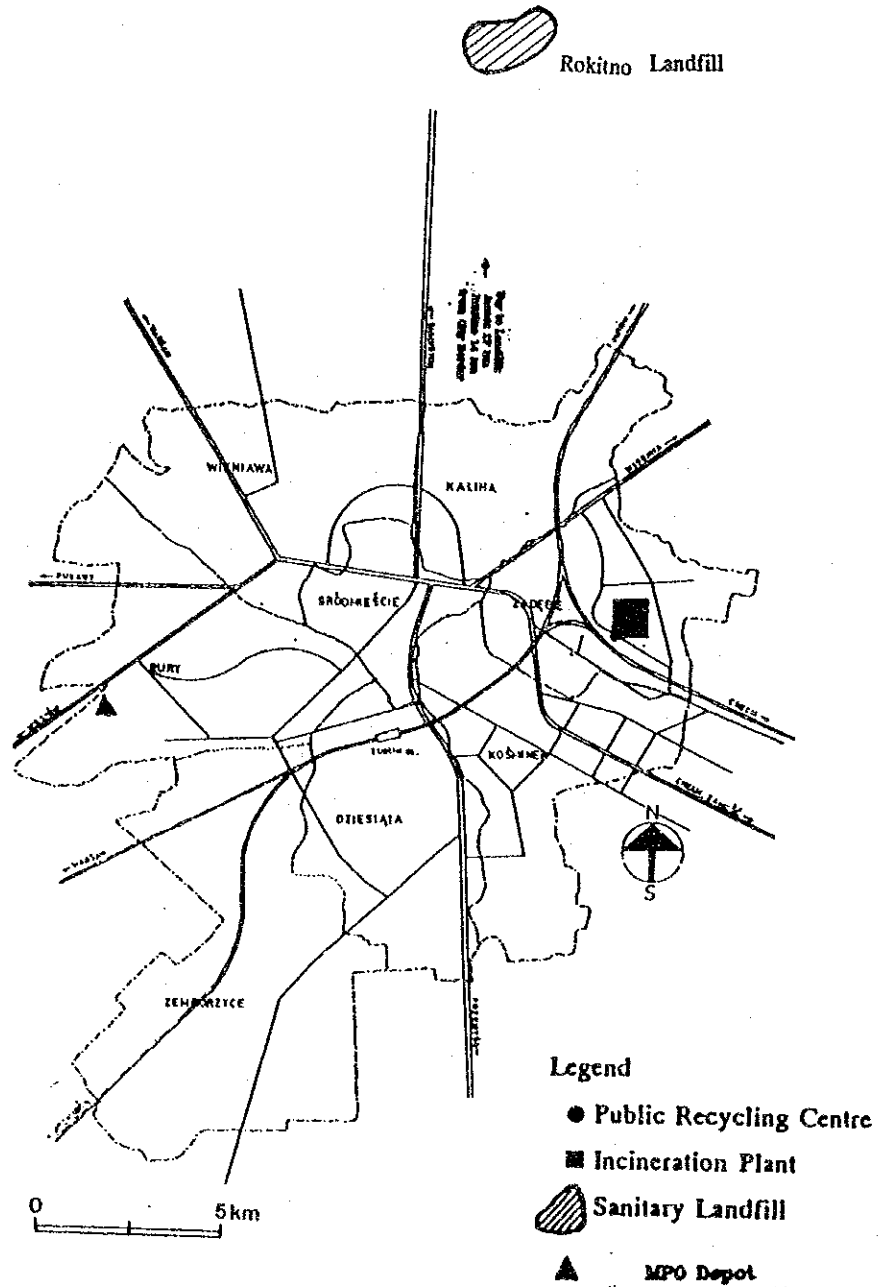


Fig.4.3-1 Location of MSWM Facilities

### 3) Planned Waste Flow of MSWM Master Plan

The waste flow in the MSW Master Plan is presented in Fig.4.3-2.

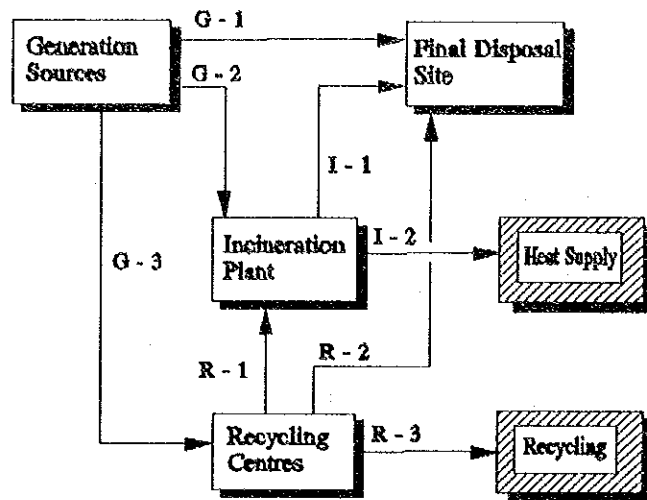


Fig.4.3-2 Planned Waste Flow

The explanation for the waste flow shown in Fig.4.3-2 is as follows.

#### From Generation Source:

The householder discharges categorized wastes and disposes them separately to G1, G2 and G3 flows. Flow G-1 and G-2 are obligatory but Flow G-3 is a non-obligatory activity.

- Flow G-1: Non-combustible wastes are carried to the final disposal site.
- Flow G-2: Combustible wastes are carried to the incineration plant.
- Flow G-3: Unsuitable wastes for regular collection and recyclable wastes are carried to recycling centres.

#### From Incineration Plant:

- Flow I-1: The residues from the incineration plant are carried to the final disposal site.
- Flow I-2: Heat generated by waste incineration is delivered to users.

#### From Recycling Centres:

- Flow R-1: Some of the combustibles wastes are carried to the incineration plant.
- Flow R-2: Some of the non-combustible wastes are carried to the final disposal site.
- Flow R-3: Some of the recyclable wastes are recycled.

## 4.4 Cost Estimation

### 1) Incineration Plant

#### a. Required capacity

The required capacity for the incineration plant is calculated based on the following preconditions:

- Waste quantity: 137,500 tons/year in 2010.
- Calorific value of waste: 2000 kcal/kg in 2010.
- 7,000 operation hours per year
- 20% monthly variation in the generated waste quantity.
- The required capacity for the incinerators is specified at a calorific value of 2000 kcal/kg.

$$\text{Required capacity: } \frac{137,500 \times 1.20}{7,000} = 24 \text{ tons/hour,}$$

or 3 incineration lines for every 8 tons/hour.

The construction of the incineration plant is recommended to be carried out in phases based on financial considerations.

*Phase 1 comprises:*

- 1 incineration line including machinery for flue gas cleaning, energy production, etc..
- All building facilities for 3 incineration lines.

*Phase 2 comprises:*

- 1 incineration line including separate line for flue gas cleaning and energy production.

*Phase 3 comprises:*

- 1 incineration line including separate line for flue gas cleaning and energy production.

Alternatively, the plant might be built in 2 phases, allowing for 2 incineration lines in Phase 1. This alternative is more attractive from a technical point of view, since the whole plant need not be closed in case one incineration line breaks down.

**b. Cost estimates**

Based on the study in Poznan, the cost for construction and operation of the proposed incineration plant was estimated and tabulated in Table 4.4-1 and 4.4-2.

