

2.5 Organization

The s.w.m. services including street sweeping, is at present basically being carried out as an obligation of the Governorate of Alexandria. In addition, wastes collection services covering commercial wastes and a part of domestic wastes are being provided by ADS which is a satellite organ of each of the six districts and also by Zabbaleen who are in the characteristic of scavengers.

Although records show that Zabbaleen have handled about 70% of waste collection in Alexandria in the past, the number of Zabbaleen registered in 1984 is only 132. As many of them have been placed under the supervision of ADS, it can be said that virtually all s.w.m. services are being carried out by the Governorate of Alexandria and ADS.

ADS obtains its financial resources from revenues from charges for collection services offered to shops, business establishments and households, and the profits of selling plastic bags, and is therefore highly independent financially. But it is also subject to the authority of the districts which are sub-organs of the Governorate, since the District Chief also serves as the administrator of ADS, whose waste collection vehicles and crews are almost entirely composed of those belong to the districts.

This clause overviews the administrative organization of the Governorate of Alexandria, and the organizations related to the s.w.m. services and the way each organization takes its function in the services and indicates the organizational problems.

2.5.1 Administrative Organization of Alexandria Governorate

Alexandria Governorate is one of 26 governorates composing the Arab Republic of Egypt. The Governorate employs 16,700 staff as of October 1984.

Organizational structure of the Alexandria Governorate is shown in Fig. 2-5-1.

The Governor, Secretary General and District Chiefs of six districts are appointed by the Central Government. From the figure, the department directly charged with the s.w.m. is the General Follow-up Department from the cleansing administration side and the 6 districts undertaking the field services.

