12 FINANCE

The financing of solid waste services in Bucharest, particularly capital investment, has been greatly constrained and a result, the opportunity to improve the quality of SWM services to the citizens of Bucharest has been limited.

It is proposed that MB finance SWM services through a waste tax which MB is empowered to levy under Law 27, 1994. There will be separate household and business waste taxes. The deciding reasons are:

1. MB is too financially constrained to finance SWM from its general tax revenues;
2. the waste tax is the only option to expand MB's revenue base; and
3. tariffs will cease to be collected because contractors for collection and haulage and street sweeping will be remunerated directly by MB.

1. Financial Policy

It is recommended that MB adopt the following financial policy for SWM, based on the introduction of the waste tax:

1. the objective of implementing the waste tax is to make SWM financially viable rather than changing consumer behaviour;
2. the principle of cost recovery from the waste tax is established. As a minimum, all operating costs of collection and haulage, disposal and street sweeping are recovered. This includes amortisation costs of contractors equipment.;
3. contractors are remunerated so that they can finance both their operating and equipment expenditures;
4. where it is feasible, capital costs, primarily those of building landfill sites, should also be recovered. If it is not feasible, investment should be financed from loans or other means. Financing costs of loans should be fully recovered from the waste tax;
5. household and business waste taxes are structured which optimise revenues and are socially equitable;
6. waste taxes are set with due consideration to the affordability of citizens and businesses, as well as, to their willingness to pay; and
7. procedures for collecting the tax must ensure a good rate of collection.

Forecast SWM expenditures, an assessment of their affordability by MB and citizens, and proposals for financing SWM over the Master Planning period are presented below.

2. Forecast SWM Expenditures

Figure 12-1 below shows how total forecast SWM expenditures for Bucharest move over the Master Planning period from 1996 to 2010.

The peak between 1997 and 1999 shows the impact of project investment in landfills on total costs which peak at US$21.9m in 1998. Disposal costs reach 76% (1998) and 56% (1999) of total SWM costs.

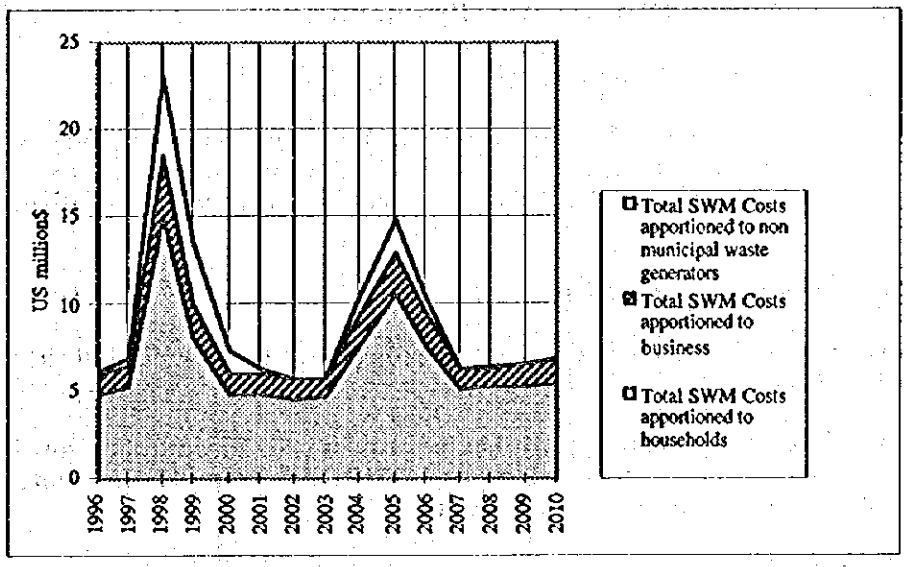


Figure 12-1 Forecast Total Expenditures for Solid Waste Management in Bucharest 1996 to 2010

The peak between 2004 and 2006 shows the large post project investment costs of constructing additional embankments at Balaceanca and Cretuleasca sites and three new disposal sites at Berceni, Afumati and Jilava.

The Municipality will find it very difficult to finance project expenditures in 1998 and 1999 and the substantial post project investment from 2004 to 2006, solely from the waste tax and ensure full cost recovery of SWM expenditures. An increase in the household waste tax of approximately 230% in 1998 is required to fully recover costs. This increase is too large to implement and MB will have to consider alternative ways of financing the disposal project.

3. Affordability of SWM by MB

A comparison of forecast SWM expenditures with forecast Municipal expenditures over the period, shows that SWM costs average only 1.21% of Municipal expenditures. This is very low when broadly compared to other cities in both developing and developed countries. Therefore, in general terms **SWM expenditures, including the project costs, are affordable by the Municipality.**

4. Citizens' Affordability

A comparison of per capita SWM costs to per capita GDP over the period indicates that **forecast expenditures SWM are also affordable by citizens.**

The average percentage of per capita SWM costs to per capita GDP is **0.31%** over the period; peaking at **0.94%** in 1998. These percentages compare favourably with international comparators for both developing and developed countries.

Although SWM is affordable, there is an unwillingness of citizens to pay higher tariffs for SWM unless service quality improves. MB and GoR have also expressed reluctance to impose a waste tax which is much higher than current tariff levels. It would be unacceptable to citizens and MB to raise the tax by **230%** in 1998 to finance the project. Alternative ways of financing SWM expenditures need to be considered.

5. Financing Future SWM Expenditures

1) Recurrent Expenditures

Future contracts for **collection and haulage** and street sweeping will be fully financed from the waste tax and should enable efficient contractors to recover both their operational and capital costs. Likewise, operational expenditures of **disposal** will be fully financed from the waste tax.

2) Capital Expenditures

It is not possible to recover the proposed project investment in landfill sites solely from the waste tax.

Therefore, it is recommended that the project is financed from a soft loan from an international lending agency and that the loan is repaid from the waste tax. Projections of SWM expenditures with a loan are given below.

Alternative financing from 1) MB's general taxation and 2) GoR capex subventions, 3) Romanian banks, 4) issuing Municipal bonds, were considered. However, MB is too financially constrained to afford the project from its general tax revenues. GoR capex subventions are mostly prioritised to "work in progress" projects rather than new project investment. However, partial financing from the state budget could be considered.

It is recommended that the **post project investment** costs (2004 to 2006) which are considerable and cannot be wholly funded from the waste tax, are financed from a similar soft loan or possibly from a concession.

3) Soft Loan Financing from an International Lending Agency

Figure 12-2 below gives total forecast SWM expenditures over the 15 year period. assuming that 75% of the project investment costs are financed by a soft loan.

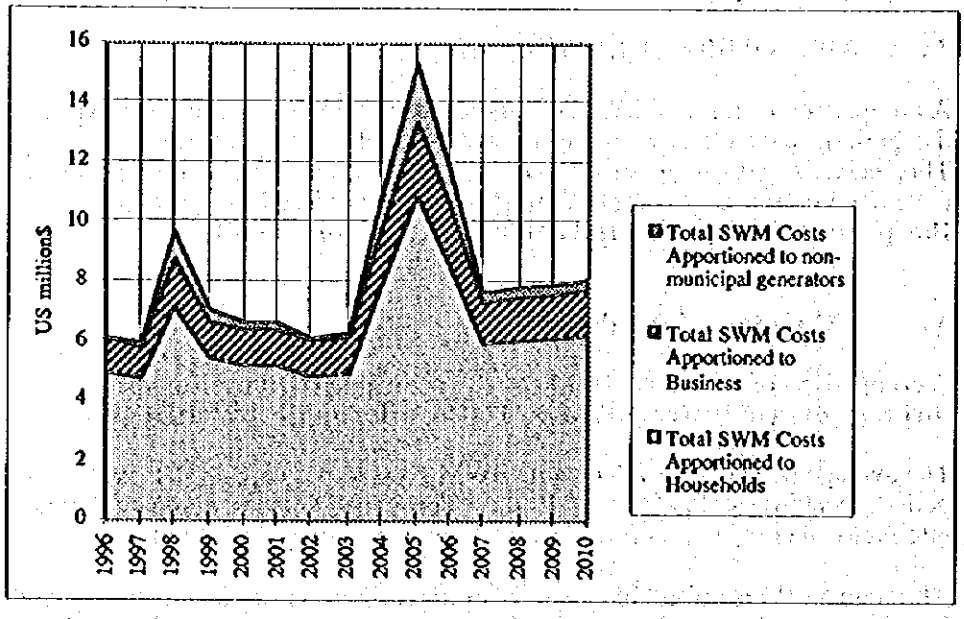


Figure 12-2 Forecast Total Expenditures for Solid Waste Management in Bucharest with a Soft Loan

The first peak between 1997 and 1999 shows the impact of the project investment. A comparison of the chart with SWM expenditures in Figure 12-1 above (without a loan) shows how financing the project with the loan significantly smoothes the cost profile over the project period between 1996 to 1999. **Forecast SWM expenditures are also affordable by citizens.**

Projections of household waste tax, which assume full cost recovery and loan financing, indicates that the household tax only needs to raised by about 24% between 1996 and 1998, to Lei 560 in 1998. This is feasible and would be acceptable to both citizens and government. Figure 12-3 below illustrates how the monthly household waste tax moves over the 15 year period.

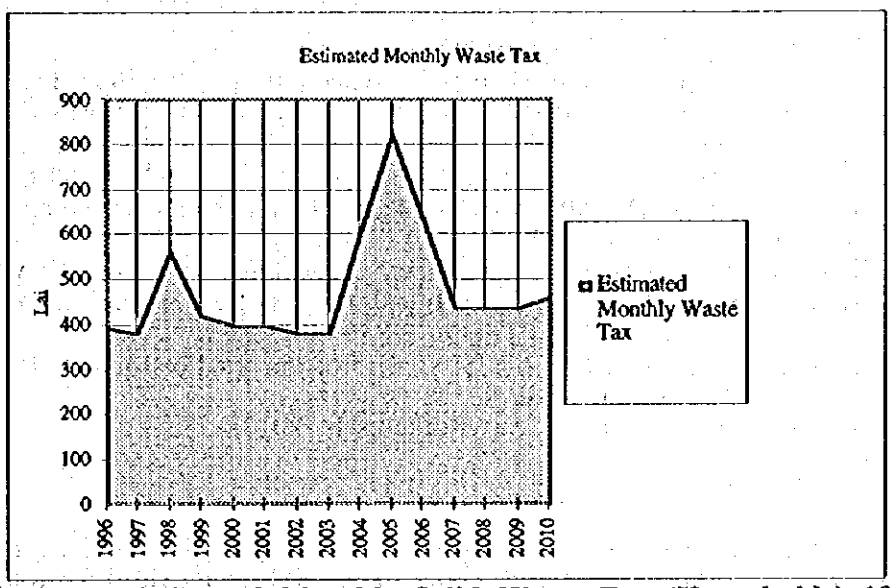


Figure 12-3 Estimated Monthly Solid Waste Tax (Households) 1996 to 2010

6. Setting and Implementing the Waste Tax

The waste tax should be set over the master planning period to recover:

1. operating costs of collection and haulage, disposal and street sweeping;
2. project loan financing costs;
3. any project costs not financed by the loan; and
4. to provide savings for post project investment costs (2004 to 2006).

Under the proposed technical assistance (TA), the waste tax will be modeled taking each of the above into account, account, to ascertain the tax rates which will assure full cost recovery taking households' and businesses' affordability and willingness to pay into consideration. As far as possible the tax should be smoothed over the period but without compromising cost recovery. See Chapter 1 in Part C of the Summary for details of the TA.

Savings for post project investment costs should be established to contribute in some way to future loan financing costs (and any unfinanced portions of the investment) or the costs of a concession(s). The level of savings and their absorption in the tax will be modeled under the TA. and will take into account the likely cash flow over the investment period.

An investment fund or reserve will need to be set up with appropriate fiscal controls to accrue the savings.

13 STAGED IMPLEMENTATION PLAN

This chapter shows key targets and goals to be achieved and actions to be carried out to implement the master plan. The master plan period is 15 years from 1996 to 2010, which is divided into 2 phases, i.e., Phase 1: 1996 - 2000, and Phase 2: 2001 - 2010. Key targets and actions are summarized below. Details are shown in the Master Plan Report Chapter 12.

A. Collection and Haulage

Most of the collection targets should be achieved by the end of the 1st phase. Main targets and actions include the following:

1. 100 % collection coverage by 2000
2. Minimum frequency by 2000 should be once a week. By 2005, twice a week collection should be provided for all the households, and at least twice a week collection for business waste.
3. Replace all RASUB's existing collection trucks by recommended types, i.e., Compactor (16 m^3) with two mechanical lifts and Container compactor with mechanical arm-roll by 1999.
4. Replace 110 liter bins with 240 liter plastic bins, with casters, which are compatible with compactor (16 m^3) with two mechanical lifts. 120 liter bins should be used for individual houses.
5. Eliminate shortage of bins by 1998. Use of imported plastic bins is the most economical and recommendable.
6. Become the cleanest city in eastern Europe by 2010.

B. Street Sweeping

Main improvement point is to introduce patrol cars for monitoring and identification of streets which need sweeping. By 2000, patrol cars will be provided for rough stone roads in the central areas within the inner beltway, and by 2010 patrol cars will be introduced for suburban trunk roads.

C. Disposal

It is planned that the Bucharest Municipality will execute the project "Development of 3 landfill sites" by acquiring soft loan from an international lending agency. The project has the following components:

1) Improvement of the existing Glina site.
2) Construction of a new landfill site in Balaceanca.
3) Construction of a new landfill site in Cretaleasca.

Construction of another 3 landfill sites in Berceni, Afumati and Jilava will be required so that they can be used in 2006 and thereafter.

D. Waste Utilization

The target recycling rate (10 -15 % of household waste generation) should be achieved by 2000.

A major recommendation is that recycling boxes should be provided on streets in which people deposit recyclable materials. 1,000 boxes may be necessary. By 1996, MB should establish a system to issue licenses to collectors who collect materials from those boxes. An option is that collectors should provide collection bins, and in return obtain the licenses to collect recyclable materials from them.

E. Institutional Arrangements

Collection & Haulage
MB will use RASUB and RGR and other collection service providers as contractors. MB will use at least 3 contractors in Phase 1. All sectors will be contracted out within 1 to 2 years. During Phase 1, RASUB should be considered for a program of institutional strengthening. Privatization of RASUB should also be considered in Phase 1.

Street Sweeping
In Phase 1 street sweeping will be initially provided by RASUB but will be separately contracted out from collection and haulage to the private sector when conditions are appropriate. Participation of many sweeping contractors is expected.

Disposal
MB will establish a Disposal organization by March 1996 responsible for waste disposal. The preferred option is a Foreign Joint Venture Company. MB receives technical assistance to set up new disposal organisation. MB agrees performance contract with FJVC.

Maintenance of RASUB 's Waste Trucks
In Phase 1 RASUB will begin contracting out maintenance service for waste trucks.

Monitoring of SWM Contractors
Monitoring responsibility will split between the Sectors and PSD. Each Sector will establish a section responsible for service monitoring before MB starts using contractors. Each Sector will carry out daily monitoring. PSD will be responsible for preparation of monitoring plan, analysis of monitoring data, monitoring compliance with contract terms and conditions, and application of sanctions to contractors when necessary.

F. Finance

Waste Tariff/Tax
The Waste Tax and the joint contracting out of collection/haulage & street sweeping are simultaneously implemented. Contractors cease to levy tariffs, and are remunerated through their contracts which are financed from the waste tax.

In principle 100 % of operation and investment costs of SWM should be recovered. However, if it is difficult in Phase 1, to recover 100 % of total SWM costs from the proposed waste tax, an option is to set the tax to cover SWM costs excluding or partly covering disposal investment costs. By Phase 2, all SWM costs should be recovered through the waste tax.

Procurement of Waste Trucks
In Phase 1 RASUB and private sector contractors will be responsible for purchasing their own trucks and equipment. MB should set contract remuneration to enable contractors to finance their equipment purchases

Note: If RASUB is transformed into SALUB, SALUB will substitute for RASUB in the above.

G. Public Education & Information Program

MB will prepare and implement a public education program for the citizens. The program will cover waste handling manner and recycling, etc. The program will also inform the citizens of new SWM developments.

H. Training of SWM Personnel

Regular training should be provided for SWM personnel (both managers & engineers) in the public and private sectors.

I. Research & Development (R & D)

MB should establish a R & D section responsible for improvement of solid waste management standards. R & D topics will include standardization of disposal methods according to area conditions, collection efficiency improvement and recycling technology, etc.

Part B

Summary of Feasibility Study on the Development of the 3 Sanitary Landfill Sites in Balaceanca, Cretuleasca and Glina

♦ 1 PROJECT BACKGROUND, OBJECTIVE AND NECESSITY

1. Background

This project "Development of the 3 sanitary Landfill Sites in Balaceanca, Cretuleasca and Glina" was identified through the formulation of master plan for solid waste management for Bucharest.

At present, Bucharest has one landfill site in Glina, which has been used since the mid 1970's. The site is managed and operated by RASUB, a public service providing company controlled by the Bucharest municipality. (This company was a state company in the former regime).

Open dumping is practiced on the site. There are no facilities to control environmental pollution. Naturally, the current open dumping practice in the Glina site has been causing environmental pollution and public health risks to local citizens living nearby the site.

At present, it is estimated that annual waste disposal quantity at the Glina site is 490,000 tons. It is projected that in 2010, the disposal quantity will increase to 820,000 tons.

2. Objectives

The major objective of the project is:

1. to develop final disposal sites in the 3 areas; Balaceanca, Cretuleasca and Glina which have capacity to dispose of all solid waste (except for hazardous waste) collected from the Bucharest municipal area, in sanitary and environmentally sound manner without causing significant public health risks to local citizens.
2. to serve as a national model of landfill
3. to diffuse sanitary landfill technology to other localities

3. Project Components

The project "Development of Landfill Sites in Balaceanca, Cretuleasca and Glina" has the following 3 construction components:

1. Construction of a sanitary landfill site in Balaceanca
2. Construction of a sanitary landfill site in Cretuleasca
3. Improvement of the existing landfill site in Glina

Locations of the 3 sites are shown in Fig. 3-1. Necessary engineering services are included in the project. In addition, the project has the following component:

4. Diffusion of sanitary landfill technology to other localities

4. Executing Agencies and Beneficiaries

1) Executing Agencies

The executing agency for the first 3 components shown in the above item 3 will be the Bucharest Municipality. Public Service Department of the municipality is a key department responsible for the project implementation.

Ministry of Public Works and Regional Planning will be responsible for the 4th component (diffusion of sanitary landfill technology to other localities).

2) Beneficiaries

Beneficiaries for the first 3 components (construction of the 3 landfill sites) are the citizens of Bucharest. Local residents living in villages situated to the east of the planned Balaceanca landfill site in the Agricultural Sector will be beneficiaries of a new access road which is included in the Balaceanca site construction component.

Beneficiaries of the 4th component (diffusion of landfill technology to localities) will be persons involved in landfill design and operation both in local governments and in disposal service providing organizations.

♦ 2 OPTIONS OF WASTE DISPOSAL

The current project is the sanitary landfill project. In the Master Plan (Part A Chapter 8 of this report), a few different disposal options including sanitary landfill and incineration were studied before selecting the sanitary landfill as a major appropriate disposal method applicable to Bucharest. Full details on this subject are shown in the Feasibility Study Report Chapter 2.