Table 4.4.-1 Initial Investments for Incineration Plant: Capacity: 24 tons/hour

PRICE LEVEL IN WESTERN EUROPE MILL. USD	PRICE LEVEL IN POLAND MILL. ZL
<b>Mechanical and Electrical works:</b>	
- Furnaces, boilers, semidry flue gas cleaning system incl. bag filters, blowers and computerized operation/monitoring system: 28.0	
- Various machinery cranes, shredder, weigh bridge, compressors etc.: 3.2	
<b>Civil works:</b>	
- Construction works incl. waste silo, buildings (approx. 4,000 m <sup>2</sup> ), chimney, earth works, roads etc:	102,000
Design, supervision and training: 3.4	17,400
Miscellaneous 10%: 3.5	12,600
<b>TOTAL: Investments</b> 38.1	<b>132,000</b>

Note: Investment for purchase of land and connection fees (sewerage, electricity, water, transmission pipe for heat etc.) are not included.

Table 4.4-2 Operation Costs for Incineration Plant: Capacity 24 tons/hour

Operation costs at 24 tons/hour	Price level in Poland mill. ZL/year
- Labour Costs (60 persons)	7,830
- Lime, electricity etc.	11,140
- Disposal costs of residues:	1,860
- Maintenance:	8,370
- Administration	3,480
<b>TOTAL: Annual operation costs</b>	<b>32,680</b>

**c. Phased construction**

The construction of the incineration plant is recommended to be carried out in 3 phases. The investments and operation costs are estimated as follows:

**Phase 1:**

- 1 incineration line and other machineries 17.5 mill USD
- Building facilities for 3 incineration lines 132,000 mill ZL
- Operation costs for plant with 1 incineration line, capacity 10 tons/hour 14,000 mill ZL/year

**Phase 2:**

- 1 incineration line 11.6 mill USD
- Operation costs for plant with 2 incineration lines, capacity 20 tons/hour 23,400 mill ZL/year

**Phase 3:**

- 1 incineration line 11.6 mill USD
- Operation costs for plant with 3 incineration lines, capacity 30 tons/hour 32,680 mill ZL/year

**d. Summary for incineration plant**

Based on the forecasts on waste quantity and composition (refer to 4.2.3), the estimated heat production from the incineration plant appears in Table 4.4-3. 80% of the energy taken from waste is assumed to be utilized.

Table 4.4-3 Estimated Input and Output for the Incineration Plant.

Year	Waste received		Heat for sale TJ/year
	ton/year	Calorific value (kcal/kg)	
2001	45,800	1,400	220
2006	91,600	1,800	540
2010	137,400	2,000	931

Summary for the described incineration plant is presented in the Table below, including quantity of waste treated, sale of heat, investments and operation costs.

Table 4.4-4 Summary for Incineration Plant, Capacity 24 tons/hour at 2000 kcal/kg, 3 lines in operation.

Capacity of plant at 7,000 operation hours/year		137,500 tons/year	
Investment		38.1 mill. USD + 32,680 mill. ZL	
Year	Waste received (tons/year)	Slag and ash (tons/year)	Heat for sale (TJ/year)
2001	45,800	15,590	220
2006	91,600	31,130	540
2010	137,400	46,720	931

A flow diagram of incineration processing and a sectional view of the plant are shown in Fig.4.4-1 and 4.4-2.

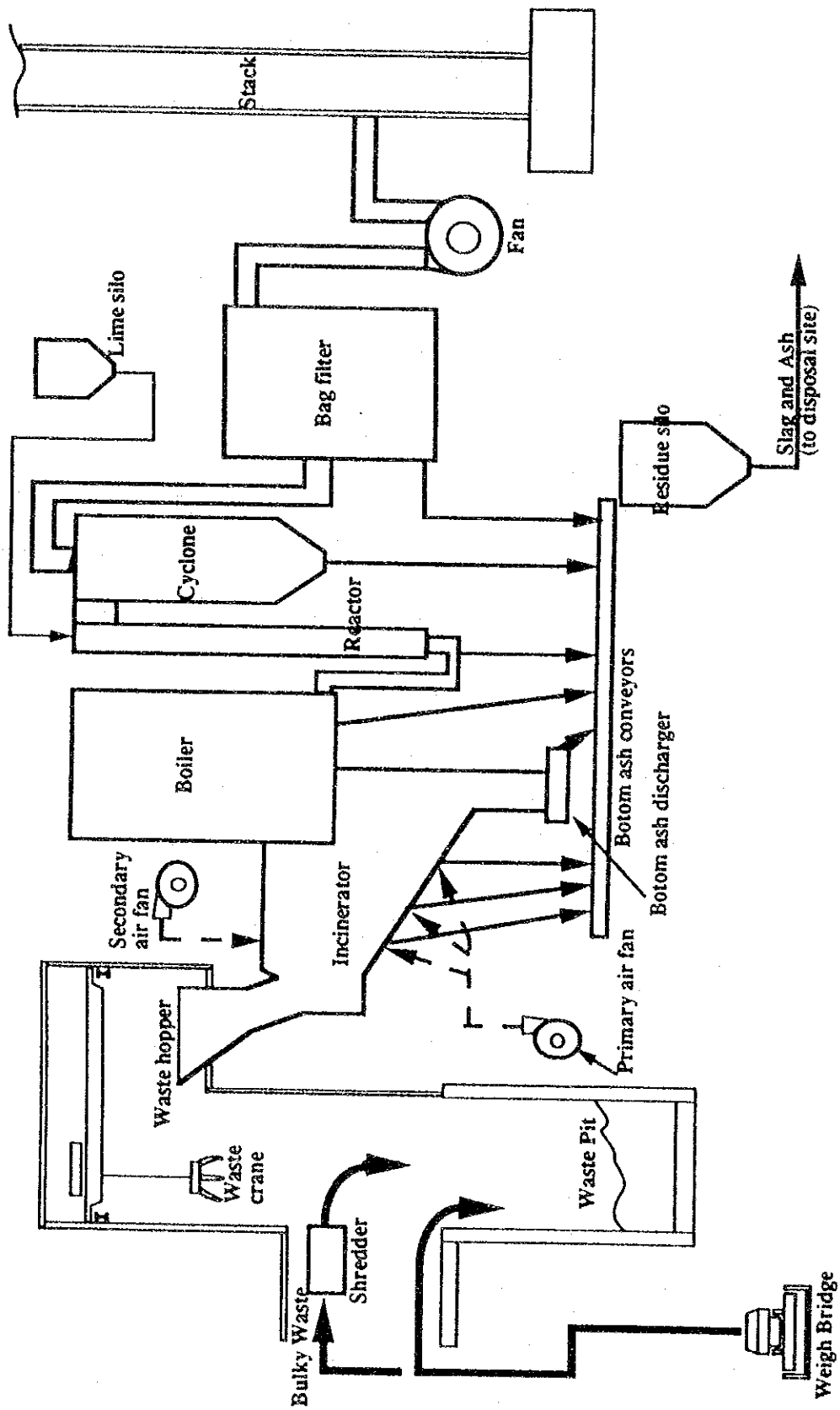
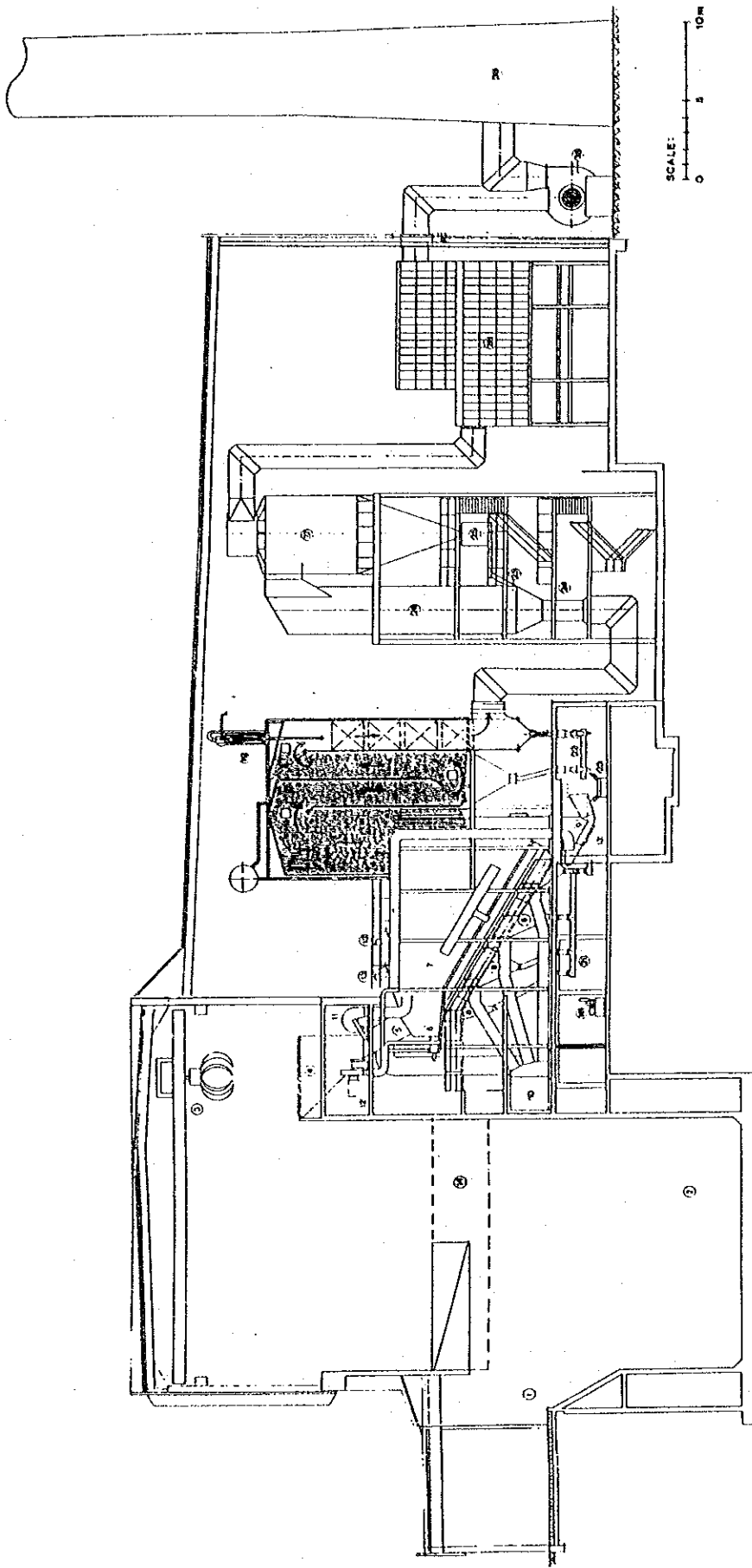