DEPARTMENT AND ORGANIZATIONS

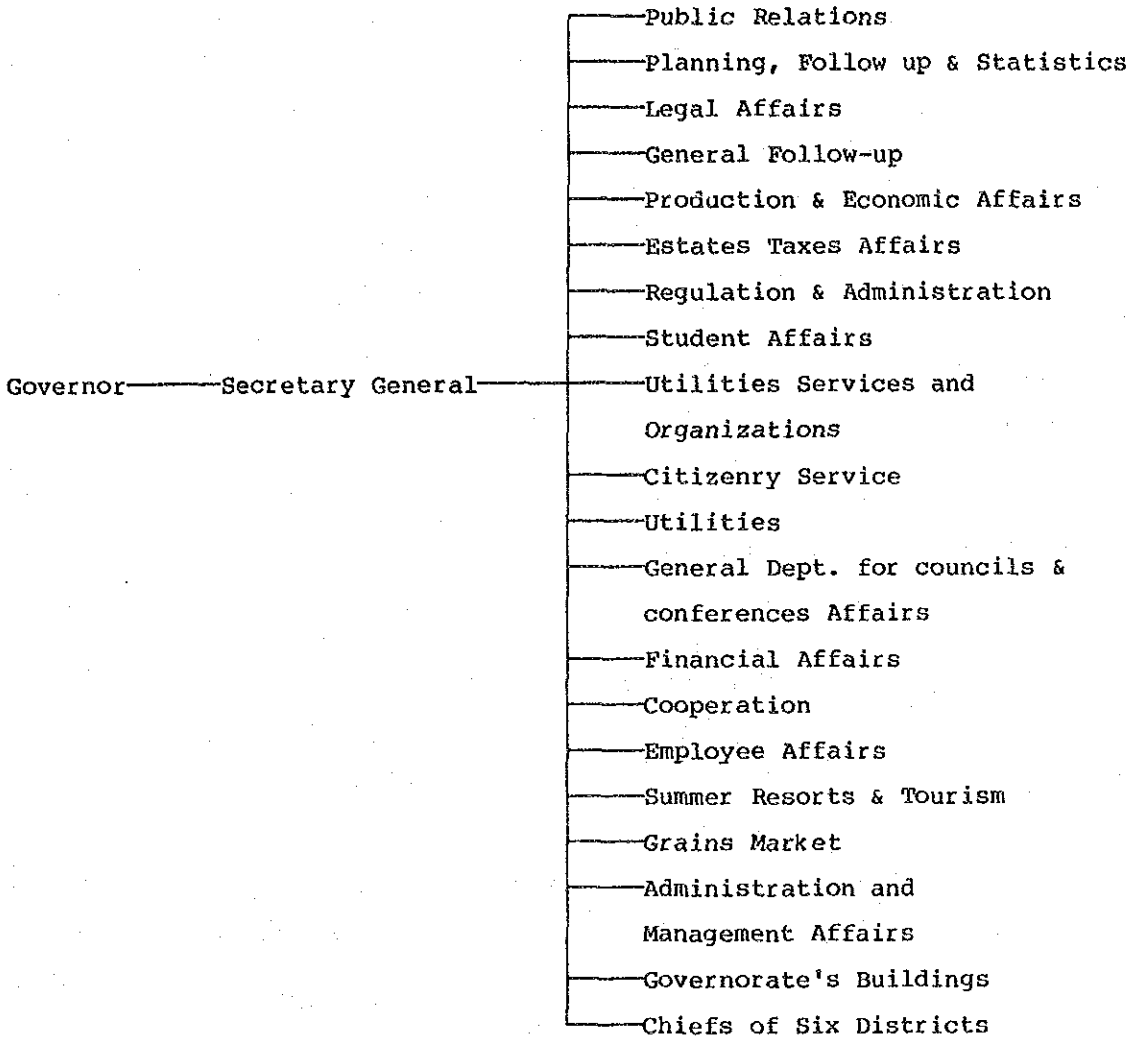


Fig. 2-5-1 ORGANIZATION CHART OF ALEXANDRIA GOVERNORATE

In Alexandria, public service activities other than s.w.m. which have large operational departments, such as waterworks, sewerage, electric power supply, public transport (tramway, bus) are operated by independent authorities or publicly-owned companies. In this respect, the s.w.m. function is the largest

department within the Governorate in terms of the number of personnel. The following briefly describes the organizations concerned with the s.w.m. services of Alexandria.

1) General Follow-up Dept.

The General Follow-up Dept. is one of the departments of the Governorate of Alexandria whose basic duties are supervising, guiding, surveying and recording of various public service activities centered around cleansing. It also acts as the Egyptian counterparts with respect to this study project.

The department's actual duties are becoming increasingly expanded up to the area of cleansing work. In 1985, the department has newly established a section responsible for the operation and follow-up of the compost plant.

The department has four sections as shown in Fig. 2-5-2, and has approximately 100 personnel.

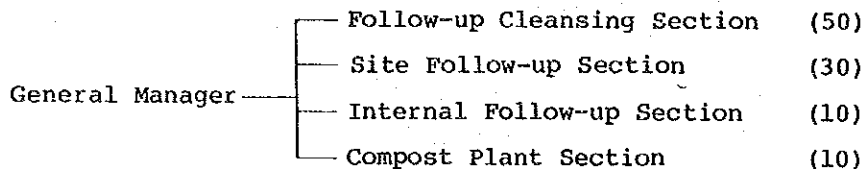


Fig. 2-5-2 ORGANIZATION OF THE GENERAL FOLLOW-UP DEPT.

Of the foregoing four sections, the Follow-up Cleansing Section is responsible for supervising, guiding, surveying and recording of cleansing services performed by each district, and the breakdown of its personnel as of December 1984 is as per Table 2-5-1.

Table 2-5-1 BREAKDOWN OF THE PERSONNEL OF THE FOLLOW-UP CLEANSING SECTION

Cleansing inspectors	: 22 (persons)
Dump site inspectors	: 10
Inspectors reserved for emergency	: 6
Female office clerk	: 3
Inspectors on long leave	: 10

2) District

There are six districts under the Governorate of Alexandria, and the chief of each district is appointed by the Ministry of Local Government.

The organization of each district is generally as shown in Fig. 2-5-3, and each district performs administrative works which are directly relevant to the inhabitants.