♦ 3 SITES SELECTION, CONDITIONS AND ENVIRONMENTAL EVALUATION

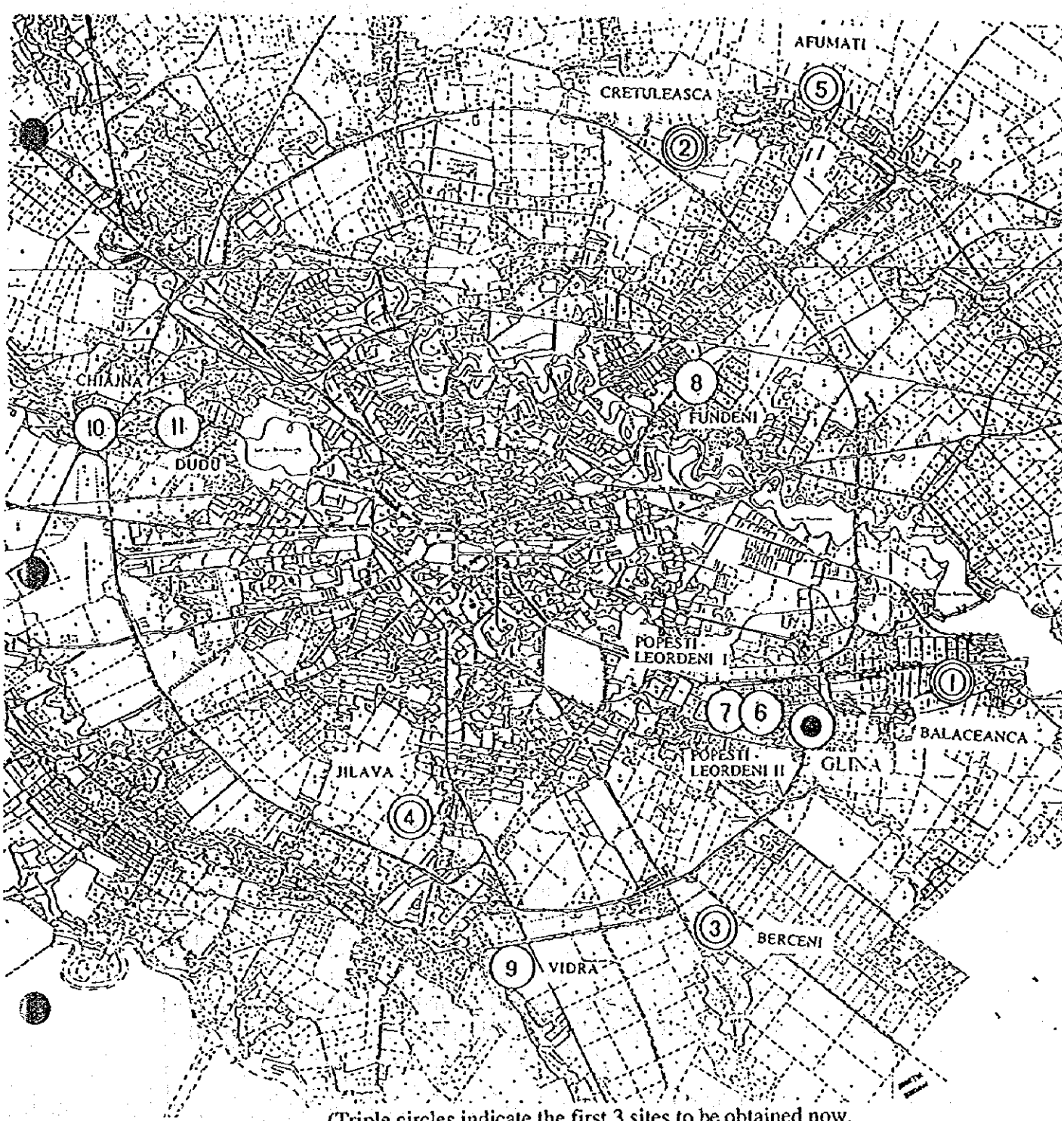
1. Site Selection

After 11 candidates disposal sites were identified and preliminary evaluated by the Study Team and the counterparts through the Master Plan Study, the Bucharest Municipality sent letters to each villages councils where the candidates sites are located to check possibility of using the candidates sites for waste disposal. Of the 11 the village councils, 3 village councils, i.e., Cernica council (for Balaceanca site), Stefanesti de Jos council (for Cretuleasca site) and Vidra council (for Vidra site) agreed that the Study Team would carry out a feasibility study for construction of disposal sites.

Of the 3 sites (Balaceanca, Cretuleasca and Vidra), the first 2 sites, i.e., Balaceanca and Cretuleasca sites have been selected for feasibility study because 1) it was estimated that the construction cost of Vidra site is higher than the other 2 sites, 2) Balaceanca site construction cost was estimated to be the lowest among all the 11 candidate sites, and 3) through the Master Plan study, it was considered advisable for the Bucharest Municipality to acquire 2 new sites as soon as possible in addition to the existing Glina site for economical waste haulage.

The Master Plan proposes that the Bucharest Municipality should acquire 3 more sites for waste disposal in Berceni, Afumati and Jilava so that these sites can be used after filling up the planned sites in Balaceanca and Cretuleasca as well as the existing Glina site.

The project sites as well as other sites are shown in Fig. 3-1.



(Triple circles indicate the first 3 sites to be obtained now.
Double circles indicate the other 3 sites to be constructed later.)

Fig. 3-1 Location of Candidate Sites

2. Description of the Project Sites

1) Cretuleasca Project Site

The Cretuleasca project site is within the Stefanesti commune, on the right bank of the Pasarea river. Cretuleasca, Stefanesti de Jos and Stefanesti de Sus are at a short distance downstream on the river banks. Proximity of the water front and Cretuleasca village (500m) makes this location not very favorable from the environmental point of view.

The project site is almost classified as pasture land, but actual informal use is crops (maize). It seems that about 7ha of the land within the limits of the project site could be privately owned by 4 households of Cretuleasca. The bottom of the site depression is used for informal and illegal dump of waste.

2) Balaceanca Project Site

The Balaceanca project site is within the Cernica commune, on the right bank of the Dimbovita river, and between 2 villages at equal distance: Glina and Balaceanca. Distance to these villages is about 1km. Distance to the actual waste disposal site is about 3 km, to the west.

The project site is a part of the communal and natural pasture land of the Balaceanca village. Within the site, 6 households pay land use rights for individual cultivation of maize crops. Pasture land is mainly used by cattle owners of the western part of Balaceanca, but this pasture is secondary for its quality and location in comparison with other pasture land sites, and for Balaceanca people on a whole. Pasture land users pay an annual land use fee to the commune.

The site is also used for informal and illegal dump of solid waste. A small part of the project site is still remaining as swamp, with natural vegetation and water surface.

The western escarpment of the project site is an important historical site of the Glina culture (2600 - 1900 BC). The site covers a period from 3000BC (neotlithic) to the first century (Dacic settlements). The project must obtain the approval of the National Commission of Historical Monuments (Ministry of Culture). Protection must be considered.

3) Glina Project Site

The Glina project site is almost within the Popesti Leordeni commune, just at the limit with the Glina commune. The project site is shared by both communes, since 1.7% of the land area of Popesti Leordeni, and 0.36% of the land area of Glina commune are registered as landfill. The site is immediately surrounded by the villages of Popesti Leordeni and Glina, and the Ring Road of Bucharest. Natural conditions are similar to those of the Balaceanca site project. The site has been used for 30 years, and the impact on the social environment is critical.

Actual use also includes informal uses like individual cultivation of crops (maize) and herding of cattle on pasture land. A small part of the project site is still remaining as swamp, with natural vegetation and stagnant water.

<u>National and Social Conditions</u>

Hydrogical, geographical and geological as well as social conditions of each site are shown in the Feasibility Study Report Section 4.2.

3. Recommended Measures for the Best Integration of the Project Within the Natural and Social Environment

Possible impacts of the project are explained in the Fearibility Study Report Section 4.3.

The following measures should be considered by the Bucharest municipality and discussed with the village councils for appropriate planning. The first measure below is however the jurisdiction of the Ministry of Culture. These measures are recommendations. They are as follows:

1. Protection of the historical patrimony of Glina, at Balaceanca project site.
2. Revival of the drinking water supply network of Glina, in order to make positive the impact of the project on drinking water resources.
3. Revival of the irrigation network at Cretuleasca village, in order to get acceptability of the project. Without local advantage of the project in terms of employment activity or increased income, and provided that standards of living are very low, social acceptability of the project would be difficult and would appear as a source of conflicts.
4. Improvement of accesses and road infrastructure for the people of Balaceanca, who are ready to accept the project if accesses and communications are improved.
5. Improvement of accesses and road infrastructure for the traffic of waste trucks between the Cretuleasca site and Bucharest, specially at crossing sections with the railway and the Ring Road.
6. Conservation of the living environment and improvement of sanitary conditions in each site, in order to integrate the sanitary landfill site in a clean environment. This measure is useful for the living conditions and health of the local people. It is also useful for the future acceptability of such projects in Romania. The purpose of this measure could be summarized as "a clean disposal of waste in a clean environment". Main actions are:
    a. Collection of solid waste from the local residents
    b. Cleaning and elimination of dumping sites
    c. Prohibition of illegal dumping
7. Information campaign concerning the environmental issues, in order to get full agreement of the people about the project, and to involve them in finding the most appropriate integration of the project within the site.

4. Conclusion

1) Acceptability of the Impacts at Site Level

The acceptability of the impacts means that the change of the initial natural or social conditions due to the implementation of the project appears to be acceptable as regards to the following:

1. Opinion and living of the local people around the project sites
2. National standards of living and sanitation
3. Standards of environmental quality
4. Environmental policy and environmental international conventions
5. Value that the Romanian people give to the culture and nature.

Given the application of recommended measures, the impacts of the project seem quite acceptable.

CRETULEASCA SITE
The impact on sound landscape is negative during the operation of the landfill site only. The impact on land property and land use rights is limited to the starting stage of the project. If measures are taken, the project will have positive effects on the social environment, and should not raise major problems on the quality of the environment .

BALACEANCA SITE
There will be no negative impact on the environment if recommended measures are taken. If measures are taken, the project will have positive effects on the social and cultural environment.

GLINA SITE
The impact on groundwater quality cannot be avoided because lining method is not possible. However, the measures which have been proposed will limit the contamination of groundwater, particularly compared with the actual open dump practice. Impact on the scavengers community is negative, unless an alternative solution is found by the municipality in order to ensure their basic income. If measures are taken, the project will be almost positive for the surrounding natural and social environment.

2) Acceptability of the Impacts at Bucharest Level

The projects have very few negative impacts on the environment, once measures have been taken. The effect is obviously positive and extremely important for the sanitation, cleanliness, and amenity of Bucharest.

THEN, ACCEPTABILITY OF THE PROJECT AT LOCAL LEVEL IS THE MAJOR ISSUE. IT SHOULD NOT BE A PROBLEM IF THE MEASURES AS THOSE RECOMMENDED ABOVE ARE TAKEN.

♦ 4 FACILITIES PLAN AND DESIGN

1. Planning and Design Policy

The facility plan and design were carried out based on the following policy.

1. Site selection from economic and environmental view points
2. Non-acceptance of hazardous waste
3. Control of incoming waste quantity
4. Introduction of sanitary landfill and pollution control
5. Satisfaction of EU disposal standards
6. Sanitary and good working conditions for site workers
7. Environmental monitoring
8. Application of a fill-up and cell method for landfill operation
9. Use of local materials and economical construction
10. Landfill operation is locally manageable
11. No-methane gas recovery because it is not economically feasible
12. Post-site closure land use considered in the design

2. Major Specifications of Facilities

1) Type of Facilities

The landfill facilities consist of the following 3 components:

a. Main facilities
b. Management facilities
c. Other facilities

Contents of each component are shown below:

a. Main facilities

- Access road from main road,
- Embankment to store the waste,
- Liner,
- Rainwater drainage system,
- Leachate collection and treatment.

b. Management facilities

- Truck scale,
- Control office,
- Management road,
- Environmental monitoring facilities.

c. Other facilities

- Net fence,
- Sign Board.

Table 4-1 shows how each facility is helpful for specific pollution control.

Table 4-1 Planned Environmental Pollution Control Measures for the 3 Sites in Balaceanca, Cretuleasca and Glina

Pollutants Generated from Landfill Sites	Possible Pollution if no measures are taken	Facilities Provided for Pollution Control
a. Dumped waste	Dumped waste may fly out of sites, and cause public nuisance.	1. Embankment 2. Fence 3. Cover soil
b. Leachate (waste water generated from waste deposit)	Leachate may contaminate surface and ground water.	1. Artificial lining (2 mm rubber sheet) on the bottom of the sites) 2. Leachate collection pipes 3. Leachate storage pond 4. Leachate transmission pipes 5. Leachate treatment at Glina sewage treatment facility 6. Rain water drainage around the sites 7. Monitoring facilities
c. Gas (Methane gas & CO^2 gas)	Methane gas may cause explosion.	1. Gas exhaust pipes 2. Monitoring facilities
d. Smoke, bad odor & rats and crow	These pollutants may reduce quality of life of local residents, and cause health risks to site workers.	1. Cover soil 2. Non-acceptance of municipal waste at part of the Glina site that is near to the Popesti-Leordeni village residents.
e. Waste, odor & noise from waste trucks	These pollutants may reduce quality of life of local residents.	1. Access road

Note: Artificial lining will be provided for the new sites (Balaceanca and Cretuleasca), but not for the existing Glina site as the provision of the lining is not possible for .

3. Design Outline

The major site characteristics are shown in Table 4-2. Design plan drawing of each site is given in Fig. 4-1, 4-2 and 4-3 respectively. A set of basic design drawings is in a separate book. Appendices report contains design calculations and quantity calculations.

Table 4-2 Major Site Characteristics

Item	Glina	Balaceanca	Cletuleasca	(Total)
Distance from center of the city (km)	9 km	12 km	12 km	-
Site Area (ha)	104.1	39.9	28.0	172.0
Landfill Area (ha)	99.2	35.4	22.5	157.1
Site Capacity (Million m^3)	6.53	4.15	1.44	12.12
Leachate Storage Pond Capacity (m3)	60,000	20,250	15,500	-
Major Environmental Protection Measures and Facilities	See Table 4-1			-

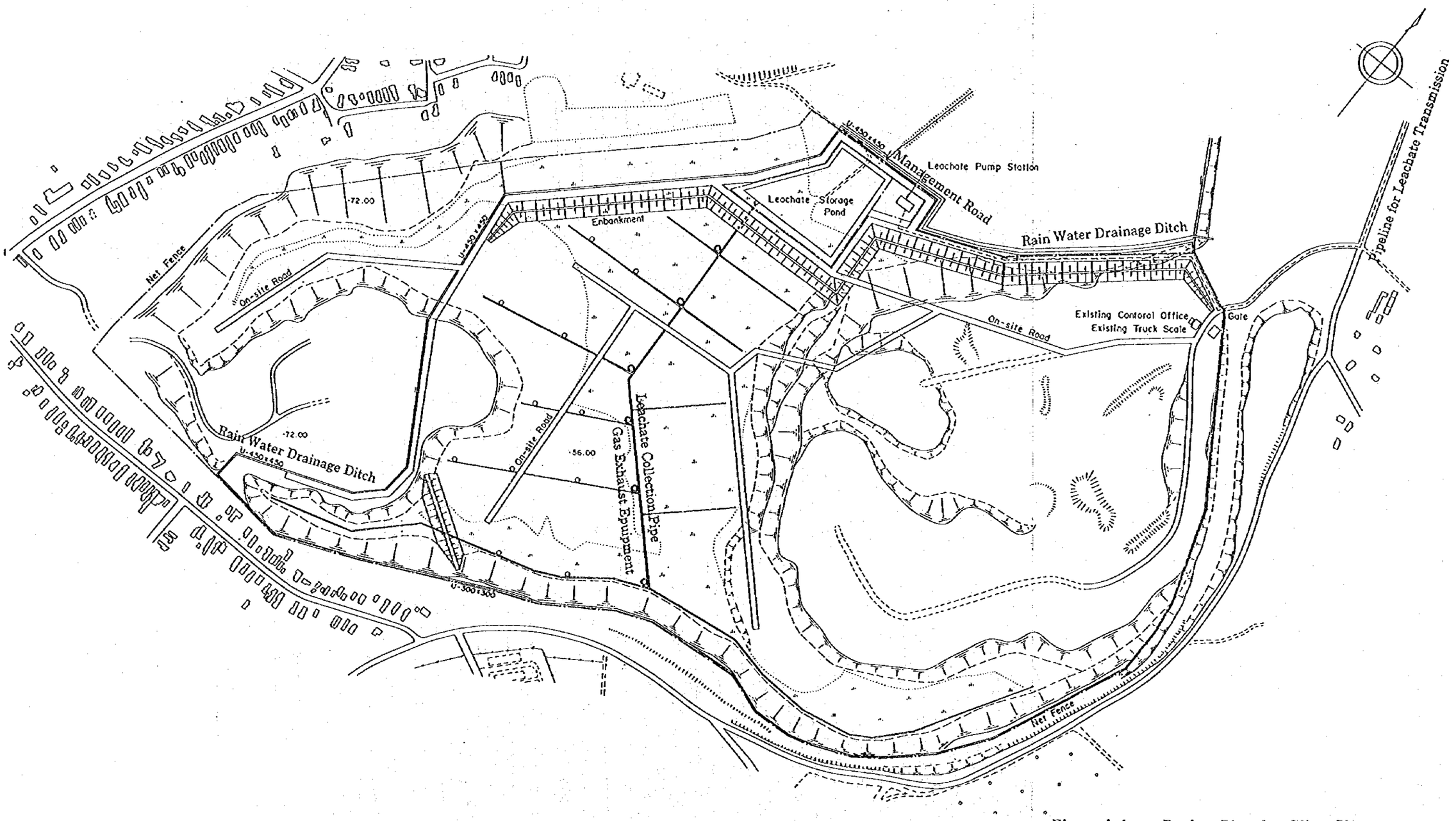


Fig. 4-1 Design Plan for Glina Site

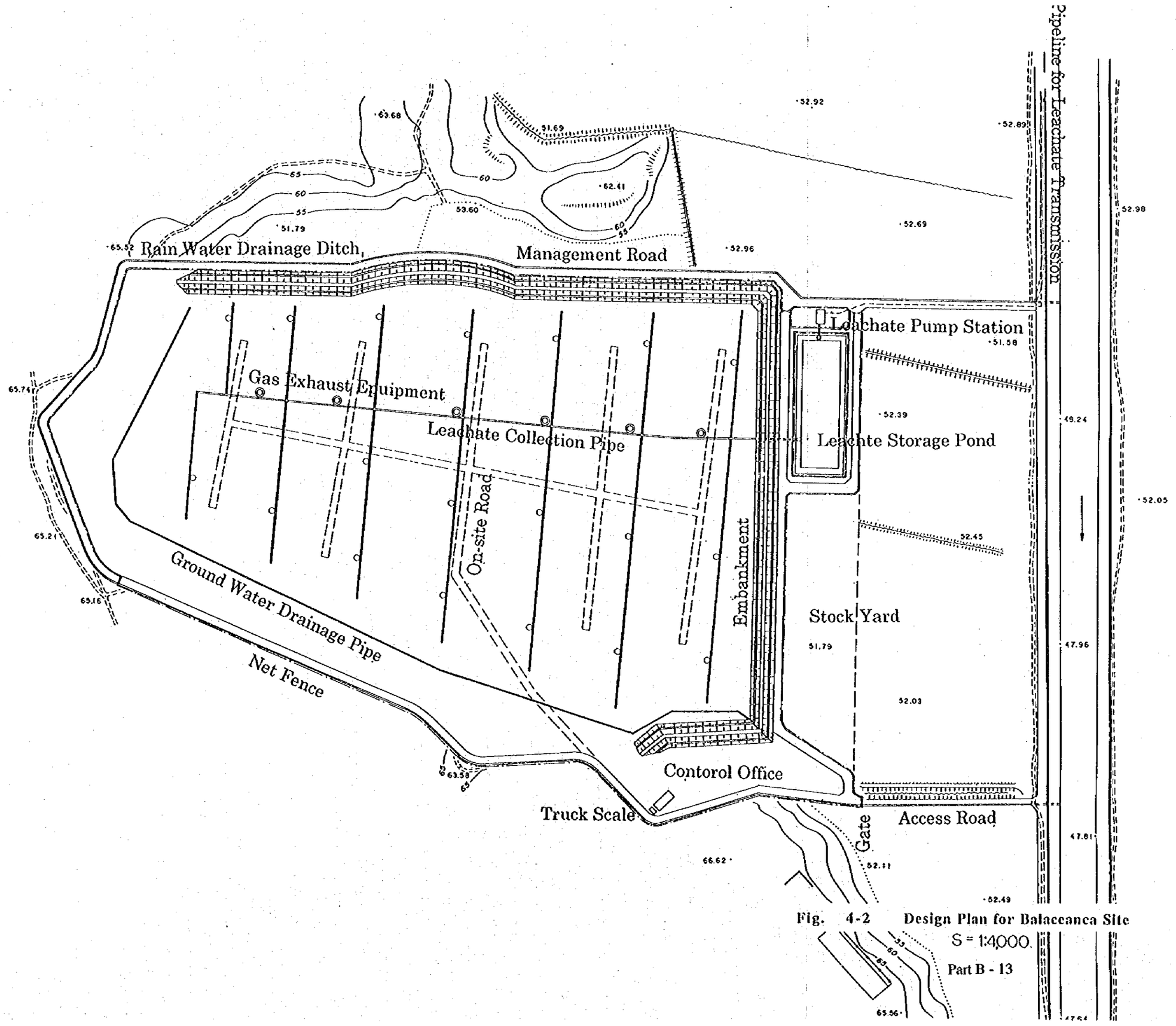


Fig. 4-2 Design Plan for Balaccanca Site

S = 1:4000.