Fig.4.4-1 Flow Diagram of Incineration Processing



- |                                  |  |
|----------------------------------|--|
| 1. Waste reception               | 14. Control and operator room for cranes   |
| 2. Waste pit                     | 18. Boiler                                 |
| 3. Waste cranes                  | 19. Shot cleaning                          |
| 4. Waste hopper                  | 21. Vibration conveyor for grate shiftings |
| 5. Feed chute                    | 22. Conveyors for fly ash                  |
| 6. Feeder                        | 23. Bottom ash vibration conveyor          |
| 7. Incinerator                   | 24. Slurry injection                       |
| 8. Hopper for grate sifting      | 25. Recirculation of solids                |
| 9. Bottom ash discharger         | 26. Reactor                                |
| 10. Primary air with pre-heating | 27. Cyclone                                |
| 11. Secondary air fan            | 28. Bag filter                             |
| 12. Cooling air fan              | 35. Fan                                    |
| 13. Burner (optional)            | 36. Stack                                  |

Fig.4.4-2 Sectional View of Incineration Plant



## 2) Public Recycling Centres

### a. Introduction

The purpose of introducing recycling centres is to make it easier for householders and small enterprises to get rid of their waste (e.g. bulky waste, garden waste, materials for recycling and hazardous waste), which is not collected as part of the regular service for kitchen waste.

Another purpose is to make sure that the waste is separated into categories for maximum utilization (recycling, composting or incineration) and a minimum for dumping.

The recycling centres receive all types of waste, except kitchen waste. However, it is a condition that households separate their waste into the appropriate categories before delivery to the recycling centre.

### b. Technical description

The recycling centre:

- Has an area of 2,000.
- Paved in asphalt, except for the parking area for containers which is paved in concrete.
- Covered with fences and plants.
- Installed with a guard house.
- Has 10 maxi containers (8 to 25 m<sup>2</sup>). These containers are collected by container hoist trucks.
- Has 3 mini containers (1.5 to 3 m<sup>2</sup>), one for bottles and one for textiles.
- Has a store room or container for hazardous waste (used oil, solvents, batteries, discarded medicine, etc.)

Each maxi container is designed differently facilitating households unloading of the different waste categories. It is assumed that the containers can be produced in Poland.

The recycling centre is staffed for control and guidance. It is open everyday, including weekends. Delivery of waste might be free of charge, except for waste from smaller enterprises, who may pay a fixed fee per load (adjusted to the landfill

fee; so it is cheaper to directly dispose of one's waste to the landfill if quantity is huge). It might also be possible to pay households for recyclable materials.

Table 4.4-5 Container Equipping for Small and Large Recycling Centres and Designed Treatment

Waste type	Container equipping for recycling centre (nos.)	Designed treatment
Bottles	mini container	Recycling
	2	
Metal, including refrigerators, etc.	maxi container	Recycling
	1	
Textiles	mini container	Recycling
	1	
Cardboard	maxi container with compaction equipment	Recycling
	1	
Paper (newspapers)	maxi container	Recycling
	1	
Garden waste	maxi container	Incineration or landfill
	2	
Furniture	maxi container	Landfill or incineration after crushing
	1	
Combustible waste, including plastic	maxi container	Incineration or landfill
	2	
Incombustible (soil and stone)	maxi container	Dump area
	1	
Chemical and oil	shed or container	Special treatment
	1	
TOTAL nos. of containers	3 mini 10 maxi	
Area required	2,000 m <sup>2</sup>	

**c. Cost estimates**

Based on the study in Poznan, the cost for construction and operation of the proposed 8 recycling centres was estimated and shown in Table 4.4-6.

Table 4.4-6 Cost Estimate for Small Recycling Centre

Recycling centre, Type: Small (2,000 m <sup>2</sup> , 10 maxi containers)	Price level in Poland, June 1992, mill. Zl
<b>Investments:</b>	
- Earthworks, 1,000 m <sup>2</sup> for pavement and sewerage	580
- Fences and plants	116
- Guardhouse (30 m <sup>2</sup> )	174
- 10 maxi containers	348
- 3 mini containers	29
- Shed for hazardous waste	58
- Miscellaneous	319
<b>TOTAL investment</b>	<b>1,624</b>
<b>Annual Operation Costs:</b>	
- Salary, 2 men 7 days a week	197
- Treatment costs for garden waste, combustibles, soil and stones	406
- Maintenance of containers (7%)	29
- Maintenance of construction (0.5%)	12
- Administration, 15% of above	110
<b>TOTAL annual operation costs</b>	<b>754</b>

Hence, total investment is:

$$1,624 \times 8 = 12,992 \text{ mill zl}$$

and total O&M cost is:

$$754 \times 8 = 6,032 \text{ mill zl}$$

**d. Localization**

This study did not identify the location of 8 public recycling centres. The Lublin Municipality is requested to localize those sites.

**3) Final Disposal: Sanitary Landfill**

As described in section 3.3, a new sanitary landfill at Rokitono is being constructed and the construction cost including compensation for Lubartow is 98 billion zl.

However, we could not get the O&M cost for the landfill. In this study, we estimate the O&M cost based on the results of the Poznan study.

#### **4.5 Phased Implementation Plan**

##### **1) Examination of Implementation Schedule**

The designed basic conditions to formulate the phased implementation plan of MSWM Master Plan are as follows.

- The Master Plan period is from 1994 until 2000.
- All municipal solid waste in the Lublin Agglomeration will be carried into the Rokitno landfill site after the year 1994.
- The master plan is implemented in three stages.
- The phased implementation schedule of incineration plant precedes others.
- The 3 lines for the incineration plant will be constructed one by one.
- Separate collection will start from one area to another to enable the capacity of the constructing line to accommodate enough combustible waste.
- 2 years of training period is maintained for separate collection.
- construction of public recycling centres will start in 1995, to control illegal dumping cases as soon as possible.

##### **2) Phased Implementation Plan**

Based on the above-mentioned conditions, the phased implementation plan of the MSWM Master Plan is shown in Fig.4.5-1 and Fig.4.5-2. For better understanding, an activity schedule of MSWM Master Plan is tabulated in Table 4.5-1.