Part B - 13

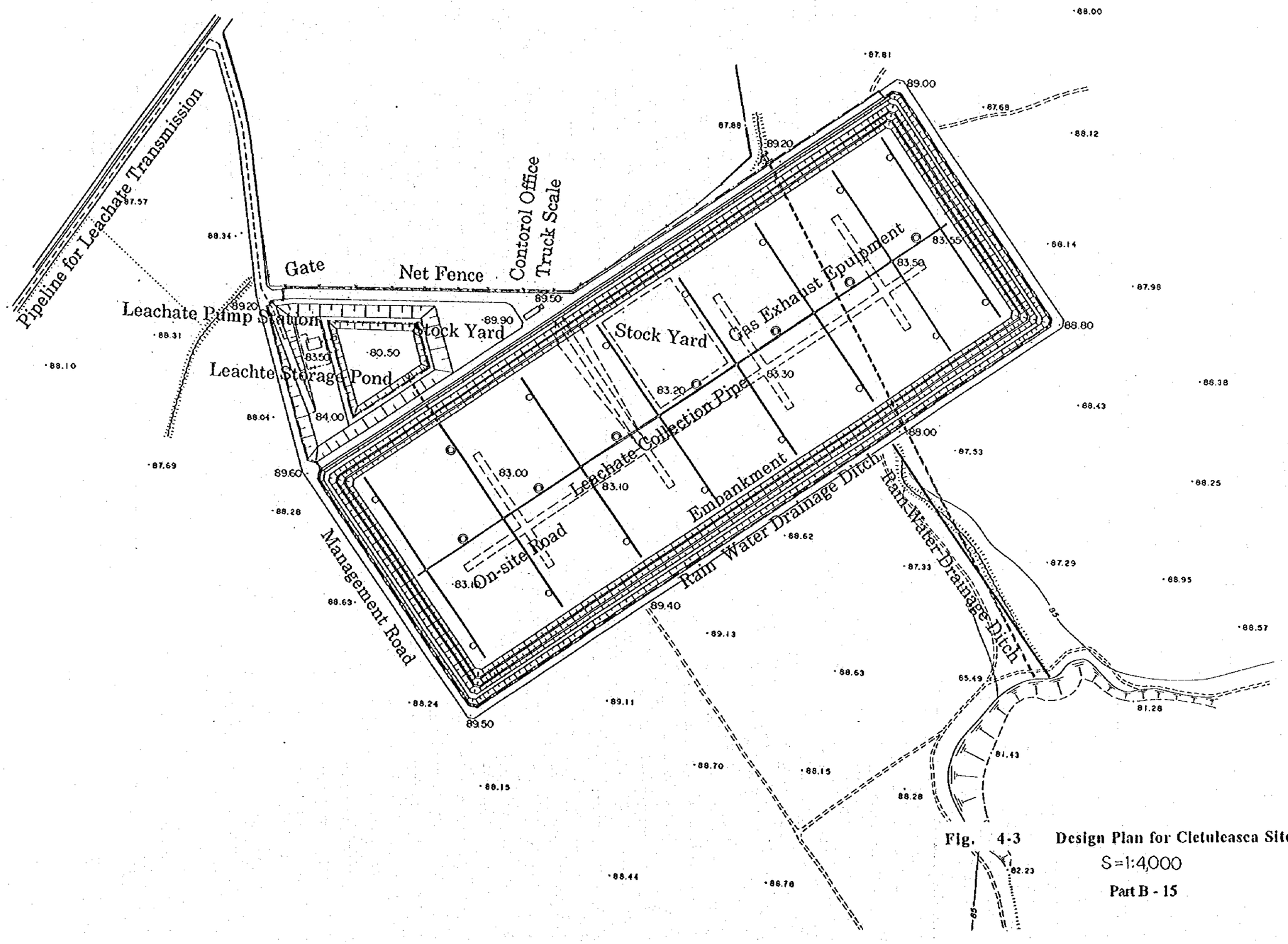


Fig. 4-3 Design Plan for Cletuleasca Site

S=1:4,000

Part B - 15

♦ 5 PLAN FOR SITE OPERATION AND ENVIRONMENTAL MONITORING

1. Site Management Activities

Conditions of the planned sanitary landfill sites equipped with necessary environmental protection facilities can become as bad as that of an open dumping site if there are no proper site management activities. Necessary site management include the following:

1) Staff the site with a site manager and qualified engineers
2) Control of hazardous waste and quantity checking
3) Make weekly and monthly plan for use of landfill area
4) Inspection of site and off-site areas
5) Monitor labor and health conditions of site workers
6) Inform the citizens of who is responsible for site management

2. Landfill Operation Method

The solid waste must be sufficiently compacted so as to stabilize the landfill foundation and prolong use period of landfill. A layer of cover soil must be systematically placed after landfilling each layer of solid waste.

The cell method is recommended for sanitary landfill in view of large area of landfill, and up-fill method is recommended for bedding and compassion. Daily covering by soil should be done. The method is shown in Fig. 5-1 ~ 5-5.

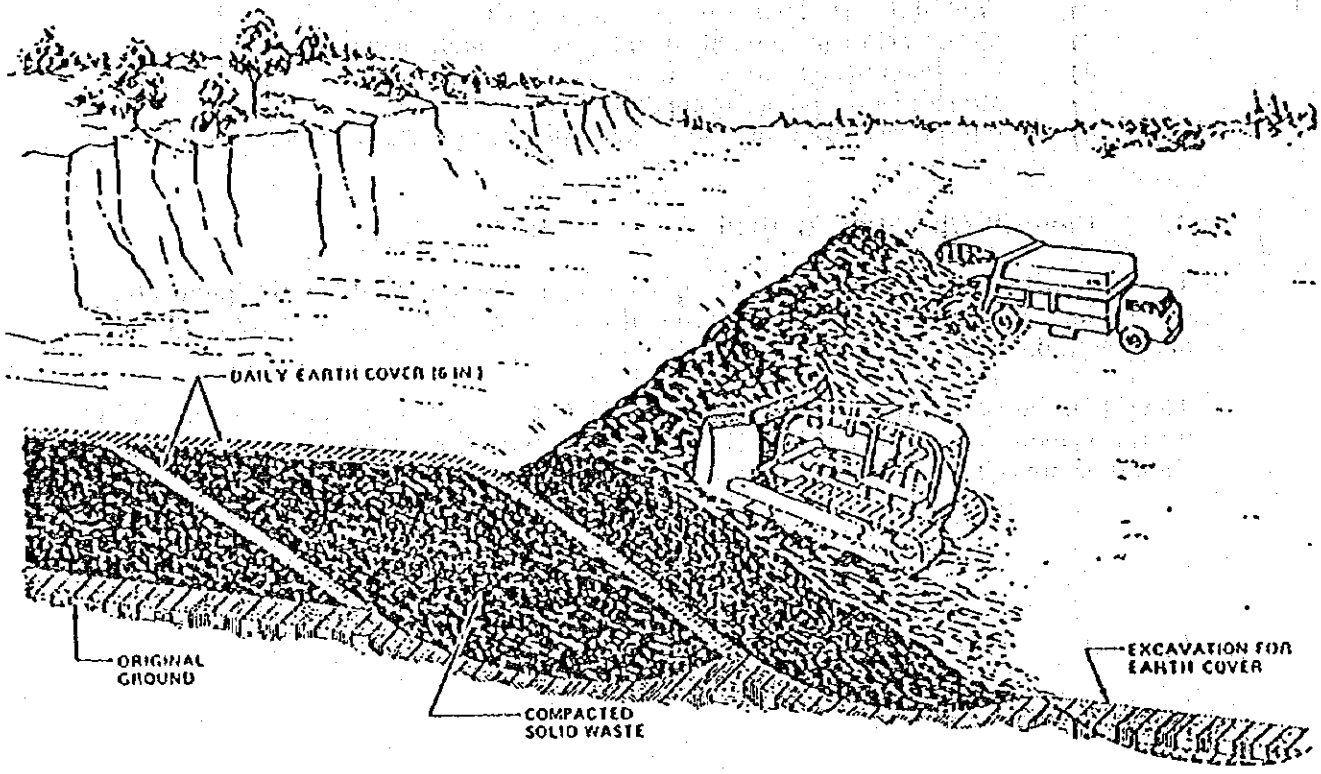


Fig. 5-1 Landfill Methods

Fig. 5-2 Method of Bedding and Compaction

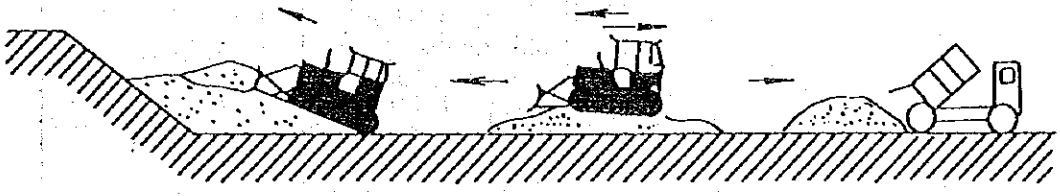


Fig. 5-3 Preparation of A Unit of Cell with the Up-fill Method

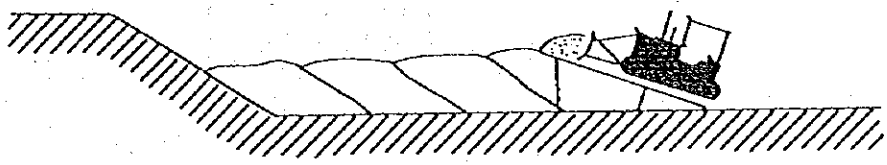


Fig. 5-4 Preparation of Cells with the Up-fill Method

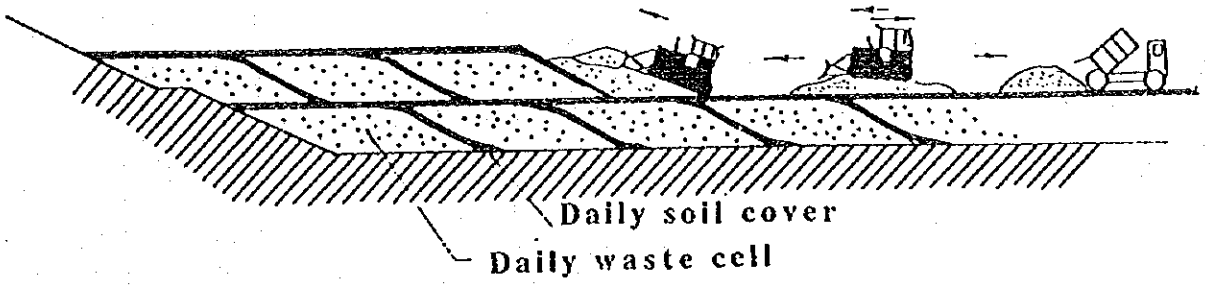


Fig. 5-5 Typical Landfill by Cell Method

3. Environmental Monitoring

1) Monitoring Scheme

Table 5-1 shows a proposed monitoring scheme. Monitoring parameters include ground water gas, settlement of ground level, order and leachate.

Table 5-1 Proposed Monitoring Scheme

MONITORING ITEMS	MONITORING FACILITY	MONITORING PARAMETERS	MINIMUM FREQUENCY
Ground water	Monitoring well	pH, CN, Pb, T-Hg, Cd, BOD, COD, SS, MPN, Color	1 / month
Gas	Gas out-let pipe	Temperature and humidity of original air, Temperature and volume of gas, component analysis (CH4, CO2, O2)	1 / month
Settlement	Settlement board	Settlement of ground level	1 / month
Odor	-	Monitoring parameters should be selected according to odor conditions	2 / year
Leachate	Leachate reservoir pond	pH, CN, Pb, T-Hg, Cd, BOD, COD, SS, MPN, Color	1 / month

♦ 6 SCHEDULE FOR SITE DEVELOPMENT AND USE

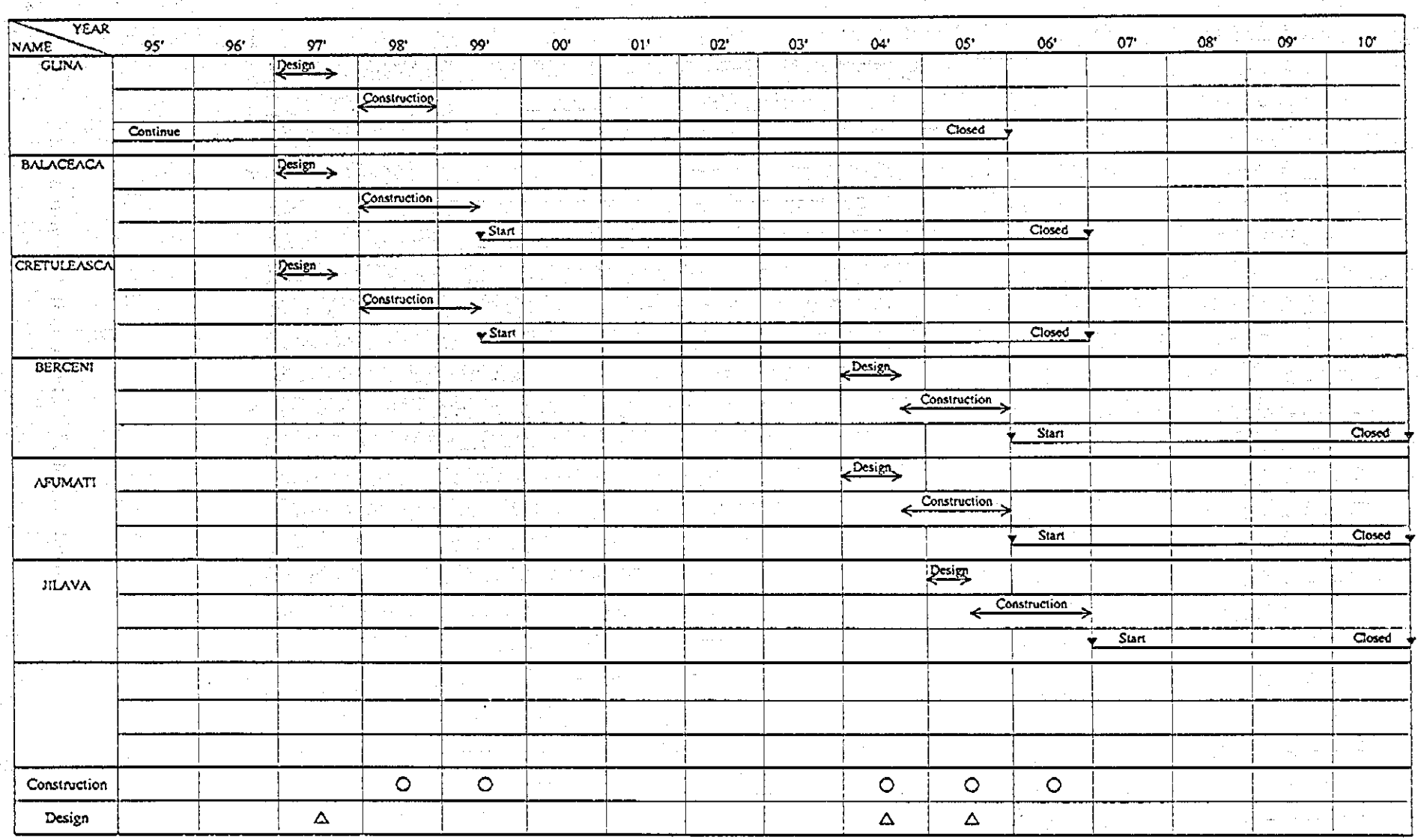
1. Schedule for Site Development and Use

Table 6-1 shows schedule for the development and use of the 3 sites. It is planned that the design and engineering services will start in early 1997, the construction will start in early 1998. The operation of the Glina site (newly constructed part) will start in early 1999, while Balaccanca and Cleturcasca sites will be open in the middle of 1999. It is planned Glina sit will be filled up by mid 2005, while the Balaceanca and Cretuleasca sites will be filled up by mid 2006.

According to the Master Plan, 3 more new landfill should be developed; Berceni, Afumati and Jilava so that they should be available after closing the 3 sites in Balaceanca, Cretuleasca and Glina. See Fig.6-1 for locations of the 3 additional sites, total area of these 3 sites (Berceni, Afumati and Jilava) will be 99 ha and have capacity of deposing 6.8 million m^3 of waste and cover soil. Total capacity of the 5 new sites (Balaccanca, Cleturcasca, Berceni, Afumati and Jilava) will 12.39 million m^3 (167 ha) and will be sufficient to meet the demand arising from 1996 to 2010.

Fig.6-1 **Planned Landfill Site Locations**

Table 6-1 Final Disposal Sites Development Schedule



2. Incoming Waste Allocation Plan

It is planned that the two new sites (Balaceanca and Cretuleasca) will open in the mid 1999. At that time, there will be 3 final disposal sites including the existing Glina site in Bucharest, and all these sites will be used simultaneously. Disposal waste quantity for each of the 3 sites are planned as shown in Fig.6-2. Balaceanca and Cretuleasca sites will be used for 7 years respectively starting from the second half of 1999.