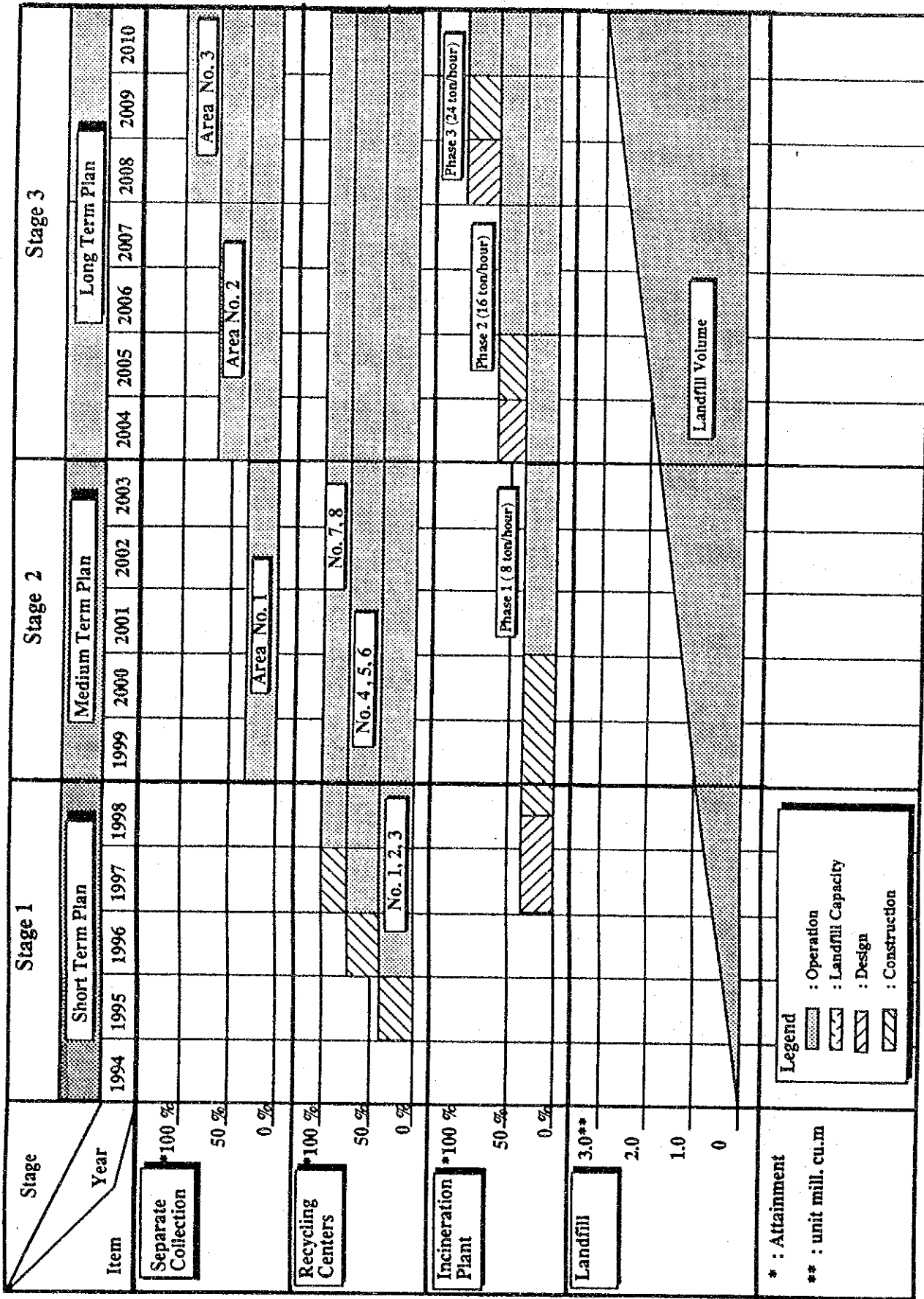


Fig.4.5-1 Phased Implementation Plan of MSWM Master Plan for Technical System

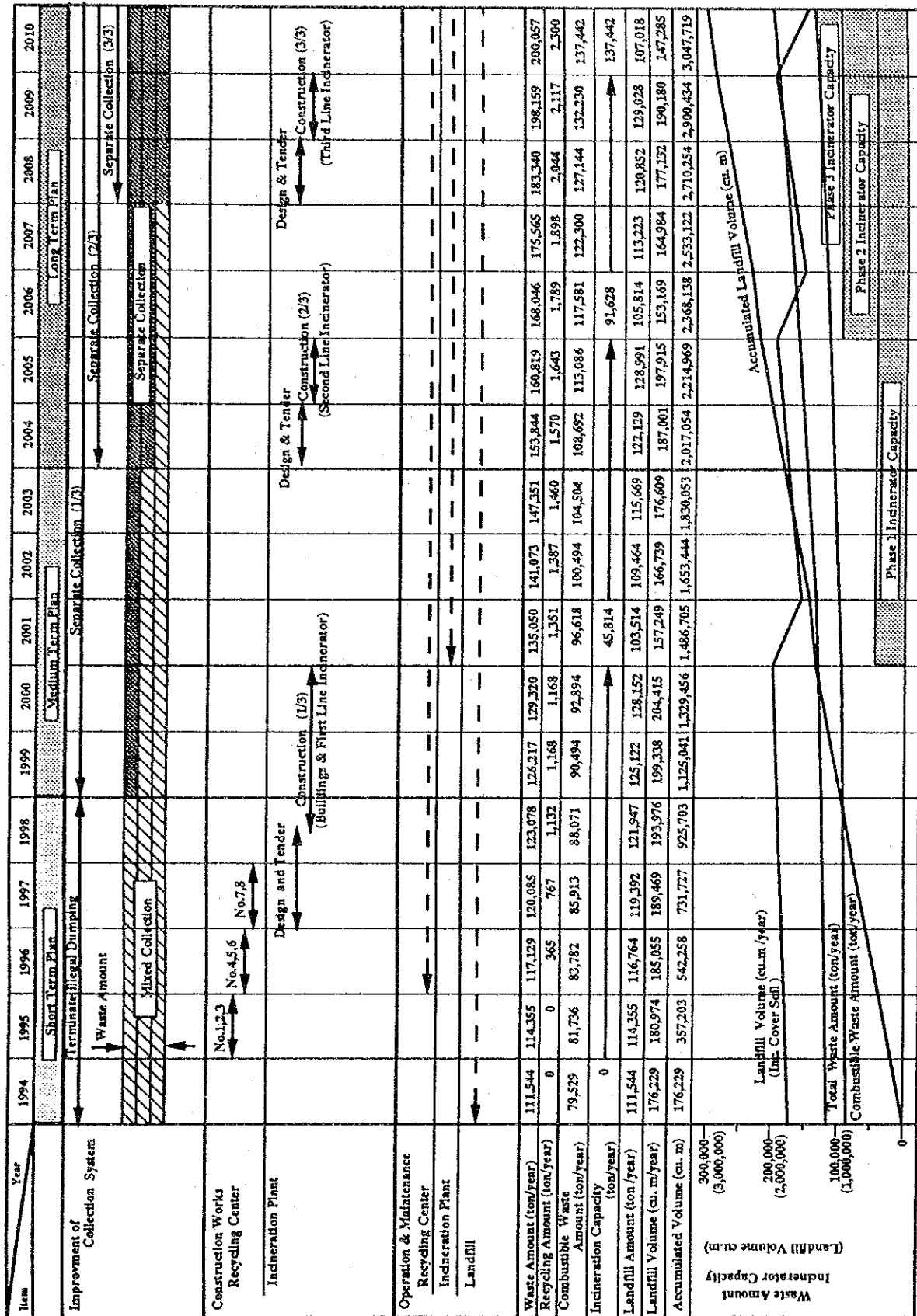


Fig.4.5-2 Implementation Schedule of Technical System for MSWM Master Plan

Table 4.5-1 Activity Schedule of MSWM Master Plan

Year	Category	Activities
1993	Organization	-MPO is privatized.
	Organization	-Strengthening of municipal organization with formation of Department for MSWM.
1994	Incineration	-Feasibility study on an incineration plant.
	Organization	-Formation of municipal company responsible for sanitary landfill and incineration plant (Lublin Waste Treatment and Disposal Company).
	Organization	-Intensive training of personnel at all levels to upgrade skills.
1995	Organization	-Revision of local regulations for municipal waste services.
	Landfill	-Shift landfill from Jawidz to Rokitno.
	Collection	-Introduction of compulsory household waste collection.
1996	Financing	-Introduction of municipal collection of fees for municipal waste services.
	Collection	-Bulky waste collection operation.
1997	Public Recycling Centre	-No. 1.2.3 public recycling centres operation.
1998	Incineration	-Detailed design of an incinerator.
	Public Recycling Centre	-No. 4.5.6 public recycling centres operation.
1999	Incineration	-Tender and construction of Incinerator Phase 1.
2001	Collection	-Operation of separate collection for 1/3 area of Lublin Agglomeration.
2002	Incineration	-Incinerator Phase I operation.
2003		
2004		
2005	Collection	-Operation of separate collection for 2/3 of the area of Lublin Agglomeration.
2006	Incineration	-Incinerator Phase 2 operation.
2007		
2008	Collection	-Operation of separate collection for whole Lublin Agglomeration.
2010	Incineration	-Incinerator Phase 3 operation.

## 4.6 Institutional System

This section will provide recommendations for institutional development of the optimum MSWM for Lublin Municipality. The activities to be considered in the institutional development are:

### Administration

- Planning
- Administration
- Financing/cost recovery
- Control and supervision

### Technical systems

- Collection systems
- Recycling centres
- Incineration Plant
- Sanitary Landfill
- Road sweeping and public area cleansing

Upon the upgrading of the institutional system, the implementation of the technical system and administration must also be considered as an early modification of the institutional system may ease implementation (or be one of the factors that may decide the implementation) of the technical system.

### 1) Strategy for Institutional and Organizational Development in Lublin Municipality

The general modernization of MSWM in Lublin Municipality and the increase in activities to be carried out make it appropriate to determine some general guidelines for institutional and organizational development.

The basic philosophy is that MSWM is a public task and, thus, should be operated under public control. It is, however, recommended that sub-ordinate municipal companies, business-like in structure and orientation, should be formed to smoothen daily operation. Aside from recommending the introduction of competitive bidding, the following guidelines were also recommended:



- Services of MSWM will be executed by sub-ordinate independent companies under municipal control in a business-like manner to facilitate decision-making and administration.
- Competitive bidding must be introduced to secure the best service for least costs.
- Facilities that will contribute to the pollution of the environment after their primary operation shall be owned 100% by the Municipality (eg. a sanitary landfill).
- If compulsory municipal waste services are performed parallel to commercial waste services, a division of these group of activities must be done in order to control costs.
- In case a private investor becomes a shareholder of municipal company, the Municipality must secure ultimate public control for services related to compulsory waste services.
- Fees and charges will be imposed and collected by the Municipality for public services determined by the Law or by municipal regulation.
- Activities related to overall planning and administration will remain in the municipal organization under strengthened power.
- The Municipality will exercise independent control over the activities (municipal control).

## 2) Overall Institutional System for Lublin Municipality

Based on the defined activities, we recommend the overall institutional system illustrated below for Lublin Municipality.

Table 4.6-1 Proposed overall Institutional System for Poznan Municipality

BODY	TASKS
Department for Municipal Solid Waste Management in Lublin Municipality as the overall responsible body for MSWM	<ul style="list-style-type: none"> <li>- Planning</li> <li>- Administration</li> <li>- Collection of fees</li> <li>- Control and supervision</li> </ul>
Subordinate municipal companies under municipal control as executive bodies (or through direct tendering from responsible body)	<ul style="list-style-type: none"> <li>- Operation of collection services</li> <li>- Operation of recycling centres</li> <li>- Operation of incineration plant</li> <li>- Operation of sanitary landfill</li> <li>- Execution of road sweeping</li> <li>- Execution of public area cleansing</li> </ul>

The proposed structure necessitates a strengthening of the municipal administration and supervision of MSWM. Today, these duties (among other duties) are carried out by the Department of Municipal Management.

The future organizational structure is expected to strengthen the administration and supervision of MSWM by joining the duties and responsibilities in one department by either strengthening the present organization in the Department of Municipal Management or establishing a new department under the auspices of the Mayor of Lublin.

We consider both alternatives to be appropriate, but to avoid confusion we will use the name "Department for Municipal Solid Waste Management" in the subsequent text.

For executive tasks, we recommend a combination of direct tendering and formation of municipal companies business-like in orientation with smooth decision-making processes and who are financially independent of the municipality.

The above structure will enable the introduction and implementation of a business-orientated MSWM and will make municipal control over the duties through the Department for Municipal Solid Waste Management possible. Tendering will also bring about cost minimization and well defined services.

### **3) Department for Municipal Solid Waste Management**

The strengthened Department for Municipal Solid Waste Management shall carry out the following main duties:

- Overall planning of MSWM
- Implementation of competitive bidding and tender of services
- Collection of fees for municipal services
- Control and supervision, including handling of complaints
- Administration

#### **a. Overall planning of MSWM**

The Department will be responsible for the overall planning of MSWM, including definition of standards and guidelines for the performance of services.

The Department will take care of all major matters in relation to MSWM, but main executing activities are handed over to the municipal companies.

The Department will formulate current waste strategies and describe the necessary actions for implementation.

#### **b. Competitive bidding**

In accordance with privatization and in order to ensure the best services for least costs, competitive bidding must be implemented.

The Department will be responsible for the definition of appropriate areas for competitive bidding and for the bidding procedure.

Generally, areas which are not delegated to municipal companies must be subject to competitive bidding.

#### **c. Collection of fees and charges**

An important new role to be added to the Department will be collection of fees and charges for municipal waste services. At present, MPO and other private contrac-

tors who offer waste collection services to the citizens, who are given the freedom of choice, carry out collection themselves.

The idea behind municipal collection of fees and charges is to make compulsory municipal services and to provide the municipality with the best tool to control the fees. For proper implementation of the recommended municipal collection of fees and charges, the municipality must be able to choose the contractor for collecting household wastes.

Collection of fees and charges necessitates the forming of a register and introduction of a payment procedure. Payment can be collected along with the collection of municipal taxes including property tax or other payments for municipal services (water and sewage).

To ease administration, the fee system must be simplified and generalized.

Fees and charges for waste services, which are not part of the compulsory municipal services, will be collected directly by the contractor based on individual contracts.

With the proposed fee collection system, it is possible for the Municipality to engage a contractor for municipal services and, thus, apply competitive bidding.

#### **d. Control and supervision**

By delegating main executive activities to the municipal companies, the Department for Municipal Solid Waste Management can exercise supervision and control over the activities. Also, it is recommended that complaints from citizens over municipal services are handled, investigated and solved by the Department.

#### **4) Executive Bodies**

Generally, establishment of a municipal company is the recommendable way of organizing execution of MSWM where complex technology or high level of activity are involved, while direct tendering can be applied for well defined services as eg. road sweeping and public area cleansing.

The ideal institutional plan includes 2 companies under municipal control for execution of services related to collection of waste and treatment/disposal of waste respectively.

The present MPO, even after privatization, could be appointed as the municipal company responsible for all collection services. However, the company's execution of compulsory municipal services will take place under strengthened supervision and control of the municipality. Basically, municipal waste management is a public duty and a non-profit business. Thus, a municipal company should not be profit oriented.

We recommend that the responsibility for execution of compulsory municipal waste collection services is maintained in the Department for Municipal Solid Waste Management and that the execution is carried out as follows:

- Through a tender of districts (at least 25% of the volume, or may be more, as privatized MPO may participate in the tender). The tender must be held in appropriate districts, so smaller companies may also take part in the tender.
- Through direct contract with the privatized MPO; the contract fee will be determined from the contract price of tendered districts.

For execution of duties for the Incineration Plant and Sanitary Landfill, we propose the formation of a company with the municipality as major share holder.

For road sweeping and public area cleansing services the present system with direct tender of the activities should be maintained.

These considerations led to the following institutional plan.

Table 4.6-2 Institutional Plan

<b>RESPONSIBLE BODY</b>	Department for Municipal Solid Waste Management in Poznan Municipality	<ul style="list-style-type: none"> <li>- Planning</li> <li>- Administration</li> <li>- Collection of fees</li> <li>- Control and supervision</li> </ul>
<b>EXECUTIVE BODIES</b>	Department for Municipal Solid Waste Management in Poznan Municipality through direct tender	Operation of: <ul style="list-style-type: none"> <li>- Collection system</li> <li>- Recycling centres</li> <li>- Bulky waste collection</li> </ul>
	Lublin Waste Treatment and Disposal Company	Operation of: <ul style="list-style-type: none"> <li>- Incineration plant</li> <li>- Sanitary landfill</li> </ul>
	Provincial Road Authority and Department for Municipal Solid Waste Management through direct tender	Execution of road sweeping services

## 4.7 Financial Plan

### 1) Assumptions

Since the field survey was only carried out in the city of Lublin, the financial data of other local governments in Lublin Agglomeration were not obtained. The following assumptions were, therefore, set up in order to prepare a financial plan.

- The total budget of Lublin Agglomeration is assumed at 832,709 million zł by multiplying the budget of Lublin Municipality in 1993 (596,000 million zł) by the ratio of 1.397 (the ratio of the population of Lublin Agglomeration divided by the population of Lublin City). The same assumption is used for the operational costs for collection, incineration plant and sanitary landfill. However, the calculated operational costs for public recycling centres, road sweeping and public area cleansing were only made for Lublin Municipality.
- The average household income in 1993 is assumed as to be 3,600,000 zł/month.
- Heat price applied in this study is 942,000zł/GJ.  
Tipping fee for sewage sludge (special fee), which was also used in the Poznan study, is assumed to be 1,790,000 zł/ton.
- Since discharge ratio of household waste is 400g/person and present collection fee is 6,875 zł/person/month, collection fee of household waste is calculated to be 566,000 zł/ton including disposal cost, by the following formula:  
$$(6,875 \times 12) + (0.0004 \times 365) = 565,068 \rightarrow 566,000$$
- Operational costs for sanitary landfill, bulky waste collection, public recycling centres and control and supervision, are assumed from the results of the Poznan study.
- Treatment and disposal cost (483,000 zł/ton) after the introduction of an incineration plant is calculated by the same method applied in the Poznan study.
- Treatment and disposal cost (200,000 zł/ton) before the introduction of the incinerator is calculated by dividing the present price of 40,000 zł/m<sup>3</sup> by the apparent specific gravity of 0.2 ton/m<sup>3</sup>.

- Bulky waste to be collected by the Municipalities are 30% of total bulky waste generated; and remains 70% are brought to public recycling centres by the citizens.
- Half of the containers' cost for separate collection will be subsidized by the municipality.

## 2) Required Finances and their Sources

The required financial amount and its proposed sources are presented in Table 4.7-1.

Table 4.7-1 Required Financial Amount and Source unit: mill.zł

	1994 - 2000	2001 - 2005	2006 - 2010	Total
Public Recycling Centres	16,003	5,366	4,896	26,265
Incineration Plant	447,963	209,438	209,438	866,839
Sanitary landfill	98,000	-	-	98,000
Bulky Waste Collection	500	500	500	1,500
<b>Total</b>	<b>562,466</b>	<b>215,304</b>	<b>214,834</b>	<b>992,604</b>
Budget of Lublin Agglomeration	16,503	5,866	5,396	27,765
Lublin Treatment Disposal Co. (long-term loan)	545,963 (315,963)	209,438 (209,438)	209,438 (209,438)	964,839 (734,839)

Note:

- The cost of replacing old trucks for regular collection, road sweeping and public area cleansing is not included.
- Long-term loan is only for the incineration project.

The required annual expenditure is presented in Table 4.7-2.

Table 4.7-2 Annual Expenditure unit: mill.zł

Category	1995	2000	2005	2010
Regular Collection	30,980	32,329	40,077	49,188
Public Recycling Centres	-	8,902	9,302	9,302
Incineration Plant	-	-	38,885	84,980
Sanitary landfill	5,233	5,782	5,667	4,688
Bulky Waste Collection, Road Sweeping and Public Area Cleansing	8,483	8,483	8,483	8,483
<b>Total</b>	<b>44,696</b>	<b>55,496</b>	<b>102,414</b>	<b>156,641</b>

Note: O & M cost and depreciation are included in the figure above.