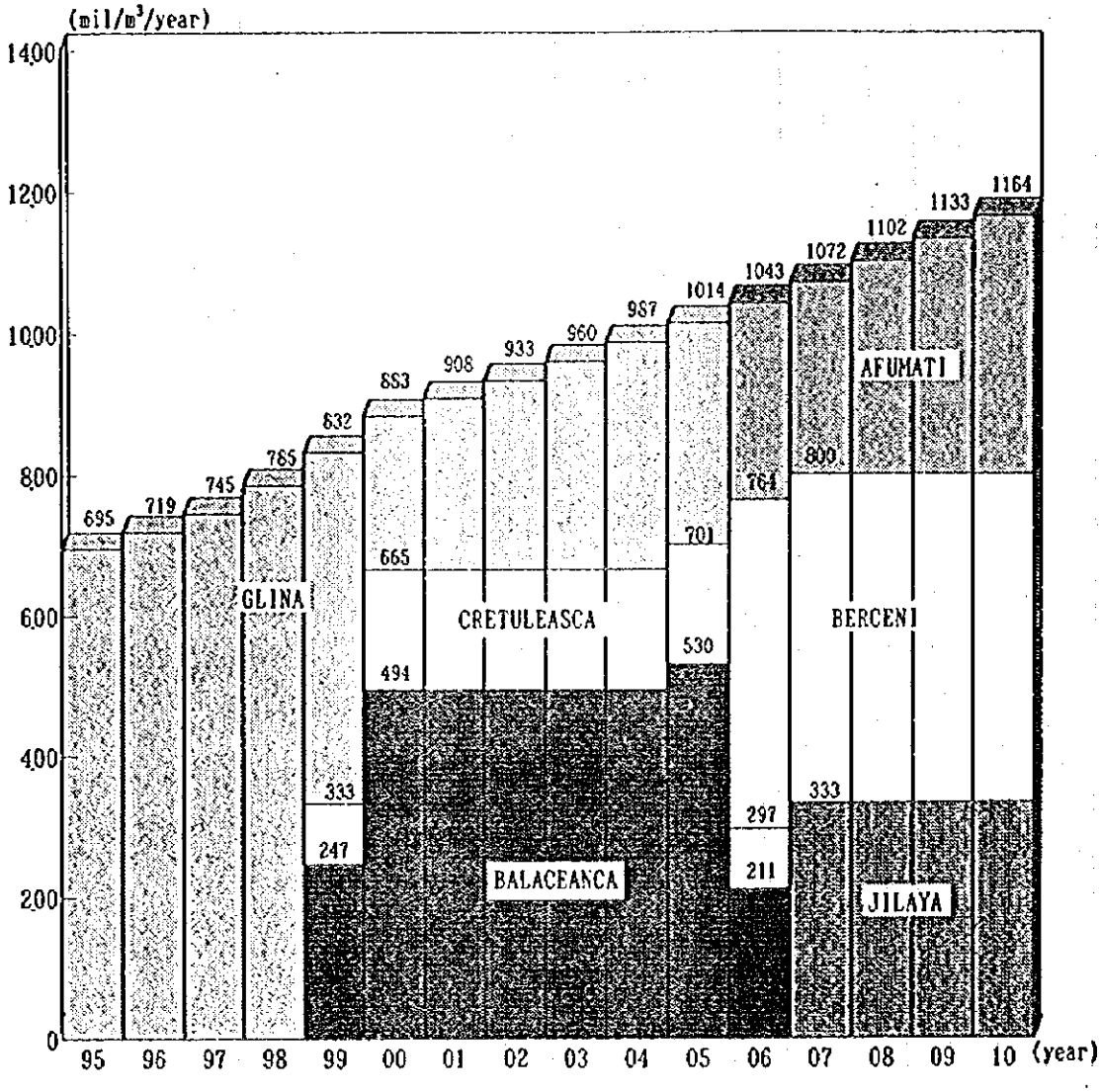


Fig. 6-2 Annual Disposal Volume and Allocation Plan

♦ 7 PROJECT COSTS

1. Project Cost Components

The project costs consist of the following components:

1. Investments
   - 1.1 Engineering services
   - 1.2 Technical assistance
   - 1.3 Construction works
   - 1.4 Equipment procurement

2. Operation and maintenance of the landfill sites

The above cost Items 1.3 (construction) and 1.4 (equipment procurement) as well as Item 2 (operation & maintenance) have been estimated based on the Romanian prices using an exchange rate of 2,000 lei/dollar which is the prevailing rate in 1995.

The Item 1.3 includes 1) overhead which is assumed to be 20 % of the direct construction cost, 2) 18 % value added tax, and 3) both physical and price contingency that is assumed to be 15 % altogether.

The Item 1.4 includes 1) 18 % value added tax and 2) 10 % price contingency.

2. Estimated Project Costs

Total project cost is estimated to be about $ 26 million. The estimated project costs are shown in Table 7-1. See Chapter 8 of the Feasibility Report for details. Total disposal costs including both the project costs and other disposal casts are also shown in the Chapter 8 of the same report.

Table 7-1 Project Costs

Unit: US dollar in 1995 price

	Balaceanca (a)	Cretuleasca (b)	Glina (c)	Sub Total a + b + c = (d)	Value Added Tax (18% of d) (e)	Total d + e = (f)
1. Investments 1.1 Engineering Services for Items 1.3 & 1.4	735,000	389,000	407,500	1,531,500	275,670	1,807,170
1.2 Technical Assistance	35,000	18,500	19,500	73,000	13,140	86,140
1.3 Construction Work including 15 % physical & price contingency	8,096,000	4,289,000	4,496,000	16,881,000	3,038,580	19,919,580
1.4 Equipment Procurement including 10 % price contingency	489,000	264,000	324,000	1,077,000	193,860	1,270,860
1.5 Total (1.1+1.2+1.3+1.4)	9,355,000	4,960,500	5,247,000	19,562,500	3,521,250	23,083,750
2. Operation & maintenance of Landfill Sites	1,351,951	683,760	967,844	3,003,555	0	3,003,555
3. Total (1+2)	10,706,951	5,644,260	6,214,844	22,566,055	3,521,250	26,087,305

Note:

1) Physical contingency and price contingency of the Construction work (Item 1.3) are assumed to be 5 % and 10 % of the original construction cost respectively. 10 % price contingency is assumed for the procurement of equipment. No contingency is assumed for other work items.
2) Tables 8.2-2, 8-2-3, and 8.2-4 of the Feasibility Study Report show details of the project costs.

♦ 8 INSTITUTIONAL ARRANGEMENTS

1. Recommendations for Institutional Arrangements for Municipal Waste Disposal

The preferred option is that MB form a joint venture (FJVC) with a foreign company to manage the disposal services. The FJVC is a secure way of benefiting from private sector involvement and gaining access to overseas expertise. The FJVC would initially manage Glina site and later Balaceanca and Cretuleasca sites. Ownership of the landfill sites and facilities would remain with the Municipality or the relevant beneficiary.

However, as an option the foreign partner might be offered the right of purchase or lease of the site for commercal development after its closure. This is might be a good way to attract a foreign partner.

If a foreign partner cannot be found, **it is recommended** that MB set up a Municipal Waste Disposal Administration (MWDA), subsumed under it, which manages the disposal services at Glina site.

Under this option **it is also recommended** that, Balaceanca and Cretuleasca sites are contracted out rather than operated by MWDA, as it is assumed that MB will have sufficient contracting capabilities by the time these sites become operational. Similarly, Glina could eventually be contracted out rather than managed by MWDA.

Since it remains uncertain whether a foreign partner can be found, arrangements for both organisational options are presented below.

It is recommended that maintenance is contracted out by the FJVC or the MWDA.

1) Organisational Arrangements for the FJVC

The FJVC is set up by a Local Government Decision and the Municipality would agree a performance contract with the FJVC. The contract would be monitored by a Waste Administration set up within MB specifically for this purpose.

The FJVC has a Board of Directors with representation from MB and the foreign partner. It is headed by a Director who reports to the Board. The organisational structure comprises operations, a technical section, a small personnel section and financial accounting and purchasing sections. Operations are organised by site teams.

2) Organisational Arrangements for the MWDA

The MWDA is set up by the Local Government Decision which transforms RASUB into the commercial enterprise SALUB. The MWDA has the same departmental and sectional structure as the FJVC, minus Balaceanca and Cretuleasca sites which are contracted out. It is headed by a Director who reports to the Vice Mayor in charge of this activity and the Public Services Department.

3) Financing Waste Disposal

The FJVC will be remunerated under a performance contract which is financed from the waste tax.

The MWDA's operating costs are recovered through the waste tax. Investment expenditures could be financed from either the waste tax, the State budget, a loan from the Japanese OECF, or through a combination.

2. The Project Management Unit

It is recommended that a Project Management Unit (PMU) is established within MB which is responsible for project management and implementation. The PMU would be headed by a senior executive from MB, supported by one Municipal employee and one local consultant over the 38 months of the project. Its responsibilities include:

1. overseeing the whole process of project execution;
2. a main point of contact for project execution between MB and the:
    - International Lending Agency;
    - Romanian Ministry of Finance;
    - International Engineering Services Consultants;
    - Construction Supervisor;
    - Construction Contractors; and
    - Involved ministries, eg MLPAT and MoE;
3. participation, without decision responsibility, in tendering the engineering services and construction contracts and;
4. monitoring the engineering and construction contracts for compliance with terms and conditions;
5. requesting loan disbursements;
6. providing logistical support for any Technical Assistance which is part of the project.

The PMU's responsibilities can be included in the loan agreement, or possibly under a procurement agreement, between the International Lending Agency and the Romanian side.

The PMU should also be provided with short term technical assistance by one international consultant to set it up.

♦ 9 ENGINEERING SERVICES AND TECHNICAL ASSISTANCE NEEDED

1. Engineering Services Needed

1) Type and Description of Engineering Services Needed

The following engineering services are required:

a. Topographic surveys,
b. Preparation of tender documents including detail design,
c. Assistance for tender evaluation,
d. Construction supervision,
e. Preparation of operation manuals,
f. Training of municipal personnel for management and operation of landfill,
g. Diffusion of landfill technology to other localities.

2) Required Engineers and Costs

It is estimated that the engineering services need foreign consultants of 48 man-months and local consultants of 138 man-months.

The total engineering service cost is estimated to be $1.8 million, of which $0.7 million is for detail design, and topographic survey; and $1.1 million is for supervision, tender evaluation, manual preparation, training and technology that will be provided during construction period. The ratios of the services costs to the construction cost including equipment cost are 3.2% and 5.3% respectively. The total is 8.5%.

2. Technical Assistance Needed

Technical assistance (TA) is required to establish the new waste disposal organisation and the Project Management Unit.

1) TA for Institutional Strengthening of the Waste Disposal Organisation

It is proposed that MB form a "disposal organisation" as a joint venture with a foreign company (FJVC) or, alternatively, a Municipal Waste Disposal Administration (MWDA) if a foreign partner cannot be found.

If the MWDA option is implemeted **it is recommended** that MB receive TA for the institutional strengthening of the the MWDA, to implement a:

1. a planning capability;
2. financial management and financial systems;
3. simple management information systems (mis); and
4. a system of objective setting and performance measurement.

The TA would be provided by two international consultants; one Financial Consultant and one Institutional Consultant with respective inputs of 1.75 and 1.5 months. Estimated costs of consultant inputs and computer software/hardware are US$140,000. Recommended implementation of the TA is September 1996.

2) The Project Management Unit (PMU)

It is recommended that the PMU is provided with one international consultant for one month to provide TA to set up the PMU. In addition the PMU would be supported by one local consultant for 38 months of the project.

The main components of the TA are training in project management and familiarisation with International Lending Agency procurement rules. Estimated costs of consultant inputs areUS$86,000. Recommended implementation of the TA is July 1996 when the PMU is scheduled to be set up.

♦ 10 PROJECT EVALUATION

The project evaluation made in this chapter include the following:

1. financial and economic evaluation:
   - forecast SWM expenditures
   - affordability of the project by the Bucharest Municipality
   - citizen's affordability;
2. environmental evaluation;
3. technical evaluation;
4. local citizens' acceptability;
5. benefits of using land for landfill; and
6. relative importance of the project.

1. Financial and Economic Evaluation

A financial evaluation of the project is presented which includes forecasts of SWM expenditures from 1996 to 2010 and an assessment of their affordability by MB and citizens.

1) Forecast SWM Expenditures

Figure 10-1 below shows how total forecast SWM expenditures for Bucharest move over the Master Planning period from 1996 to 2010.

The peak between 1997 and 1999 shows the impact of project investment in landfills on total costs which peak at US$21.9m in 1998. Disposal costs reach 76% (1998) and 56% (1999) of total SWM costs.

The peak between 2004 and 2006 shows the large post project investment costs of constructing additional embankments for Balaceanca and Cretuleasca sites and three new disposal sites at Berceni, Afumati and Jilava.

Household costs average about 75% of total SWM costs over the 15 year period.

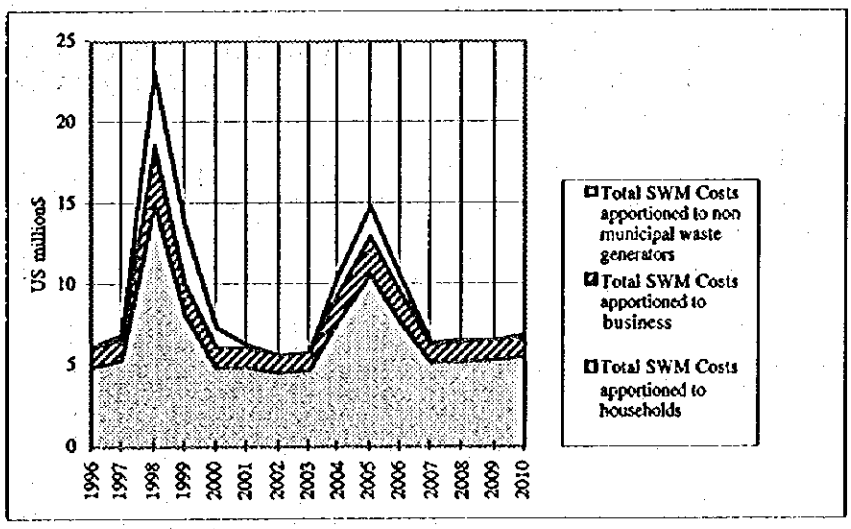


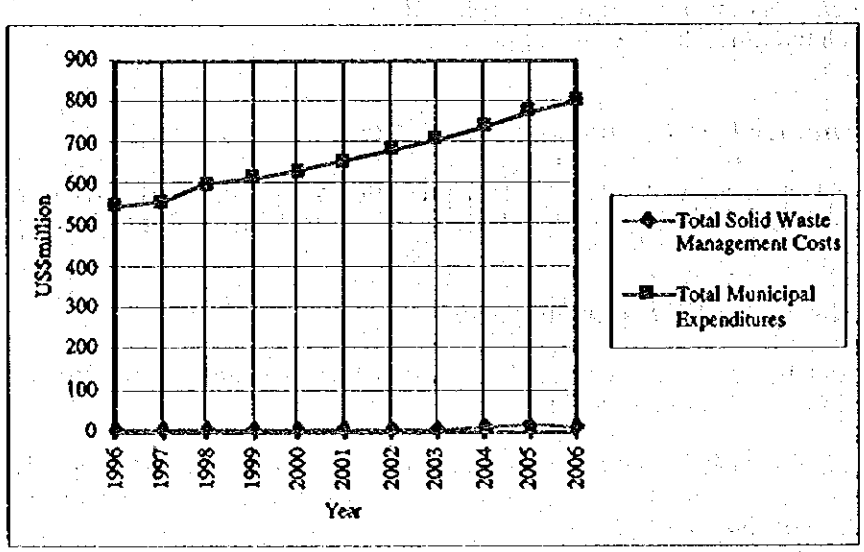
Fig. 10-1 Forecast Total Expenditures for Solid Waste Management in Bucharest 1996 to 2010

2) Affordability of the Project by MB

A comparison of forecast SWM expenditures with forecast Municipal expenditures over the Project period, shows that SWM costs average only 1.44% of Municipal expenditures. This is very low when broadly compared to other cities in both developing and developed countries.

The results indicate that in general terms **SWM expenditures, including the project costs, are affordable by the Municipality.**

Figure 10-2 illustrates how small SWM costs are compared to total municipal spend.



Note: Municipal service expenditures for Bucharest include SWM, public transportation, heating, water and sewerage, and Municipal Administration services.

Fig. 10-2 Comparison of Total SWM Costs to Total Municipal Expenditures 1996 to 2006

However the Municipality will find it very difficult to finance project expenditures in 1998 and 1999, solely from the waste tax and to ensure full cost recovery of SWM expenditures.

Fig. 10-3 below gives total SWM costs split between disposal and collection and haulage and street sweeping. The figure illustrates the burden the project investment costs would impose on Municipality.

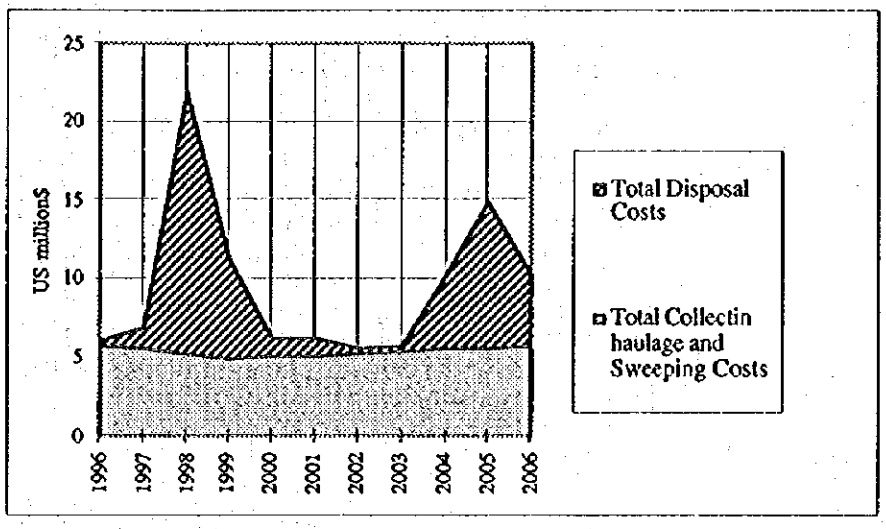


Fig. 10-3 Comparison of Total Disposal Costs to Total SWM Costs 1996 to 2006

An increase in the household waste tax of approximately 230% in 1998 is required to fully recover the project costs, as well as, all other SWM costs. This increase is too large to implement and MB will have to consider alternative ways of financing the disposal project.

As the Municipality's general tax base is financially constrained it has no alternative but to seek financing from external loans and/or the state budget.

3) Citizens' Affordability

A comparison of per capita SWM costs to per capita GDP over the Master Planning period indicates that **the project is also affordable by citizens.**

The average percentage of per capita SWM costs to per capita GDP is 0.41% over the period; peaking at 0.94% in 1998. These percentages compare favourably with international comparators for both developing and developed countries.

However, although the project is affordable, there is an unwillingness of citizens to pay higher tariffs for SWM unless service quality improves. MB and GoR have also expressed reluctance to impose a waste tax which is much higher than current tariff levels. It would be unacceptable to citizens and MB to raise the tax by 200% in 1998 to enable the project to be financed.

Again, alternative ways of financing the project investment from external loans and/or the state budget have to be considered.

4) Conclusion

In general terms project and total SWM expenditures appear to be at reasonable levels when measured against total municipal expenditures. However, it will be difficult for MB to finance the project from the proposed waste tax. As MB's general tax base is constrained, it has no alternative but to seek external financing in the form of loans and/or state budget subventions.

2. Environmental Evaluation

Details of the environmental evaluation of the project is shown in Chapter 4 or the Feasibility Study Report. A conclusion is summarized as follows.

It is evaluated that the measures for minimizing the public health risks and environmental protection are adequately considered in the proposed landfill plan. It is judged that the planned landfill development is environmentally sound and acceptable in terms of both facility design and operation which include plans for monitoring and control of hazardous waste. The facility design for the new landfill sites satisfies the EU Disposal Standards.

It is advised that the Bucharest Municipality will prepare, during the detail design stage, plans for provision of some facilities for the benefits of the surrounding villages as well as post-closure land use plans in consultation with the villages.

3. Technical Evaluation

The design and technology used for the landfill project are shown in Chapter 5. The proposed design and technology are evaluated to be reliable and appropriate in view of the following:

1. The proposed landfill design and technology are those generally used by many local governments in the world, and therefore proved to be reliable.

2. The design of new landfill sites in Balaceanca and Cretuleasca follows EU Council Directives. For the design calculations and specification, the Guidelines for Structure of Waste Disposal Facilities issued by the Japanese Ministry of Health and Welfare was used. Therefore, the design of the new landfill satisfies both the EU Standards and the Japanese Standards.

   Note:
   Although, the existing Glina landfill sites cannot be provided with the lining, it is evaluated that the improvement plan for the Glina site with leachate collection system will contribute to substantial reduction of risks of contamination of water

3. Materials for the lining were selected considering costs and quality of waste to be disposed of.

4. For treatment of leachate collected, the off-site treatment (transmission of collected leachate to the nearest public sewer line, and treatment at the existing sewage treatment facility in Glina) is planned instead of on-site treatment which is more costly.

5. Local residents will not be suffered from the traffic of waste trucks because the project will provide access roads which do not pass through the local villages. The access roads are wide enough so that there will be no traffic jams created.

6. For operation of landfill, the fill-up and cell method are proposed. This method is appropriate in terms of efficiency of landfill and minimization of public nuisance such as smoke and odor that may affect local residents. Procurement of adequate quantity of bulldozers and other necessary equipment are included in the plan.

7. The site facilities include offices and other facilities which are useful for creating safe, efficient and comfortable working conditions.