The waste collection fee shown in Table 4.7-3 was estimated based on the following conditions.

- International lending agencies shall be the financial sources for the incineration plant.
- Required internal rate of return is more than 15 %.
- Other projects shall be self-financed.

Table 4.7-3 Solid Waste Fee

unit: zl/ton

	in 1992	1995 - 2000	2001 - 2010
Treatment and Disposal	200,000	200,000	483,000
Collection	366,000	366,000	366,000

## 2) Money Flow

Overall money flow whereby the Municipality collects fees from householders and the expenses of the activities of Lublin Treatment and Disposal Company are covered by the sale of heat and tipping fees, is presented in Fig.4.7-1.

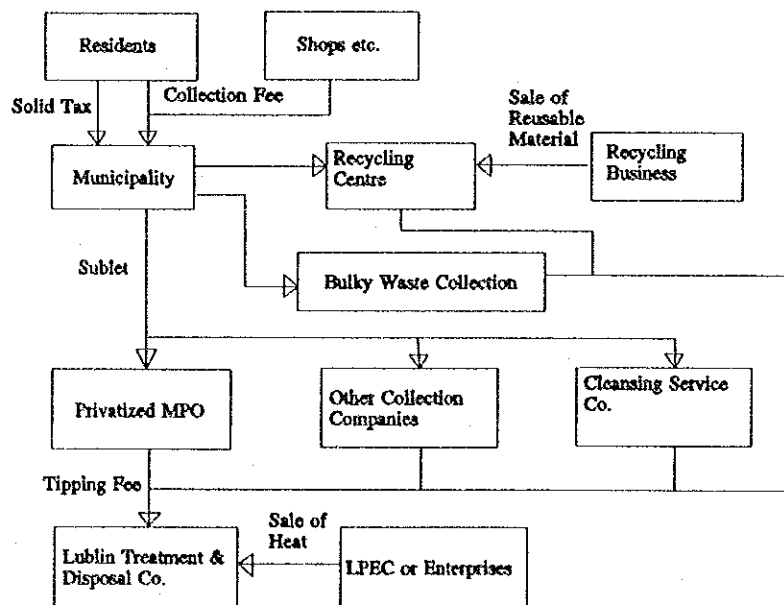


Fig.4.7-1 Money Flow for MSWM

### 3) Fee collection system

Every fee collection system has its advantages and disadvantages. A fee collection system according to weight of waste discharged should be introduced by 2010 in order to maintain equality. However, the waste fee system based on the number of persons and waste tax based on their income were proposed, because there are many difficulties involved in introducing the former. The waste fee list is shown in Table 4.7-4.

Table 4.7-4 Waste Fee List

unit: zł

		Present	1995 - 2000	2001 - 2005	2006 - 2010
<b>Collection Fee</b>					
- General Waste					
. Household	zł/person/month	6,875* <sup>1</sup>	4,370	4,520	5,340
. Shops	zł/m <sup>2</sup> /month	NA	365	595	705
. Catering	zł/seat/month	NA	3,000	4,810	5,730
. Market	zł/ton	NA	566,000	849,000	849,000
- Bulky Waste	zł/ton	-	850,000	1,133,000	1,133,000
<b>Solid Waste Tax</b>	zł/household/-month	-	2,390	5,970	7,050
<b>Tipping Fee</b>					
- Standard	zł/ton	40,000* <sup>2</sup>	200,000	483,000	483,000
- Special* <sup>3</sup>	zł/ton	-	-	1,790,000	1,790,000

Note:

- Collection fee of shops, market and bulky waste shall include collection, treatment and disposal costs.
- Collection fee of household waste shall include collection cost only.
- Solid waste tax shall include treatment and disposal costs.
- \*1 Collection fee shown at "present" includes disposal cost and excluding rental fee of container.
- \*2 means 40,000 zł/m<sup>3</sup>.
- \*3 Special fee is for the tipping fee for sewage sludge, hospital waste, etc..

### 4) Amount Shouldered by Citizens and Lublin Agglomeration

Amount shouldered by citizens and Lublin Agglomeration is in Table 4.7-5.

Table 4.7-5 Amount shouldered by Citizens and Lublin Municipality

	unit	1992	1995	2000	2005	2010
<b>Citizens' Cost-Burden</b>						
- Solid Waste Tax	mill.zl	-	14,871	16,197	43,987	56,640
- Collection Fee	mill.zl	40,631* <sup>1</sup>	27,190	29,615	33,303	42,902
- Bulky Waste Collection Fee	mill.zl	-	819	949	1,576	1,960
- Dustbin	mill.zl	-	2,826	4,130	5,117	5,117
Total	mill.zl	40,631	45,706	50,891	83,983	106,619
Number of Household * <sup>2</sup>		123,125	129,625	141,188	153,500	167,375
Cost-Burden per Household		27,500	29,383	30,037	45,593	53,084
Average Monthly Income	1000 zl	3,600	3,419	3,639	4,480	5,498
Rate of Citizens' Cost-Burden	%	0.76	0.86	0.83	1.02	0.97
<b>Municipality's Cost-Burden</b>						
- Capital Investment for P.R.C	mill.zl	-	5,812	1,131	1,131	2,071
- O & M cost of P.R.C.	mill.zl	-	0	9,575	14,978	17,481
- Public Area Cleansing	mill.zl	8,787	9,167	9,415	12,896	14,166
- Control and Supervision	mill.zl	0	5,292	5,292	5,292	5,292
- Subsidies for Container* <sup>3</sup>	mill.zl	0	0	0	0	0
Total	mill.zl	8,787	20,271	25,413	34,297	39,010
Budget of Lublin Agglomeration	bill.zl	833	833	965	1,292	1,729
Lublin Agglomeration's Cost-Burden	%	1.05	2.43	2.63	2.66	2.26

Note: \*1 The present cost-burden by collection fee is calculated by multiplying present fee with the population of the Agglomeration.

\*2 Average family member is assumed to be 4.

\*3 Subsidies for purchase of containers are required in 1998, 2002 and 2006.

# **CHAPTER 5**

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## **CONCLUSION AND RECOMMENDATIONS**



## CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

#### 1) Technical System

##### a. Present MSWM in Poznan

- Present amount of MSW discharged in Lublin Agglomeration is estimated to be 250.1 tons/day (508 g/person/day) in 1992, and the disposal amount at the present Jawidz landfill including wastes other than MSW is 291.2 tons/day. However, due to the lack of data on the actual weight of disposal amount, the estimated amount seems to be more than the actual amount.
- The LCV (Lower Calorific Value) of MSW, excluding road sweeping and bulky wastes and domestic ash, was estimated to be 1,213 kcal/kg.

##### b. MSWM master plan

- It is forecasted that the amount of MSW discharged in Lublin Agglomeration will be 466.6 tons/day (697 g/person/day) in 2010, and that the LCV of MSW excluding road sweeping and bulky waste will be 2,217 kcal/kg with a separate collection system and 1,628 kcal/kg without.
- Alternatives for the MSWM Master Plan were not examined. However, to achieve the goal established, an alternative consisting of separate collection, public recycling centres, an incineration plant and sanitary landfill was selected as the optimum technical system, based on the discussions with persons concerned in MSWM, the study on Poznan and the EC PHARE report.
- The construction of MSWM facilities proposed in the Master Plan shall be implemented on a step by step basis, i.e. short term (1994-1998), middle term (1999-2003) and long term (2004-2010).

### **c. Feasibility Study**

In order to obtain the required finance for the implementation, Lublin Municipality with other local governments in Lublin Agglomeration is requested to carry out a feasibility study for the priority projects in the Master Plan as soon as possible.

## **2) Institutional Development**

For institutional development, the following conclusions on the study may be presented:

### **a. General conclusions**

- The complete transition of the Polish society from a socialist, centralised system to a capitalistic, decentralised community with free market economy inevitably led to transitional problems due to the lack of tools in the local level required in managing public duties. Therefore, there is a need for tools to be transferred from national and regional levels to the local level.

For MSWM, the problems in transaction includes lack in legislative tools related to the enforcement of compulsory waste services and tools for financing through local taxation and the municipalities' capability in raising loans.

- Generally, it is difficult to overcome opposition and to obtain land for waste facilities due to lack of procedures for compulsory purchase of land for projects benefiting the whole community.
- General discussions should be conducted on standards appropriate for the MSWM, e.g. to determine the time schedule required for the transition to EC-standards.
- The implementation and evaluation of the project in terms of the provision of feasibility analysis for decision-making, execution of competitive bidding in the purchase phase and supervision of construction works were not adequately managed.

- The custom for public subsidization results in low financial contributions from the users leading to a lack of public monitoring and control of the services.

#### **b. Conclusions for Lublin Municipality**

- Generally, the MSW-services in Lublin Municipality are carried out in a satisfactory way.
- The institutional system of MSWM in Lublin Municipality is being reorganized and strengthened. Furthermore, MPO is being privatized. The municipality still requires further improvement and strengthened control over the activities of the privatized MPO.
- The present method in the collection of fees for waste services, performed by the executing contractor, is insufficient and tends to provide unequal services to the citizens.
- Sanctions in controlling the disposal of construction waste are essential to the prevention of illegal dumping.

## **5.2 Recommendations**

### **1) Technical System**

#### **a. Obtainment of basic data and its utilization**

- Basic data on the waste stream diagram and composition were obtained from the Study. It is, however, insufficient for the formulation of the feasibility study of an incineration plant. Therefore, the execution of a periodical waste amount and composition survey and the reviewal of basic data for a successful feasibility study, are recommended.
- As for the amount of waste collected and disposed, measurement by volume shall be replaced by weight. Continuous observation of the amount of waste disposed shall be conducted in order to obtain the seasonal fluctuation in waste discharge to establish the capacity of the incineration plant. Consequently, the execution of a year-long measurement of the amount of waste disposed and preparation of a more precise waste flow diagram are requested.



**b. Collection**

- A separate collection system for combustible and non-combustible wastes shall be examined if the introduction of an incineration plant is feasible.
- The introduction of a bulky waste collection system shall be examined. Bulky wastes will be brought to public recycling centres by the citizens. And a bulky waste collection system may be provided to citizens who can not transport their wastes to the centres.
- The same system will be used for the collection equipment. However, ownership of public containers not less than 1.1 m<sup>3</sup> shall belong to collection companies, while dustbins (110 l) shall belong to the citizens.

**c. Recycling**

- The construction of eight public recycling centres shall be examined as soon as possible. It shall be minded that the main purpose of public recycling centres is the prevention of illegal dumping.
- It does not seem to be necessary for the Municipality to construct any special facility for recycling. However, the Municipality as well as the Central Government shall promote recycling activities in order to avoid stagnation due to decrease in the prices of recyclable materials. If necessary, they should offer incentives or subsidies for recycling activities because of the savings from collection and disposal costs to be gained.

**d. Incineration plant**

- In response to the need to reduce waste disposal amount, the citizen's intense awareness concerning environmental conservation and demand for heat supply in the area, the introduction of the incineration plant (phase 1; capacity 10 tons/hour) shall be examined.
- In order to get financial aid from international lending agencies for the construction of the plant, the feasibility study of the project shall be conducted as soon as possible.
- In order to reduce the financial burden and smooth the operation of the plant, full incineration may be performed step by step until 2010.

**e. Final disposal**

- The transfer of the landfill from Jawidz to Rokitono may bring about opposition to the Municipality from the nearby residents. Therefore, to obtain a consensus it is necessary to explain the impact of the establishment of the landfill site on the surrounding environment by using predicted data. The formulation of a periodical monitoring plan on environmental items, like water and air quality etc., is recommended.
- Proper lining of the new Rokitono landfill shall be conducted.

**2) Institutional Development**

For institutional development the following recommendations are proposed:

**a. General recommendations**

- In order to provide the optimum conditions for the implementation of appropriate MSWM at the local level, the national authorities should complete:
  - . The national MSW-policy including the determination of appropriate target years for implementation of specified (minimum) services complying with the standard applied. After determination of the policy, a period of at least 4-6 years should be settled for implementation and gaining of experience before new demands are imposed.
  - . The necessary legislation including appropriate administrative tools for municipalities' implementation of compulsory waste service. With the administrative tools, the municipalities could control and supervise the private companies involved in the MSWM.
  - . The necessary legislation that will provide appropriate tools for the acquisition of land under compulsory powers in order to facilitate localization of the waste treatment and disposal facilities needed.
  - . The necessary tools for the implementation of competitive bidding including preparation of a general regulations concerning Tender Works.
  - . The necessary financial tools for financing local MSWM through local taxation and raising loans for feasible projects.

- Establishment of a new regional authority responsible for licensing waste utilities. This new authority will supervise the performance of these utilities and whether environmental standards are met. This duty will be enforced particularly during the updating of the licences, which should take place every 4 years. Non-compliance and violation of the environmental standards would lead to confiscation of license and termination of operation.
- To compensate for the urgent need for improved surveillance during construction, provincial authorities should carry out a more intensive supervision of the projects to ensure that environmental protection measures are implemented.
- In order to heighten public awareness, education programmes should be implemented. Schools and the media are the best ways to reach the public.

**b. Recommendations for Lublin Municipality**

**i. Establishment of the Department of MSWM**

A clearer division in responsibilities and duties in MSWM is necessary to secure municipal control over the activities, and an unified and better service to the citizens. Furthermore, the division of responsibilities and duties for compulsory municipal services would entail informing the citizens of the definition of the various level of services, the methods in the handling of complaints and – most importantly –the determination and collection of fees.

Generally, a Department wholly responsible for Municipal Solid Waste Management must be formed. The department shall be responsible for overall planning, administration and control, and supervision of executing bodies.

**ii. Executing bodies**

The execution of compulsory municipal waste services, operation of facilities etc., will be tendered to private companies and also entrusted to companies to be established under municipal jurisdiction.

After the privatization of MPO, we recommend that full control and supervision should be carried out on the activities of the company by the administrative tools of the Municipality. However, since the Municipality is not granted with these tools, contracts on municipal services may be given directly to the

company, provided that the contract price for tendered districts were used as basis of payment.

We recommend the execution of the following waste services:

- Tendering by district (min. 25% of the total volume).
- The remainder is given to privatized MPO, using the contract price for the tendered districts as basis of payment.

**iii. Determination and collection of fees**

- It is desirable to have a waste fee system based on the discharge amount (weight). However, it would be difficult at the moment to calculate waste fees by measuring each generation source. Therefore, the establishment of a waste fee system which consists of collection fees (zl/person/month) and solid waste tax (for treatment and disposal costs) in accordance with income, is recommended.
- Lublin Municipality, in cooperation with other local governments, is highly recommended to make a request to the Central Government for the modification of the law related to MSWM, to enable local governments to regulate the above mentioned waste fee system and fee collection system.

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