8. Most equipment and materials needed for the planned landfill are locally available and therefore economical.

9. All the facilities are locally manageable through the training which will be included in the engineering services.

4. Local Citizens' Acceptability

The officials of the Municipality of Bucharest had meetings with all the 3 concerned village councils concerning the project.

Glina Site
The mayor of Popesti-leordeni village expressed that the village council would accept the Improvement Project of the existing Glina landfill site. This village owns 90 % of the existing Glina site.

Balaceanca Site
Cernica village council, in the previous meeting with MB, expressed also that the landfill project in Balaceanca is acceptable to the village in principle.

Cretuleasca Site
In the meeting with MB, the mayor of Stefanesti de Jos village council expressed that he would be supportive of the landfill project in Cretuleasca. However, MB will have to have some more discussions with the village council before the village council accept the project. Bucharest Municipality is confident that it can reach to an agreement with Stefanesti de Jos.

Supports by All the Concerned Authorities
The concerned authorities including; Prefect, Sub Prefect, Ministry of Finance, Ministry of Public Works, Department of Local Public Administration, and Inter Ministerial Council for Large Investments of National Interest expressed their support of the Project.

Transfer of Land Ownership
Ownership of the land of the planned sites are not necessary clarified till now because in Romania land ownership is supposed to be returned from the State to former (pre-communism) landowners according to the Romanian laws. Romania is now in the middle of this process, and it would take some years to complete this process.

Finalization of Conditions of Acceptance Needed
MB will have to have meetings with the concerned 3 village councils to discuss conditions of acceptance including compensation, form of land acquisition, and form of management of new landfill sites.

It is likely that MB will form an association with the concerned village council to acquire the land necessary for the project.

In view of the current situation mentioned above, it is considered very likely that the Project will be officially accepted by the 3 villages without affecting the project implementation schedule.

5. Benefits Deriving from the Use of the Post Closure Landfill Sites

This section shows benefits that may possibly derive from using the land before and after landfill operation.

As shown in the table below, the economic values of land in terms of value of crops (corn) that could be harvested are greater after the landfill operation is completed than before. In case of Glina, the site was a swampy land before landfill started, therefore no crops were grown. After the site is filled with waste in the future, 90 % of the site could be used as an agricultural field. The value of crop (corn) harvested is estimated to be $ 25,740/year. (Net value of the harvested crop is estimated to be $18,018, 70 % of the value of the crop assuming that the cost of production and other costs such as transportation is 30 % of the market price.)

Currently, it is estimated that 35 % of the planned Balaceanca site is used for agriculture. The remaining part of the land is not used for agriculture because there is water on the surface of the area. After the site is filled with waste in future, 90 % of the site may be used as agricultural field. Thus, the harvest of corn would increase to over 2.5 times in the Balaceanca site.

As a conclusion, the use of the land for landfill in Glina, Balaceanca and Cretuleasca is helpful to increase the value of the land in terms of agriculture (production of crops) and other business; golf course or green parks for example.

Table 10-1 Benefits of Using Landfill Sites in Glina, Balaceanca and Cretuleasca Under Different Situations

Unit: US dollar in 1995 price

	Glina Landfill Site (104 ha)	Balaceanca (40 ha)	Cretuleasca (28 ha)
1. Economic value of the land **before** using site for landfill = Rent = value of crops (corn) that could grow.	**$ 0/year** (The land was not possibly used as agricultural land because it was a swampy land.)	**$ 2,695/year (Index: 100)** (At present, about (14 ha or 35 % of the land is used as agricultural land. Other part of the land cannot be used as there is water. $ 275/ha x 14 ha x 70 %* = $ 2,695.)	**$ 4,235/year (Index: 100)** (At present, about 22 ha or 80 % of the land is used as agricultural land. $ 275/ha x 22 ha x 70 % = $4,235 .)
2. Economic value of land if used as agricultural land **after** closing the site	**$ 18,018/year** (93.6 ha or 90 % of the land can be used as agricultural land after filling the site with waste. $275/ha x 93.6 ha x 70 % = $ 18,018)	**$ 6,930/year (Index: 257)** (36 ha or 90 % of the land can be used as agricultural land after filling the site with waste. $275/ha x 36 ha x 70 % = $ 6,930)	**$ 4,813/year (Index: 114)** (25 ha or 90 % of the land can be used as agricultural land after filling the site with waste. $275/ha x 25 ha x 70 % = $ 4,813)

Note: See F/S Report Section 11.5 for assumptions used for the calculation of the above benefits.

6. Relative Importance of the Project

1) At National Level

What is the relative importance of the project ? Although the project is very small in amount relative to other investment projects in Romania, it nevertheless has substantial "visibility".

The project is relatively small because most investment is being carried out on large national sectoral programs. These are primarily being financed by the World Bank (IBRD) and the EBRD. The two largest investment programs are in rail and energy, approximately $400 million and $500 million respectively. Other sectoral investment programs are underway in the agricultural sector (a number of credit lines have been set up) and telecommunications. There is also an industrial development program.

The project has visibility because:

Firstly, the project is in Bucharest which, as the nation's capital, is a window to Romania. Therefore, the project has national focus.

Secondly, the project will be the first solid waste management project financed by an international donor agency (IDA) in Romania.

Thirdly, the project will become the model for other solid waste projects for other Romanian cities. Therefore, again it is of national importance.

Investment by IDAs other than in the large national sectors is small. There are very few environmental projects. See Section 11.3 of the Feasibility Study Report for detail.

2) At Municipal Level

At the municipal level there are very few investment projects for municipal service or utilities. Currently, the municipal projects covered by IDAs are:

1. the forthcoming World Bank Bucharest water supply project; and
2. the EBRD's water supply project for 5 cities which was implemented as part of the EBRD's Municipal Utility Development Program (MUDP).

The amounts which have been a greed by the IDAs for these projects are $46 million for the Bucharest water supply and $28 million for the MUDP. The current landfill project is smaller compared to these projects but it has visibility since there are only two extant projects.

7. Conclusion

This Project is vital for the Municipality of Bucharest and the citizens in view of;

1) demand and necessity to have sanitary landfill sites to dispose of generated waste,
2) improving MB's solid waste management to a level compatible with the nation's capital city.
3) serving as a national model in terms of landfill design and democratic process for acquisition of local citizens' consent to the project

As demonstrated in the previous section, it is judged that the Project is feasible from all aspects including financial, economic, environmental, and technical aspects as well as the local citizens' acceptability.

MB is required to make its best efforts to finalize conditions of the project acceptance through negotiations with the concerned village councils as early as possible.

♦ 11 FINANCIAL PLAN

1. Proposed Financing Plan

It is proposed that the Bucharest municipality should acquire a soft loan from an international donor agency to finance a major portion of the project investment. If an official loan of the Japanese government (Overseas Economic Cooperation Fund - OECF) is available, 75 % of the project investment cost may be financed. The Romanian side will finance the remaining part (25 %) of the project investment and all the operation and maintenance costs related to the project. See the table below.

Table 11-1 Project Financing Plan

Unit: US dollar in 1995 price

	Project Expenditures (1)	To be Financed by OECF Loan (2)	To be Financed by the Romanian Side (1) – (2) = (3)
1. Investment	23,083,000 (100 %)	17,312,250 (75 %)	5,770,750 (25 %)
2. Operation & maintenance	3,004,000 (100 %)	0 (0 %)	3,004,000 (100 %)
3. Total	26,087,000	17,312,250	8,774,750

Table 11-2 shows aggregate waste disposal expenditures including the current project for the period 1996 to 2025. The costings were prepared on the assumption that the OECF loan will be available to cover 75 % of the project investments, and all other costs will be financed by the Romanian side.

Because of the soft conditions possibly applied to the loan, the repayment of the loan will not be hard for the borrower. The maximum amount of annual repayment of the loan is estimated to be $ 1.3 million in 2006, in which year the borrower has to start paying back the principal. Annual repayments will gradually decrease thereafter. The repayment will be about $ 0.9 million in the final repayment year of 2025.

In the near future, the Bucharest Municipality should set the waste tax high enough to recover not only the costs of waste collection, haulage and street sweeping services but also the disposal costs of the repayment of the project loan all operation and maintenance costs of disposal facilities.

During the period 2004 - 2006 large investments (about $ 18 million for 3 years in total in 1995 price) will be needed to construct additional embankments for the project sites in Balaceanca and Cretuleasca and other 3 more new disposal sites in Berceni, Afumati and Jilava. It is preferable for the Municipality to acquire another soft loans to finance these investments.

Table 11.2 Project Loan Schedule and Cash Flow Related to Waste Disposal Unit: dollar in 1995 price

	Year (a)	Project Investments (b)	Annual Borrowing (75 % of Item b) (c)	Remaining Balance at the Year End (d)	Repayment of Principal (e)	Interest Payment (f)	Total Repayment (e+f) = (g)	Own Funding (25 % of Item b) (b-c) = (h)	Project O & M Expendi-	Total Project Expenditure (g+h+i) = (j)	Other Disposal Expenditure (k)	Total Disposal Expenditure (j+k) = (l)
1	1996	7,080	5,310	5,310	0	0	0	1,770	0	1,770	302,804	304,574
2	1997	741,630	556,222	561,532	0	143	143	185,408	0	185,551	254,996	440,547
3	1998	16,343,635	12,257,726	12,819,258	0	15,161	15,161	4,085,909	0	4,101,070	261,410	4,362,480
4	1999	5,991,405	4,493,553	17,312,811	0	346,120	346,120	1,497,852	325,721	2,169,693	0	2,169,693
5	2000	0	0	17,312,811	0	467,446	467,446	0	409,260	876,706	716,260	1,592,966
6	2001	0		17,312,811	0	467,446	467,446	0	414,700	882,146	607,700	1,489,846
7	2002	0	0	17,312,811	0	467,446	467,446	0	420,295	887,741	0	887,741
8	2003	0	0	17,312,811	0	467,446	467,446	0	426,044	893,490	0	893,490
9	2004	0	0	17,312,811	0	467,446	467,446	0	431,956	899,402	4,422,310	5,321,712
10	2005	0	0	17,312,811	0	467,446	467,446	0	438,033	905,479	8,753,506	9,658,985
11	2006	0	0	16,447,170	865,641	467,446	1,333,086	0	137,546	1,470,632	4,464,810	5,935,442
12	2007	0	0	15,581,530	865,641	444,074	1,309,714	0	0	1,309,714	462,980	1,772,694
13	2008	0	0	14,715,889	865,641	420,701	1,286,342	0	0	1,286,342	475,944	1,762,286
14	2009	0	0	13,850,249	865,641	397,329	1,262,970	0	0	1,262,970	489,271	1,752,241
15	2010	0	0	12,984,608	865,641	373,957	1,239,597	0	0	1,239,597	502,970	1,742,567
16	2011	0	0	12,118,968	865,641	350,584	1,216,225	0	0	1,216,225	0	1,216,225
17	2012	0	0	11,253,327	865,641	327,212	1,192,853	0	0	1,192,853	0	1,192,853
18	2013	0	0	10,387,687	865,641	303,840	1,169,480	0	0	1,169,480	0	1,169,480
19	2014	0	0	9,522,046	865,641	280,468	1,146,108	0	0	1,146,108	0	1,146,108
20	2015	0	0	8,656,405	865,641	257,095	1,122,736	0	0	1,122,736	0	1,122,736
21	2016	0	0	7,790,765	865,641	233,723	1,099,363	0	0	1,099,363	0	1,099,363
22	2017	0	0	6,925,124	865,641	210,351	1,075,991	0	0	1,075,991	0	1,075,991
23	2018	0	0	6,059,484	865,641	186,978	1,052,619	0	0	1,052,619	0	1,052,619
24	2019	0	0	5,193,843	865,641	163,606	1,029,247	0	0	1,029,247	0	1,029,247
25	2020	0	0	4,328,203	865,641	140,234	1,005,874	0	0	1,005,874		1,005,874
26	2021	0	0	3,462,562	865,641	116,861	982,502	0	0	982,502	0	982,502
27	2022	0	0	2,596,922	865,641	93,489	959,130	0	0	959,130	0	959,130
28	2023	0	0	1,731,281	865,641	70,117	935,757	0	0	935,757	0	935,757
29	2024	0	0	865,641	865,641	46,745	912,385	0	0	912,385	0	912,385
30	2025	0	0	0	865,641	23,372	889,013	0	0	889,013	0	889,013
	Total	23,083,750	17,312,811		17,312,811	8,074,282	25,387,093	5,770,939	3,003,555	34,161,587	21,714,961	55,876,548

Assumptions Used for Preparation of the Project Costing

The assumptions used for preparing the project costings shown in Table 11-1 are summarized as follows:

1. An OECF loan is available for the project to finance 75 % of the total costs of project investments.
2. Major loan conditions are as follows:
   a. Interest rate is 2.7 %/year
   b. Repayment period will be 30 years after the loan agreement. The first 10 years will be a grace period during which the borrower will only have to pay interest.
   c. The loan will cover a 75 % of the total cost of the project investments including 18 % value added tax.
3. The Romanian side will finance all the remaining part of the disposal expenditures which will include:
   (1) 25 % of the project investment costs
   (2) All operation and maintenance costs
   (3) All other capital expenditures related to the waste disposal

2. Affordability of Project

The affordability of the project with OECF loan financing is presented.

1) Forecast SWM Expenditures

Fig. 11-1 below shows how total forecast SWM expenditures for Bucharest move over the Master Planning period from 1996 to 2010. The peak between 1997 and 1999 shows the impact of project investment in landfills on total costs which peak at US$9.7m in 1998 (compared to US$.21.9m without an OECF loan).

A comparison with SWM expenditures without an OECF loan shows how financing the project with the OECF loan significantly smoothes the cost profile over the project period between 1996 to 1999.

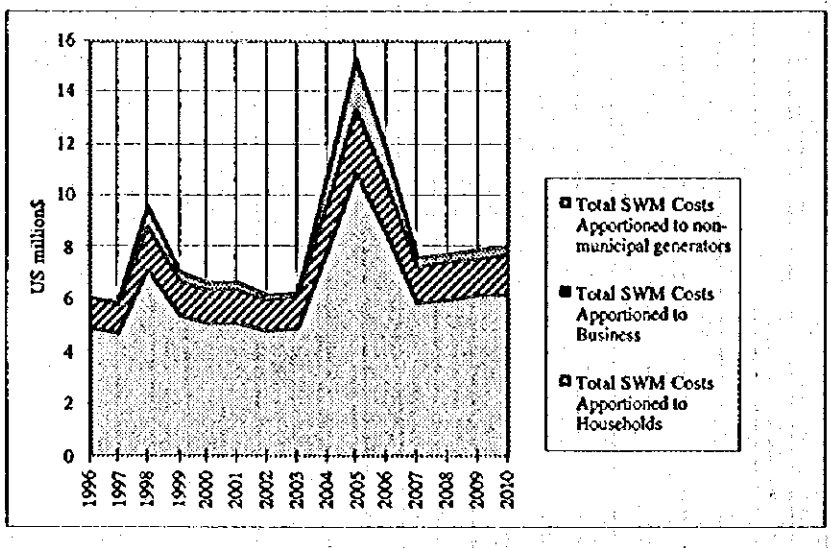


Fig. 11-1 Forecast Total Expenditures for Solid Waste Management in Bucharest 1996 to 2010

The peak between 2004 and 2006 shows the large post project investment costs of constructing additional embankments for Balaceanca and Cretuleasca sites and three new disposal sites at Berceni, Afumati and Jilava.

2) Affordability of the Project by MB

A comparison of forecast SWM expenditures with forecast Municipal expenditures over the Project & post-project period (1996 - 2006), shows that SWM costs average only 1.26% of Municipal expenditures. This is very low when broadly compared to other cities in both developing and developed countries.

The results indicate that in general terms **SWM expenditures, including the project costs, are affordable by the Municipality.**

3) Citizens' Affordability

A comparison of per capita SWM costs to per capita GDP over the Master Planning period indicates that **the project is also affordable by citizens.**

The average percentage of per capita SWM costs to per capita GDP is 0.23% over the period; peaking at 0.5% in 2005. These percentages compare favourably with international comparators for both developing and developed countries.

4) Forecast Waste Tax

Fig. 11-2 below gives the projected the monthly household waste tax over the 15 year period, under the assumptions of full cost recovery and OECF loan financing.

The results indicate that the household tax only needs to be raised by about 24% between 1996 and 1998, to Lei 560 in 1998. This is feasible and would be acceptable to both citizens and government.

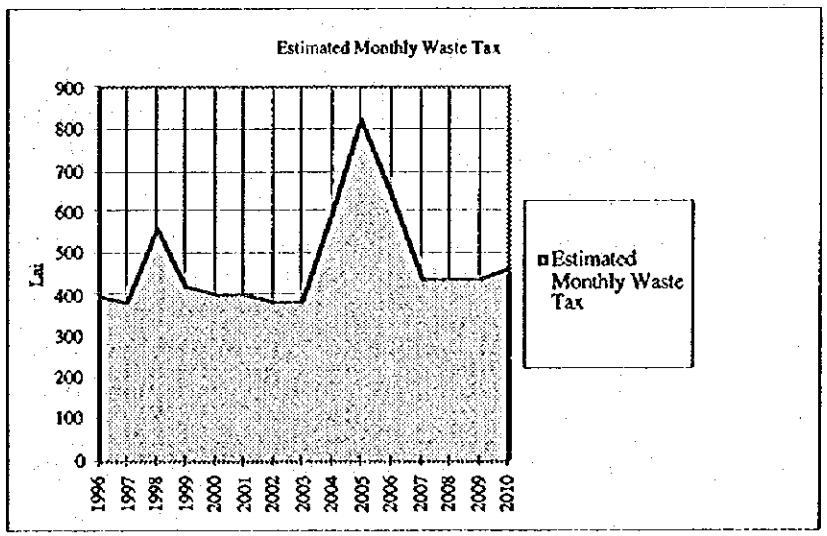


Fig. 11-2 Estimated Monthly Solid Waste Tax (Households)

The second peak between 2004 and 2006 shows the impact of the substantial post project investment costs of constructing additional embankments for Balaceanca and Cretuleasca sites and the three new disposal sites at Berceni, Afumati and Jilava.

It is clear that MB will again need financial support in this period to soften the impact on the waste tax. Financing the investment from another soft loan from an international lending agency, from MB's general taxation or by GoR state budget capex subventions, or a combination of them, should be considered.

♦ 12 PROJECT IMPLEMENTATION SCHEDULE AND THE MUNICIPALITY'S ACTIONS REQUIRED

1. Project Implementation Schedule

A proposed schedule for the project implementation is shown in the following table:

Table 12-1 Project Preparation and Implementation Schedule

Actions	Date
1. Establishment of Project Management Unit (PMU) within the Municipality of Bucharest (MB)	December 1995
2. MB's submission of request for the project budget to the central government	January 1996
3. The central government's approval of the project	February 1996
4. Loan request by Romanian Government	February 1996
5. Establish Municipal Waste Disposal Administration	By March 1996
6. Conclusion of Loan Agreement (L/A)	July 1996
7. Set up Project Management Unit	July 1996
8. Selection of Consultants for PMU	July 1996
9. Announcement of tender for engineering services	August 1996
10. Selection of consultants for the engineering services	December 1996
11. Commencement of the engineering services	January 1997
12. Announcement of tender for construction	July 1997
13. Selection of a contractor	December 1997
14. Commencement of improvement work for Glina landfill site and construction of 2 landfill sites in Balaceanca and Cretuleasca	January 1998
15. Completion of improvement work in Glina	December 1998
16. Completion of construction of landfill sites in Balaceanca and Cretuleasca	June 1999
17. Commencement of waste receiving at Balaceanca and Cretuleasca landfill sites	July 1999
18. Closure of Glina landfill site	2005
19. Closure of Cretuleasca landfill site	2006
20. Closure of Balaceanca landfill site	2006

2. Actions of the Bucharest Municipality Required

The following is a list of actions that the Bucharest Municipality must carry out for the project preparation and implementation.

1. Negotiation and agreement with the involved village councils of Cernica, Stefanesti de Jos, and Popesiti-Leordini concerning:

2. Make an application for an international loan to Ministry of Finance with necessary documents including a loan application and a project implementation plan.

3. Seek and get approval of the locally financed portion of the project not financed by an international loan (assuming that an international loan will finance 75 % of the project cost, local financing component is estimated to be 6 million US dollar (25 % of a total project cost of 27 million US dollar).

4. Obtaining permissions and approvals for the project from relevant authorities which are listed in Section 13.2 of the Feasibility Study Report.

5. Revision of Bucharest Sanitation Norm (BSN) as suggested in Section 13.2 of the Feasibility Study (F/S) Report.

6. Institutional arrangements (Refer to Section 13.2 of F/S Report)

   (1) Establishment of a Foreign Joint Venture Company (FJVC)
   (2) Establishment of a Project Management Unit (PMU) within the municipality:
   (3) Establishment of a system to prevent hazardous waste from coming to the site:

7. Selection of 2 consultants who will assist PMU.

8. Selection of an international consulting firm which will provide the engineering services.

9. Selection of a contractor for site construction and procurement of equipment

10. Periodical reporting to Ministry of Finance and an international lending institution regarding progress of the contract execution

♦ 13 CONTRACT PACKAGING

It is proposed that the Bucharest Municipality will make the following 6 contracts for the execution of the project.

1. Contract with 2 consultants (one international and one local) who will assist PMU
2. Contract for engineering services related to the below item 3
3. Contract for construction of landfill sites in Balaceanca and Cretuleasca and improvement work for the existing Glina site.
4. Procurement of heavy equipment (bulldozers)

Expected contract amount and period and biding methods are shown in the following table:

Table 13-1 Expected Contact Packages

Contract Package	Tender announcement	Amount (US dollar)	Bidding Method	Executing Agency
1. Use of 2 consultants for PMU	July 1996	86,140		MB
2. Engineering services (related to Item 3)	August 1996	1,807,170	International tender	MB & MLPAT*
3. Construction of the 3 sites	July 1997	19,919,580	International tender	MB
4. Procurement of heavy equipment (See Section 1.4)	January 1998	1,270,860	Local tender	MB
Total		23,083,750		

Abbreviations:
MB: The Bucharest Municipality
MLPAT: Ministry of Public Works and Regional Planning
* A part of the engineering services is the diffusion of landfill technology to other localities. This part should be executed by MLPAT. Cost of this part of the engineering service is estimated to be US $ 30,000.

Part C

Summary of Studies on Technical Assistance, Waste Education and Waste Bins Supply

1 TECHNICAL ASSISTANCE STUDIES

1.1 Study on Strengthening Bucharest Municipality's Contract Management and Service Monitoring Capacity

The study objective is to recommend technical assistance (TA) to assist MB to implement a contract management capability, with particular regard to contracting out collection and haulage services to the private sector. Deficiencies in MB's proposed contracting arrangements and recommendations for TA are presented below.

1.1.1 Deficiencies in MB's Proposed Contracting Arrangements

The deficiencies address legal constraints, pre contract award activities and post award contract control. Figure 1 below shows the typical stages in the contracting process.

1) Legal Deficiencies

Current legislation on contracting with Regie Autonomes and state owned Commercial Enterprises (CCs), contained in Law 66, 1993 and GD 263, 1994, is deficient and fails to enable MB to manage and regulate municipal service contracts. Furthermore, there is no legislation which covers how MB contracts with a private sector company.

2) Pre Contract Award Activities

a. Contract Specification: the contract specification is a key document but MB is uncertain of what should be in it and how to ensure that it is properly documented. MB requires assistance to define and to prepare the specification.

b Contract Strategy and Planning: MB has not defined arrangements for contract strategy and planning. MB needs assistance to plan how the contracting process is carried out.

c Tender Evaluation Criteria: MB need's assistance in setting appropriate criteria to evaluate tenders.

d Prequalification: prequalification procedures for prospective private sector tenderers are undefined. MB should implement prequalification procedures before the tender submission. MB will need TA to define procedures.

e Tender Documentation: MB needs assistance to ensure that tender documentation is complete, well prepared and appropriate.

f The Tender Evaluation and Selection Process: there are no laws or procedures which define the Tendering Committee's composition and how it is to carry out its work to award a municipal service contract. In particular MB has not defined tendering analysis procedures, eg financial, comparative bid analysis etc..

g Post Tender Negotiation and Contract Award: procedures for post tender negotiation and contract award are not defined. MB lacks experience in negotiating contracts and would benefit from negotiation skills training under the TA.

Pre Contract Award Activities

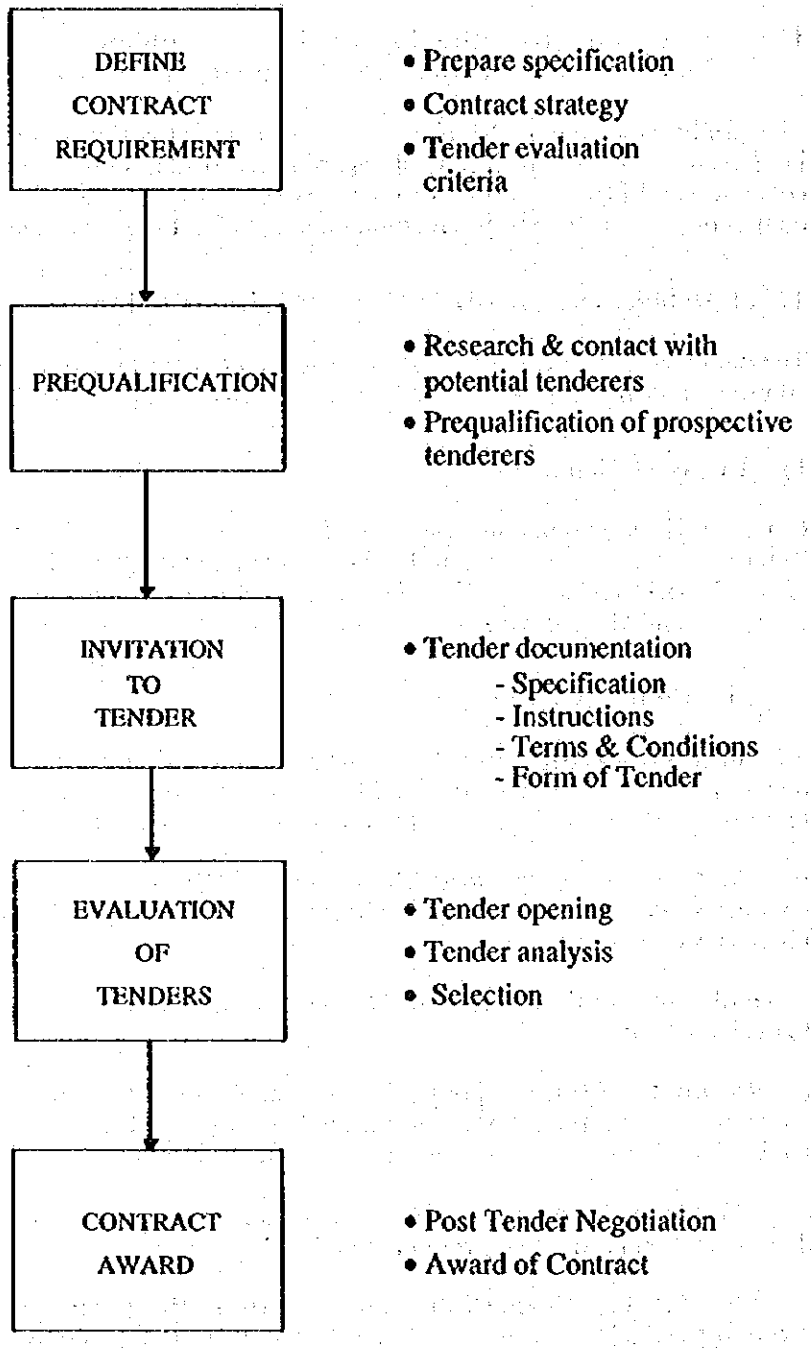


Fig. 1 The Contract Management Process

Post Contract Award Activities

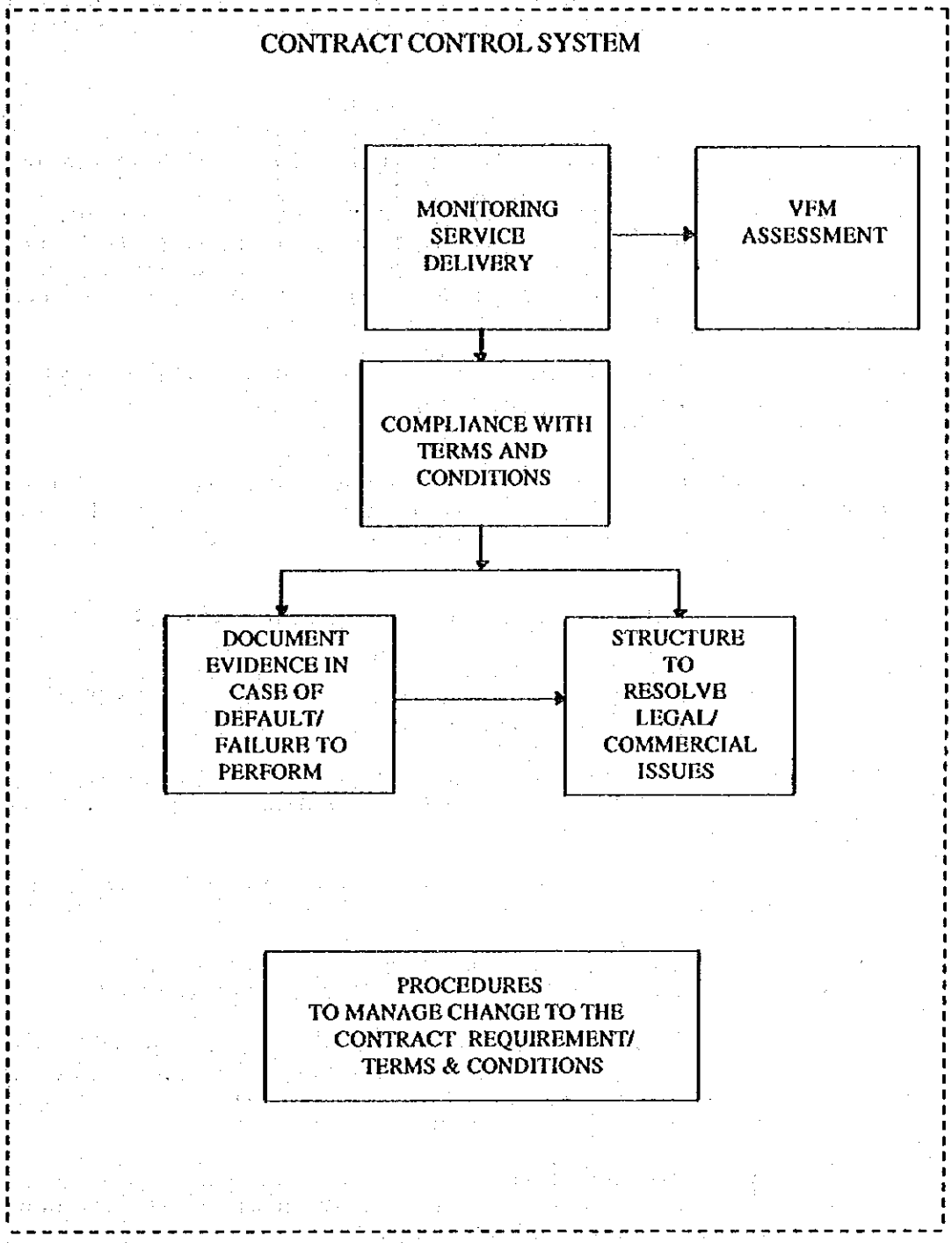


Fig. 2 The Contract Management Process.

3) Post Award Contract Control: At the moment there is no system of contract control and service monitoring. MB will require TA to enable it to set up a system since it has little experience of how such systems work. This will include:

a Monitoring Service Delivery: A performance measurement system should be established to enable MB to monitor and report on contractors' performance. Contractors should report performance data to MB as appropriate.

In this way the contractor is made responsible for the early identification of problems and to make proposals on how to resolve them. This should be supported by regular meetings between MB and the contractor to anticipate and resolve problems that arise.

b Compliance with Contract Terms and Conditions: Contract terms and conditions are monitored to ensure that the contractor complies with them. Proper documentary evidence should be maintained to facilitate the correction of failures to perform or to enable default procedures to implemented. A workable structure to resolve legal and commercial issues should also be implemented.

c Procedures to Manage Contract Change: Procedures should be implemented to enable the contracting parties to manage any changes made to the contract specification or terms and conditions.

d Meeting Contracting Goals and Objectives: MB should assess whether the contract is giving Value for Money (VFM) and whether contracting goals and objectives are met. The VFM assessment should balance risk, cost, service delivery and quality.

1.1.2 Recommendations for Contract Management Technical Assistance

The scope of the TA will cover the whole system of contract management and address each of the main pre contract and post contract award activities. The TA will primarily focus on the PSD and also the Legal Department.

It is proposed that one international contract management specialist provides the TA. Two or three counterparts should be selected from the PSD and the Legal Department to work with the international consultant.

The consultant will assist MB to implement a system of contract management in two fundamental aspects:

1. setting up appropriate contract management procedures; and
2. developing the counterparts' (and other staff) contract management skills.

Pre contract award will include: specification preparation, contract planning, setting tender evaluation criteria, prequalification, documentation, the tendering process, post tender negotiation and award of the contract. An important feature of the TA will be to advise on appropriate contract pricing structures.

Post contract award will include: arrangements to monitor service delivery, monitoring for compliance with contract terms and conditions, procedures to manage contract change and carrying out VFM assessment.

Although the international consultant will design the contract management system, the counterparts will be trained in the new system by being involved at each stage of its design and implementation.

The World Bank is intending to supply TA for contract management to MB and the scope of the Bank's TA is very similar to what we have recommended. As a result it is considered that providing TA under the Japanese ODA is not required since the Bank's TA will be more than sufficient and quickly implemented.

Draft Terms of Reference for technical assistance are provided in Appendix 1 of the Report on Technical Assistance, Waste Education and Waste Bin Supply.

1.2 Study on Strengthening Bucharest Municipality's Capacity to Set and Implement a Waste Tax

There are two main objectives to the study. These are to:

1. propose an outline policy MB should adopt towards the waste tax; and
2. identify and recommend the type of technical assistance (TA) the Municipality needs to assist it to set and implement a waste tax, which will ensure cost recovery, and to optimise the collection of the proposed tax.

1.2.1 Deficiencies in MB's Proposed Arrangements for Setting and Implementing the Waste Tax

MB is still uncertain of how to set the waste tax for a number of reasons:

1) SWM financing policy: MB lacks a comprehensive SWM financing policy and strategy to enable it to significantly improve financing of SWM services.

2) Financial Modelling: MB has not carried out any financial modelling of waste tax revenues and costs to ascertain the level at which waste taxes need to be set to ensure full cost recovery.

3) Cost Recovery: a clear policy on cost recovery has not been established. MB's objective is to recover all SWM operating costs and the capital costs of collection and street sweeping. However, it is uncertain of how much of the capital costs of disposal can be recovered.

4) Tax Structure: MB hasn't considered the different types of tax structures in enough detail, particularly for businesses.

5) Affordability: MB has not considered the affordability of the waste tax by citizens and businesses, except in the broadest terms.

6) Collection arrangements: the procedures for collecting the tax have not been established. The Municipality would prefer that the local Territorial Finance Administration (TFA) collect the tax which it is required to do under Law 10, the Law on Public Finance.

1.2.2 Proposed Policy for the Waste Tax

MB's SWM policy for the waste tax should, as a minimum, contain the following:

1. The overriding objective of implementing the tax is to make SWM financially viable;
2. SWM costs are recovered from the waste tax. As a minimum, all operating costs of collection and haulage, disposal and street sweeping are recovered. This includes the amortisation costs of equipment;
3. Contractors are remunerated so that they can finance their recurrent expenditure and, more importantly, their investment in equipment;
4. Where it is feasible, capital costs, primarily those of building landfill sites, should also be recovered. If it is not feasible, investment should be financed from loans or other means. Financing costs of loans should be fully recovered from the waste tax;
5. Household and business waste taxes are structured which optimise revenues and are socially equitable;
6. The waste taxes are set with due consideration to the affordability of citizens and businesses, as well as, to their willingness to pay; and
7. Procedures for collecting the tax are implemented which ensure a good rate of collection.

1.2.3 Recommendations for the Waste Tax Technical Assistance

The TA will cover methods of setting and implementing the tax and consider ways to improve the collection of the tax. The TA would be primarily focused on the Public Services Department and the Economics Department.

It is proposed that one international consultant is responsible for providing the TA. Counterparts would be selected from the PSD and the Economics Department to work with the international consultant in the design and implementation of the tax. The focus of the TA is to involve the Municipality's staff and to develop their skills.

The international consultant will carry out a number of tasks with the cooperation of the counterparts. These are to:

1. evaluate MB's proposals for introducing the waste tax and relevant fiscal legislation;
2. formulate appropriate tax structures for households and businesses;
3. formulate an appropriate level of the cost recovery;
4. financially model the waste tax to ascertain the level which will assure full cost recovery taking households' and businesses' affordability and willingness to pay into consideration; and
5. assist the Municipality to prepare an implementation plan.

The improvement of tax collection should include:

1. recommending an appropriate collection method so as to improve the rate of collection; and
2. considering the sanctions available for non payment.

We have discussed this waste tax technical assistance with the World Bank which is keen to include it with the contract management TA it is proposing to provide to MB. As a result, we consider that providing the waste tax TA under the Japanese ODA is not required since the World Bank's TA will be more than sufficient and, we understand, will be quickly implemented.

Draft Terms of Reference for technical assistance are attached in Appendix 2 of the Report on Technical Assistance, Waste Education and Waste Bin Supply.

2 STUDY ON WASTE EDUCATION

1. Necessity and Objective of Waste Education

1) Necessity of Waste Education

The Bucharest citizens are not well informed of the waste management and environmental sanitation. Some citizens do not know, or are not interested in how their waste is collected and disposed of, and are not very cooperative in the waste management. Some citizens do not know how they can be cooperative. It seems that lack of the citizens' understanding on the subjects is a reason for this situation.

Therefore, waste education for the citizens should be promoted. For adult citizens, a primary measure is information campaign by the municipality through media. For school children, waste education at school will be effective. The Bucharest Municipality should play a leading role in the campaign and waste education.

2) Objective of Waste Education

Considering the current waste problems in Bucharest, the objective of the waste education is proposed as follows:

1. Improvement of waste discharging manner
2. Prevention of illegal waste disposal
3. Promotion of the citizens' participation in the recycling activities

Final purpose of this waste education is to improve the sanitary and aesthetic conditions of Bucharest by enhancing the citizens' cooperation.

2. Contents of Waste Education

The Bucharest Municipality should carry out the following activities:

1. To develop citizens' correct understanding on waste management
2. To enhance the awareness of waste management and public cleansing
3. To activate citizens' cooperation

These actions can be generalized into the following three steps.

1. Dissemination of information
2. Strengthening of awareness
3. Model cooperative actions

Detailed contents of each actions are mentioned in the following sections.

1) Dissemination of Information

Dissemination of relevant information is a base for inducing the citizens' understanding. The citizens should be provided with the following basic information:

1. Every citizen is a waste generator.

2. Effort by both the municipality and the citizens is indispensable for proper waste management.

3. Waste problems can be solved if appropriate system is applied.

In addition, specific information covering the following topics, for example, should be provided:

- Who collects the waste, how and where he disposes of it?
- What is proper method for waste disposal - sanitary landfill, for example
- Current situation of Glina landfill site
- What is good for recycling? Where shall we bring them?
- Advantages of recycling such as material and energy saving

2) Strengthening of Citizens' Awareness

Strengthening of the citizens' awareness is aimed at the strengthening of the citizens' sense of responsibility for keeping the city clean and sanitary. Messages to be presented include the following:

1. Every citizen has a responsibility of waste management because everyone is a waste generator.

2. Compliance with the relevant rules is the duty of a citizens as a society member.

3. Importance of citizens' cooperation to keep the clean and sanitary.

3) Model Actions for Cooperation

Model actions for cooperation is very important for the waste education. The Bucharest Municipality should study the citizens' current activities before it select the model actions. The model actions should be clearly described, and must be ones that can possibly be accomplished by the citizens. If the municipality propose impossible actions, the citizens do not take it seriously. There are certain arrangements which the municipality should make before asking the citizens for specific cooperation. For example, when the municipality plans to collect used aluminum cans for recycling by collection boxes installed on streets, but if sufficient number of boxes are not installed, the citizens will not know where they shall bring used cans and they might leave these cans on the street.

Models of actions selected according to the municipality's objective are proposed as follows:

1. Improvement of waste discharging manner

   - Put the waste into waste bins properly

   - Prevention of littering waste at public places

   - Proper use of dust chutes

2. Prevention of illegal disposal

   - Prevention of leaving waste illegally in vacant areas

3. Promotion of citizens' participation in the recycling activity

   - Bring the following recyclable wastes to REMAT collection points
     Papers such as newspapers, magazines and books, textile, glass bottles, steel cans and aluminum cans

   - Return glass bottles of mineral water and beer which can be reused by refilling the contents to the shops

3. Proposed Measures of Waste Education

After clarifying the objective and contents, the municipality have to present its messages to the citizens effectively. Suitable measures for effective presentation should be selected with consideration of the following points:

what - what messages should be presented
to whom - to which type of citizens and which age group should be targeted
how - what kind of method or media should be used

1) Campaign for the Citizens

Possible campaign include the following:

(1) Dissemination of information by media such as papers, posters, radio and television

(2) Seminar concerning waste management

(3) Study tour of waste disposal site

(4) Best poster contest on waste management and recycling

(5) Contests of handicrafts contest made of recyclable waste material

(6) Occasional exhibition of information on waste and recycling in public space

Information campaign through media is a primary measure of public relations by the municipality. Papers, posters, radio and television are the typical media for public relations. It is recommendable to issue papers periodically. Posters, radio and television can be utilized for the campaign.

Study tour of waste disposal site, best poster contest on waste management and recycling and contests of handicrafts made of recyclable waste material can be incorporated into school education.

Establishment of a information center on waste and recycling, as seen in some Japanese cities, would be too early for Bucharest. Occasional exhibition of information on waste and recycling in public space should be considered.

2. Opportunity of Waste Education in School

a. Current Environmental Education in Romania

In Romania, reform of education is now in progress, and ecology education program has just been introduced to the school education, but waste education is not clearly proposed. It is desirable that waste education program is also introduced to the school education as a part of environmental education. The waste education will be effective if it is linked to sanitary, scientific and social education in school.

Although introduction of waste education to the school education curriculum will be discussed by the Ministry of Education, presentation of current problem and the necessity of waste education by the municipality is important to start the discussion.

b. Opportunity of Waste Education in Each School

In Bucharest a waste education program can also be introduced to school education by each school's discretion. School teachers prepare yearly schedule of school hours for each class room which they are in charge of, and prepare a detailed schedule once every

three months. In this schedule, one unit of school hour per week can be used at the teacher's discretion, for social education in a local context. Waste education program can be introduced by using this school hour. However, the problem is a shortage of waste education material. Good text books should be prepared. In the pilot study by JICA, a video movie on waste management and recycling was produced and this will be used in primary schools in Bucharest under supervision of Inspector Office of Education in Bucharest which is a local delegation of the Ministry of Education.

c. Promotion of Waste Education in School Education

To introduce waste education program to school education, national curriculum should be reviewed and revised by the Ministry of Education, and the new National Education Guidelines covering the waste education should be provided, since teachers prepare the schedule of school classes along with this Guidelines of Education. Training of teachers concerning waste education method should also be implemented.

Preparation of some waste education material is an immediate issue. Text book, color slides or video movies should be prepared as supplementary material for the waste education. Not only theoretical education but also practical one is desirable in waste education in school.

4. Proposed Actions of the Municipality

1) Establishment of the Public Relations Division

Municipality's public relations activities should be strengthened. It is recommendable to establish a division in charge of public relation (PR) on waste. The division will prepare basic plans for public relations, examine and select suitable measures, and implement them. Major tasks of the division are as follows:

- To prepare waste education plan and strategy for implementation
- To establish distribution system of municipality's PR papers
- To answer the citizens' questions on waste management
- To prepare material for PR such as papers, posters, radio and TV program
- To organize seminars and study tours on waste management
- To plan and arrange contests of posters on waste management
- To plan and arrange contests of handicrafts made of waste

2) Municipality's Involvement in School Education

Although the municipality has no direct authority on the school education, the municipality can promote waste education in schools through discussion with the Inspector office of Education. This is an efficient way since the Inspector office supervises education programs of all the school in Bucharest. The municipality should present the current problems, necessity and objective of waste education. Points to be discussed between the municipality and the Inspector Office include the following:

- Target grades of waste education
- Composition of the waste education program in schools
- Selection of waste education material
- Messages to be presented in the material

It is recommendable for the municipality to prepare supplemental materials under close cooperation with the Inspector Office. The municipality should send some staff to schools for delivering lecturers, if necessary. A study tour to some waste management facilities is another good measure of waste education for children. The children will get familiar with the facilities. The tour may be a good opportunity for the municipality as well to make children understand the municipality's activities.

3 STUDY ON WASTE BIN SUPPLY

The objective of the study is to identify the most effective and economic method of supplying waste bins to the citizens of Bucharest. The period considered is 10 years. The recommended bin specification, the demand for bins and recommendations for the method of supplying bins, including the responsibility for procurement, are presented below.

1) Recommended Bin Specification for Bucharest

Currently most citizens, with the exception of those in Sector 6, use 110 liter capacity metal bins. This type of bin is not suitable for the efficient collection of municipal waste.

The recommended bin specification for Bucharest is plastic 240 liter bins for appartments and businesses, and plastic 120 liter bins for individual houses.

RGR has clearly demonstrated this in Sector 6, where it has greatly improved the efficiency of its collection services by supplying 240 liter and 120 liter used imported bins to citizens at affordable prices.

2) Demand for Waste Bins in Bucharest

The estimated demand for 240 liter and 120 liter plastic waste bins is shown in Table 3-1 below. The demand is based on the recommended bin specification, a once a week collection service and the quantity of waste which citizens and businesses generate.

Table 3-1 Estimated Maximum Demand for Plastic Waste Bins in Bucharest

	Forecast Bin Demand	
	240 liter bins (apartments & businesses)	120 liter bins (individual houses)
1. Current Demand for Bucharest	86,560	96,000
2. Annual Average Demand for Bins	10,820	12,000
3. 10 Year Demand for Bins	108,200	120,000

3) Recommendations for the Method of Supplying Bins and the Responsibility for Procurement

a. Procurement Responsibility: it is recommended that collection and haulage contractors are made responsible to procure and supply bins to citizens. It is also recommended that the contract specifies that the contractor is obliged to make available bins to all citizens and at a good price. Time limits do not need to be set as the contractor will have the incentive to supply bins as quickly as possible.

b. Method of Supply: contractors should be free to decide on the method of supply, ie new imported, used imported or locally manufactured bins.

It is expected that contractors will want to supply 240 liter plastic used imported bins for **appartment dwellers and businesses**, since citizens will prefer them as they are the most economically priced. There is also a secure supply.

In the case of **individual house dwellers**, it is not possible to predict what citizens' preferred choice will be. 120 liter imported bins have the lowest unit price (Lei50,000), but locally manufactured 120 liter bins (estimated unit price Lei58,930), are closely priced, have a longer life and a lower amortised cost, ie are better value for money.

More affluent citizens may prefer to buy bins which last longer because they can afford to pay the higher price now and benefit from a lower amortised cost, whilst lower income citizens may choose the lower unit price, because of affordability.

c. Local Manufacturing: if an investor wishes to set up a bin manufacturing facility in Bucharest and can competitively sell bins, then this is a feasible option. However, potential manufacturers need to consider that:

Firstly, setting up a bin facility to only supply bins to Bucharest is not economically viable. It is estimated that annual production of 200,000 bins is required for the manufacturer to be commercially viable and to ensure security of supply. This is well in excess of local demand in Bucharest. A potential investor may find this level of demand unattractive.

Secondly, If it takes a long time to set up a manufacturing facility, there may be no market in Bucharest when the bin facility comes on stream, since contractors will be able to easily buy imported bins in large numbers. It should be remembered that contractors will want to supply large amounts of bins to citizens in the short term, so that they can improve their operational efficiency.

A potential investor needs to seriously consider how the supply of used imported bins will affect his market. In the medium term the demand for bins could be very low. He should also consider how he would respond to a price war.

d. Guarentees for Bin Manufacturers: If the Municipality is approached by an investor, MB should not guarantee that it or a collection and haulage contractor will buy a certain number of bins. MB should let the market decide which is the cheaper and more secure supply of bins, and contractors should be free to choose the most appropriate supply source.

e. Should Bins be Freely Provided to Citizens or Should Citizens Pay for Them? It is recommended that citizens purchase their own bins. This is a more cost effective solution and has proved to work well with RGR. Furthermore it is unlikely that the Municipality could absorb the substantial short term cost of bins, as contractors supply large numbers of them to citizens.

4 INFORMATION ON INCINERATOR

1. Introduction

There are two kinds of incineration plants for municipal solid waste treatment, one is stoker type incinerator and the other is fluidized bed type incinerator. Stoker type incinerator is major for municipal waste treatment, but the fluidized bed type incinerator with the capacity of 150 to 200 ton/24h capacity fluidized bed type has been developed and increasing the market shear recently. With regard to combustion time, incineration plant operation is devided with two types, one is batch type and the other is continuous type incinerator. Batch type (8 hours operation) incinerator is adopted for smaller capacity incinerator, and the continuos type (24 hours operation) incinerator is adopted for larger capacity incinerator. The construction cost of the facilities of the former type is lower than the that of the latter.

2. Purposes of Incineration

The purposes of incineration of municipal solid waste are summarized as follows;

1) Volume Reduction ;

Tree Components of Waste are converted to;

Combustible	-- Gas (CO2 etc.)	-- Migrate to Air
Moisture Content	-- Vapor	-- Same as above
Ash	-- Incineration Ash, Dust	-- Landfill

2) Scentless;

High temperature incineration -- Thermal decomposition, Pyrolysis -- Scentless (higher than 700 Deg. Cels.)

3) Harmless;

Hazardous material & virus -- Thermal decomposition, Pyrolysis -- Harmless.

4) Countermeasure and

Secondary environmental pollution	-- Exhaust gas treatment
(Dust, Hydrogen chloride, Sulfur	-- Waste water treatment
oxides, Nitrogen oxides, etc.)	-- Ash harmless treatment

5) Merits.

Heat utilization -- Generator, Hot water delivery -- Benefit for local people

3. Incineration Process and Component of the Facilities

1) Stoker Type Incinerator

a. Incineration Process

Incineration process of the stoker type is shown in Fig.4-1. Raw waste on driving stoker is dried by fire and radiant heat, and the waste start burning at a part of the

surface layer. The state of burning become active at the center of combustion stoker, and burning is finished at end part of combustion stoker. Even if the quality of input waste quality change, the finishing point is controlled by stoker movement speed and combustion air temperature, quantity of waste, etc. Combustion air temperature shall be kept higher than the burning point of paper for stable burning.

b. Treatment Flow

Treatment flow and the components of facilities of the stoker type incinerator is shown in Fig 4-2, and the treatment flow is explained as follows.

Waste: Collection truck - Platform - Bunker gate - Crane - Hopper - Incinerator (drying stoker - combustion stoker - after burning stoker) - ash

Ash: Ash conveyor - Crane - Bunker - Ash treatment system - Truck - Landfill

Combustion air: Bunker - Forced draft fan - Air heater - stoker

Exhaust gas: Incinerator - Gas cooling chamber - Electric precipitator - DeNox reactor - Dehydrochlorination system induced draft fan - Stack - Dispersion to air

2) Fluidized Bed Type Incinerator

a. Incineration Process

Incineration process of fluidized bed type incinerator is shown in Fig.4-3. Sand and air are the secrets behind fluidized bed incineration system. The sand act as a thermal medium to ignite the waste, and the air moves the sand and waste to distribute the combustion evenly throughout the incinerated bed. The bed of the incinerator contains billions of grain sand. Each grain of sand is only about one millimeter in diameter, but the combined surface area of all grains is several thousand square meters. Since these grains of heat, the incinerator has an effective heating surface with many times lager than a conventional stoker type incinerator. The sand is heated and kept in motion by air blown up from beneath the bed of sand. When the air quantity is small, the bed remains stationary and the air escapes through the sand. As the air quantity increases, through, the bed of sand expands and begins to move very much like boiling water. Once, the fludized sand has been heated by a primary burner to more than 600 deg. cels, waste is fed into the bed, where it mixed with the sand. The refuse starts to burn quickly and efficiently. The heat from this combustion keeps the sand hot, so there is no need for any support fuel. As more than 99 % of all combustible material is burned in excellent fluidized bed incinerators, there is much less residue than from a stoker type incinerator.

b. Treatment Flow

Treatment flow and the components of the facilities of fluidized bed incinerator is shown in Fig. 4-4.

4.4 Cost Information

1) Construction Cost of Incineration

Construction cost of incineration plant consists of two major components, one is equipments cost and the second one is building cost. Building cost changes depending on the construction area and the grade of specifications. In general, the equipment cost is estimated between 70 to 80 % of the total cost as the building is constructed by the standard grade specifications. In Europe, standard construction cost of incineration plant is estimated as shown in Table 4-1.

Table 4-1 Incineration Plant Construction Cost in Europe

Capacity	Number of Line	Unit Cost	Total Cost
200 ton/day (8.3 ton/hour)	1	250,000 $	50 Million $
1000 ton/day (41.0 ton/hour)	2	130,000 $	130 Million $

Note; The cost include basic equipments for environmental conservation and generator system.

In Japan, the cost of incineration plant is estimated almost double compare with the cost in Europe.

Operation and maintenance cost is discussed in Chapter 5 of the Feasibility Study Report.

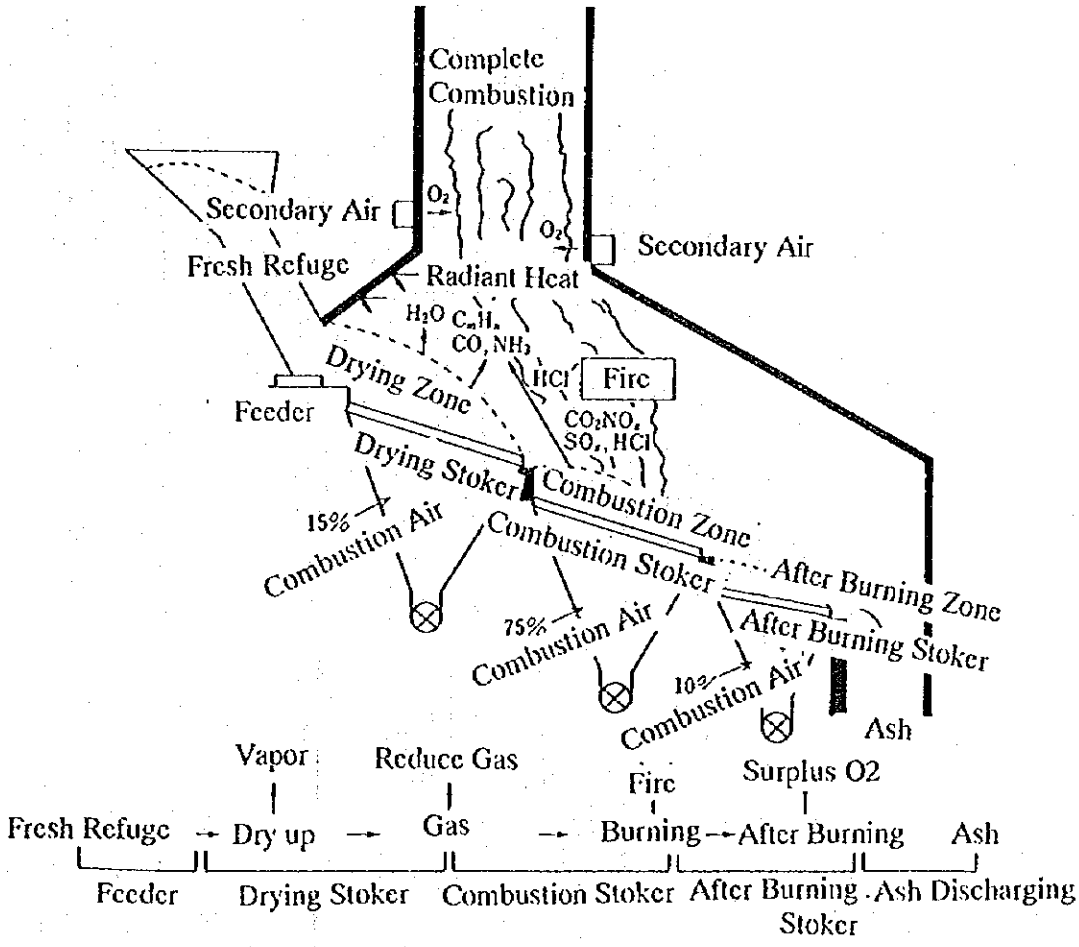
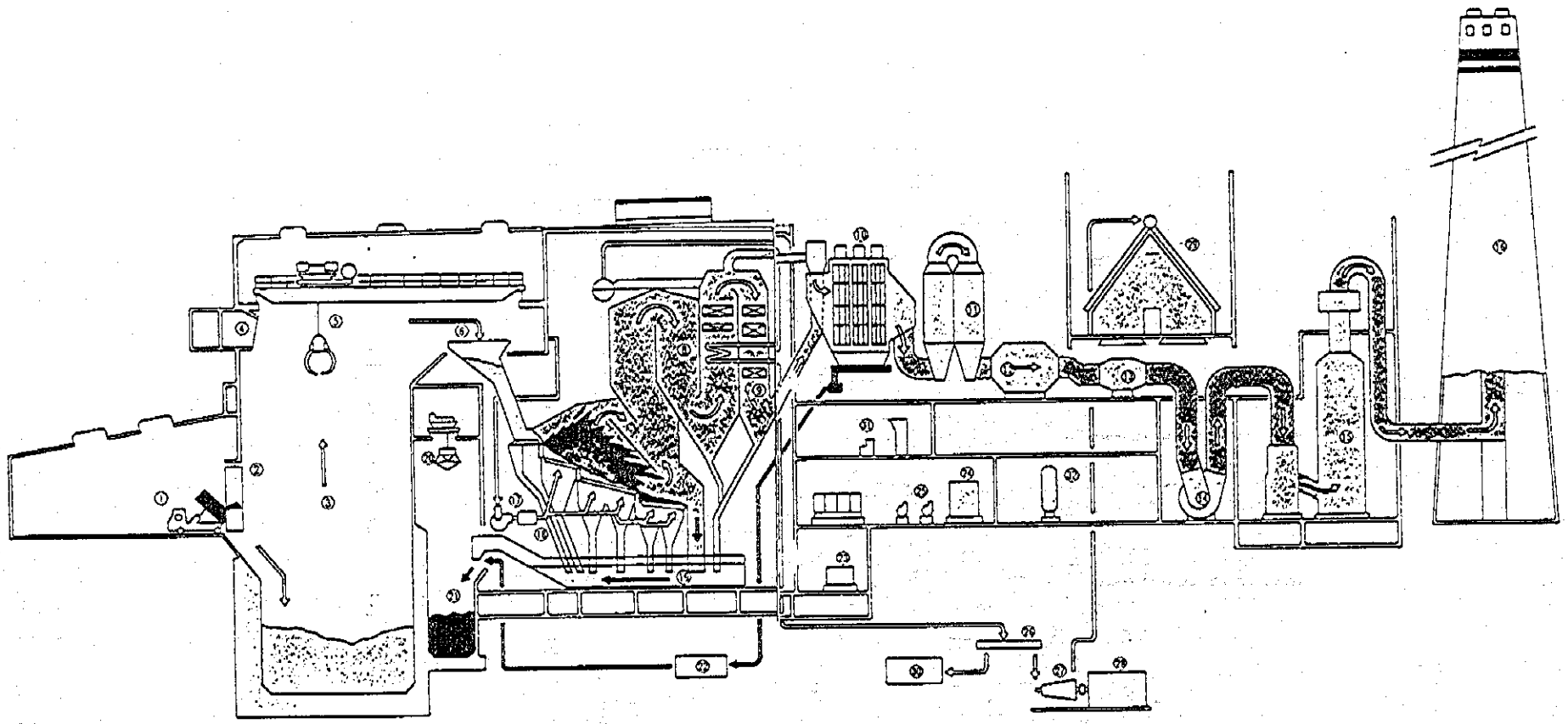


Fig. 4-1 Incineration Process



①プラットホーム Platform
②Refuse bunker gate
③Refuse bunker
④Refuse crane operating room
⑤Refuse crane
⑥Refuse hopper
⑦Incinerator
⑧Boiler
⑨High temperature economizer
⑩Electrostatic precipitator
⑪DeNOx reactor
⑫Middle temperature economizer
⑬Low temperature economizer
⑭Induced draft fan
⑮Dehydrochlorination system
⑯Stack
⑰Forced draft fan
⑱Steam air heater
⑲Ash conveyor
⑳Ash crane
㉑Ash bunker
㉒Fly ash treatment system
㉓Air compressor room
㉔Condensate water tank
㉕Pump room
㉖Steam header
㉗Steam turbine
㉘Steam turbine generator
㉙Steam condenser
㉚Surplus heat utilization facilities
㉛Central control room
㉜Waste water treatment system

Refuse flow
Ash flow
Air flow
Gas flow
Steam flow

Fig. 4-2 Teatment Flow

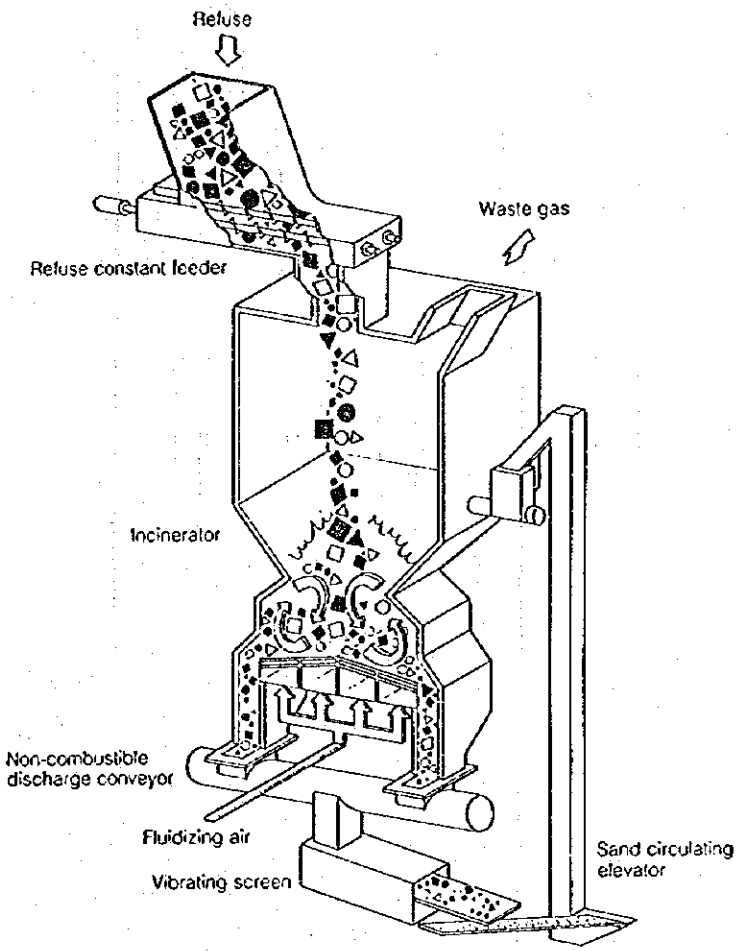


Fig. 4-3 Incineration Process

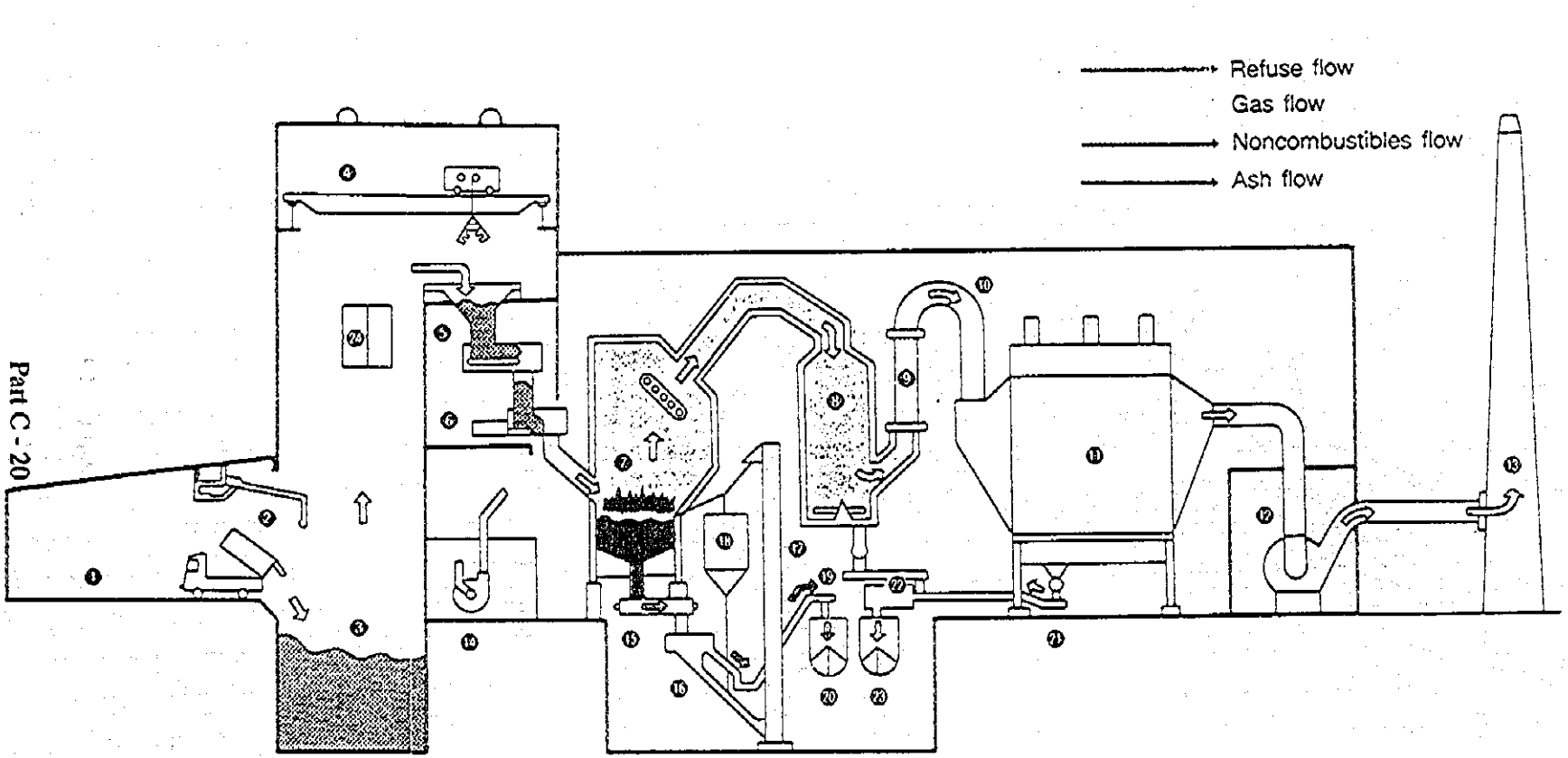


Fig. 4-4 Incineration Flow

5. FEASIBILITY OF COMPOSTING IN BUCHAREST

1. Introduction

Recently in European countries, organic treatment of waste is argued from the environmental point of view. Anaerobic fermentation of waste on the landfill site is proposed, the purpose of which is to stabilize waste on site. This is considered as the treatment and disposal method. However, composting, though it is also one of organic treatment, is not only a treatment method but it produces compost which can be used as fertilizer or soil stabilizer in agricultural fields. Use of compost for agricultural purpose is recommendable to avoid ground water pollution by overuse of nitrogen fertilizer. Thus, the composting can be reviewed and highly evaluated.

However, in the Master Plan of solid waste management in Bucharest, it is concluded that composting of the municipal waste in Bucharest is not feasible, because farmers' demand for the compost can not be expected due to its high price which resulted from high cost of composting. Even if the municipality subsidize to make the price low enough to induce the farmer's demand, the large amount of finance is required. It is not recommendable. Besides, quality control of compost made of the municipal waste is difficult.

In spite of these difficulties, composting has been argued repeatedly as it seems interesting. In the following section, it is presented that how the composting is, and why composting was not chosen in the Master Plan .

2. Purpose of Composting

Compost is used to keep the productivity of agricultural field by supplying organic substances to soil. If there is no demand for compost for agricultural purpose, it is no use to produce it. The demand for the compost is a necessary condition of composting of waste. There are many cases of failure of composting in the world for waste treatment without surveying the demand.

Why waste is made into compost to put it back to the agricultural field. Elimination of toxic substance and easy handling are the main reasons. Elimination of toxic substances includes the following three points.

a. Decomposition of unstable organic matter
b. Improvement of C/N ratio
c. Inactivation of bacteria, vermin and seeds of weeds

"a. Decomposition of unstable organic matter" is aimed to stabilize the waste by composting to avoid harms on plants due to the consumption of oxygen by waste.

"b. Improvement of C/N ratio" means the reduction of C/N ratio of the waste by composting in order to avoid over consumption of nitrogen in soil as an important nutrition. Because Carbon in organic waste of high C/N ratio reacts with nitrogen in soil and consume it.

"c. Inactivation of bacteria, vermin and seeds of weeds" is to inactivate them by heat at 50 to 65 degree Cercius in composting process.

3. Biochemical Process of Composting

Fundamental composting process is as follows:

a. Reacting with oxygen, carbohydrate in organic matter decomposes into carbon dioxide and water,
b. Protein and fat decomposes into the substances with smaller molecular weight and then into carbon, water and ammonia, and
c. Digestion of the waste by microorganisms and their autolysis by consuming up their foodstuffs makes the decomposed organic substances more stable.

Compost contains humic acid of humus and corpses of microorganisms, but cellulose remains in immatured compost because its decomposition is slow.

4. Composting System of the Municipal Waste

Schematic flow of the composting process of the municipal waste is as follows:

Municipal Waste
↓
Pulverizing
↓
Primary Separation

Fermentation
↓
Secondary Separation
↓
Post Fermentation
↓
Tertiary Selection

In this process, there are two ways. One is Windrow System in an open-air yard and another is High Speed System using a mechanical fermentation tank. The latter can be further classified into Rotary-kiln System, Multi-step System, Silo System and Bottle System.

Windrow System is the cheapest, but problems of odor, necessity of large land and seasonal fluctuation occur because it is treated in the open-air yard. High-Speed System can solve these problems but the disadvantage is its high cost.

The following process should be notices in these process.
- Desirable water content in waste as compost material is 50 to 60 %.
- Deodorizing process in required because odor substances such as ammonia, methyl-mercaptan or methyl sulfide is generated in the fermentation.
- Refused (not suitable for composting) must be treated in other way.

5. Material Balance in Composting

Products rate is a most significant factor in composting. The products rate depends on the waste input as its material. As the low production rate makes a price of the compost high, waste as the material with high production rate is desirable.

An example of the material balance in composting the municipal waste in Japan is shown below. The products rate is as low as 13.4 % while the rate of refused is 36.1 %.

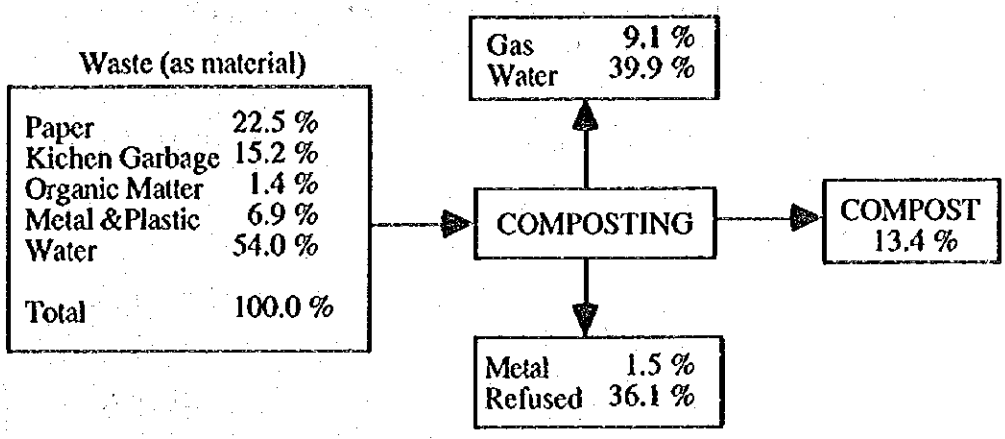


Figure 5-1 Material Balance in Composting (An Example in Japan)

20 % of products rate can b expected in Bucharest since the waste in Bucharest seems to contain much more organic substances than those in Tokyo. When waste quality changes along with the economic growth, the products rate decreases.

6. Cost of Composting

About 10 years ago in Alexandria in Egypt, unit cost of compost plant of the Windrow System, the capacity of which is 300 tons/day, costs 30,000 US$/ton of waste incoming. The cost in Bucharest is estimated based on this example. A price increase considered, current unit cost of construction is assumed to be 50,000 US$/ton. 40 % of this is construction cost and 60 % is equipment cost. The capacity of the plant is 100 tons (of incoming waste)/day. These assumption is shown in the table 5-1. Table 5-2 shows annual cost and benefit of a compost plant. The table 5-3 presents the unit cost of treating waste by composting. The unit cost of waste treatment by composting is 34.8 US$/ton of waste. Although this is cheaper than incineration cost of 42 US$/ton, it is still 7 times higher than that of the sanitary landfilling.

Table 5-1 Construction Cost and Capacity of a Compost Plant (100 ton/day)

A	Construction Cost	
	A.1 Machinery	$3,000,000
	A.2 Building	$2,000,000
	A.3 Total (1.1 +1.2)	$5,000,000
B	Waste Processing Capacity	
	B.1 Daily capacity	100 t/day
	B.2 Annual capacity	31,000 t/year
C	Compost Production Capacity	
	C.1 Daily production	20 t/day
	C.2 Annual production	6,200 t/year

Note:
1. It is assumed that the number of operation days is 310 day per year.
2. Eventually, 40% of waste incoming is refused.

Table 5-2 Annual cost and Benefits of a Compost Plant (100 ton/day)

1.	Total Cost	$679,000/year
1.1	Annual Depreciation {1) + 2)}	$399,000/year
	1) Machinery	$66,000/year
	2) Build	$333,000/year
1.2	Operation and Maintenance {1) + 2) + 3)}	$280,000/year
	1) Utilities	$60,000/year
	2) Operation & maintenance	$60,000/year
	3) Emolument (salary)	$160,000/year
2.	Total Benefit	$31,000/year
2.1	Compost sales (Direct benefit) ($5/t x 6,200 t/year)	$31,000/year
3.	Net Cost (1. – 2.)	$648,000/year

Table 5-3 Unit Cost of Waste Treatment by Composting

1.	Net Cost of Composting	$ 648,000 /year
2.	Quantity of Waste treated by Composting $31,000 (incoming waste) x 60 % =	186,000 ton/year
3.	Unit Cost of Composting $ 648,000/186,000 tons/year =	$ 34.9/ton

7. Quality of Compost

Maturity of compost, content of toxic substances and impurities are critical problem in quality control of compost. If the compost contains much impurities, even fully-matured compost is not accepted by users. If the safety form toxic substances is not guaranteed, the user avoid to use it. These quality problems can be obstacles in use as well as the high cost. Impurities can be eliminated fairly much by intensive separation, but it costs very high.

Toxic substances are the most serious problem in composting of the municipality waste, because it cannot be predicted what kind of toxic substances are incoming. Therefore, only sampling test cannot guarantee the safety of all products. Its quality is fluctuating and the possibility of disqualification cannot be denied. If the compost is disqualified, composting activity will be damaged. The possibility to be filed to the court by the users exists.

Quality standard of compost provided by European Union. is shown in the table 5-4 (a) to (c).

Table 5-4 Quality Standard of Compost by EU

(a) Nature

Class	Mesh Diameter [mm]	Glass Content at Maximum [dry wt %]		Plastic Content at Maximum [dry wt %]		Water Content Maximum [%]	Biodegradable Content at Maximum [dry wt %]	
	A	B	A	B	A - B	A	B	A
Finest	8	1	0.1	0.4	0.2	30	20	30
Fine	16	2	1	0.8	0.4	35	25	35
Middle	24	4	2	1.6	0.8	40	30	40
Crude	40	6	3	3.5	1.6	50	35	45

Note: A: Current Standard B: Target in Future

(b) Ingredient

Ingredient	N	P_2O_6	K_2O	CaO	$CaCO_3$	MgO
Conc at Minimum [dry wt %]	0.6	0.5	0.3	2.0	3.0	0.3

(c) Heavy Metal Content

Metal	Maximum Conc in Compost [mg/kg-dry wt]			Annual Usage at Maximum [kg/ha]		Maximum Quantity in Soil [mg/kg-dry wt]	
	Standard Collection		Separate				
	R	M	Collection	R	M	R	M
Zn	1000	1500	240	25.0	30.0	150	300
Pb	750	1000	160	10.0	15.0	50	100
Cu	300	500	40	10.0	12.0	50	100
Cr	150	200	30	10.30	-	50	-
Ni	50	100	10	2.0	3.0	30	50
As	-	-	-	0.35	-	20	-
Hg	5	5	0.5	0.40	-	2	-
Cd	5	5	1	0.10	0.15	1	3

Note: R: Recommended M: Mandatory

8. Distribution of Compost

Distribution of produced compost is difficult. Farmers do not always demand for the compost. Compost is demanded during fallow of the field, especially just before the beginning of next cultivation. Therefore, the compost must be stored at the compost plant until it is demanded. It is necessary to secure space for storing, otherwise stable operation is impossible.

It is not economical that the compost plant has its own delivery route. It is desirable that farmers come to take compost by their own cars. In this case farmers must bear transportation cost.

Although the demand for compost around Bucharest is not clear, the price of the compost should be less than 5 US$/ton when examples in the other countries are considered. Other wise, it cannot be sold. Farmers may use the compost if the compost is offered at free of charge, but the compost plant cannot be run.

9. Feasibility of Composting in Bucharest

If composting is promoted in Bucharest, the successful conditions are as follows:

a. Farmers' demand apparently exists around Bucharest

b. Purchase at fairly high price can be expected.
c. Benefit of composting is approved due to the increasing cost of landfilling.
d. Quality of the compost is guaranteed.

Quality control is difficult if the compost plant accept all kind of the municipal waste. It is desirable to limit the acceptable waste to kitchen garbage and market waste. Use can use the compost reliably if the compost is made of waste of stable quality. Cost condition might be satisfied when in future the waste must be transported to a much far disposal site after the planning period of the Master Plan.

10. Conclusion

As discussed above, the composting is not recommendable for the waste treatment method in Bucharest. The reasons can be summarized as follows:

- Composting cost much higher then landfilling
- Demand for the compost can not be confirmed
- Quality control of compost is difficult.
- Risk as business activity is high.

It is worthwhile, however, to examine the feasibility of composting in a small scale in a small farm village, and is recommendable from the view point of promoting organic farming.

JICA