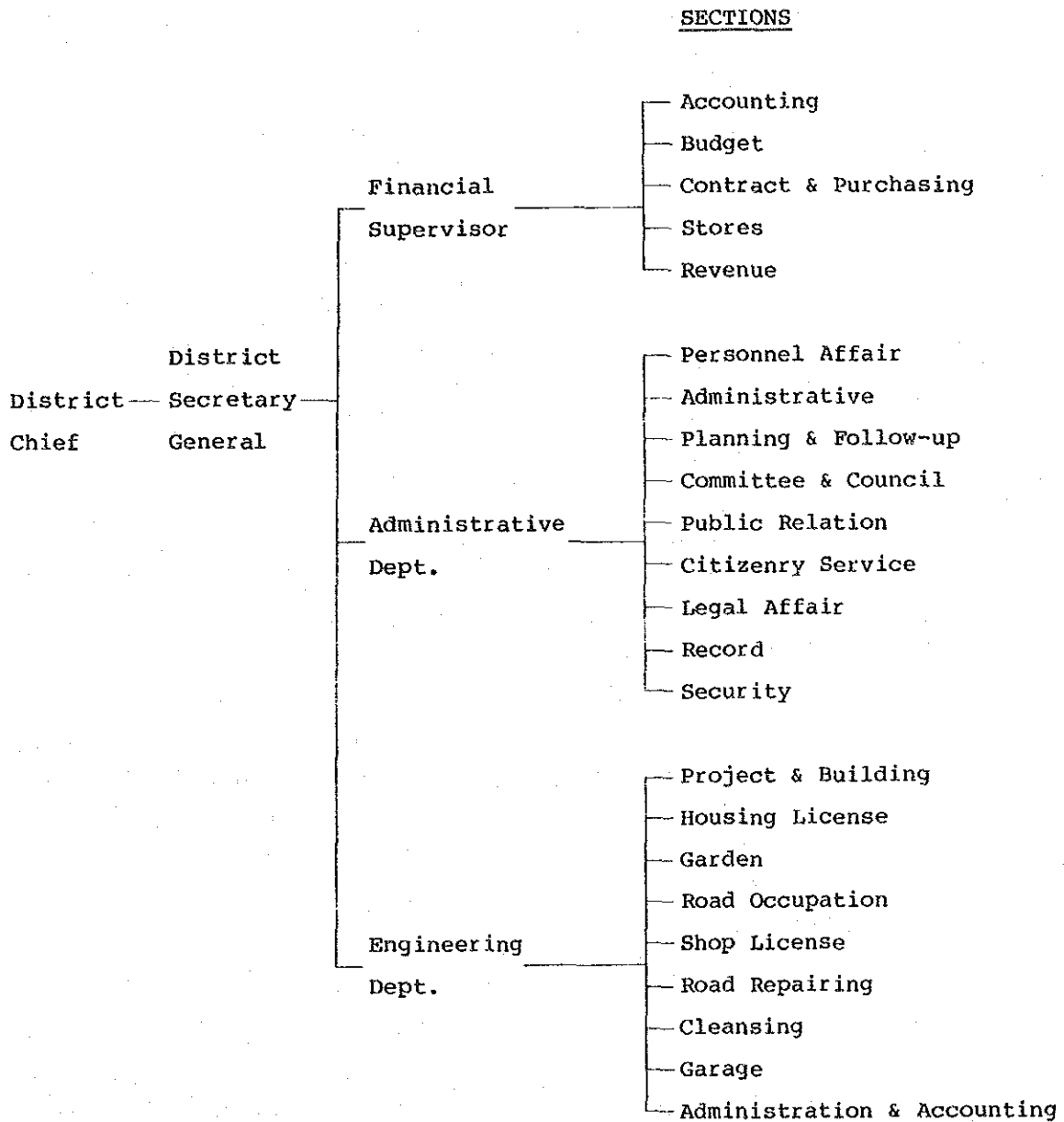


Fig. 2-5-3 ORGANIZATION CHART OF MIDDLE DISTRICT

Of these, the Cleansing Section of the Engineering Dept. is responsible for waste collection, street sweeping, maintenance and disinfection of public lavatories, control of stray cats and dogs, etc.

The chief of this section is called the "General Supervisor" under whom are several inspectors. Under each inspector are several work masters, each of whom supervises 10 to 20 cleansing workers (street sweepers and collection workers).

Each district also has a Garage Section which performs daily maintenance and simple repair work of collection vehicles, but their level of work is low due to shortages of technical staff, tools and spare parts.

3) Central Workshop

There are two vehicle workshops in Alexandria. One is in charge of maintenance and overhaul of collection vehicles and official vehicles and is so-called the "Central Workshop".

Legally, this Central Workshop is placed under the supervision of the Directorate of Housing of the Ministry of Housing and Utilities (MHU) but its budget is defrayed by the Governorate of Alexandria, and as the Directorate itself is increasingly becoming more like one of the departments of the Governorate in character, the position of the Central Workshop in the organizational setup has become hard to define.

The Central Workshop, which consists of seven departments, namely, Management, Finance, Garage, Electricity, Civil Work, Gasoline Trucks, and Diesel Trucks and Equipment Repair is a fairly large organization with 600 personnel. Repair and overhaul of collection vehicles and heavy equipments of disposal sites and compost plants are undertaken by its Diesel Trucks and Equipment Repair Dept.

The Central Workshop is also responsible for drafting the purchase plan of vehicles and heavy equipments for the s.w.m. services. Although this purchase plan is later adjusted by the Committee composed of the members listed below, the Central Workshop has a large influence on the decision of purchasing collection vehicles and heavy equipments.

- Manager of Directorate of Housing
- Manager of Central Workshop
- Financial Supervisor of the Governorate
- Director of General Follow-up Dept.

4) Cleansing Fund

The Cleansing Fund is a fund (institution) that is set up based on Article 8 of Law No. 38/1967, and it bears the major portion of the independent financial resources for cleansing work. The source of the fund consists of 2% of rental fee collected from occupants of leased dwellings, automobile tax on large vehicles, fines, penal sums, etc. and the fund is used for giving incentives to cleansing workers and for the operating expenses.

The annual budget of the Cleansing Fund is prepared by the Budget General Supervisor of the Governorate and deliberated by the Board of Directors chaired by the Secretary General, and is subject to final approval by the Executive Council of the Governorate and also of the People's Council which is a congressional elective institution.

The members of the Board of Directors are as follows.

- Secretary General (Chairman)
- Six District Chiefs
- Head of Directorate of Ministry of Housing & Utilities
- Utility Police Chief
- Traffic Department Director
- Roads Directorate General Director
- General Director of Administrative Affairs, Alexandria Water Utility
- Central Workshop General Supervisor
- Sanitary Drainage General Director
- Head of Alexandria Electricity Distribution Company
- Gardens General Director
- Ministry of Health Directorate
- Budget General Supervisor

- Member of Financial Bureau of Cleansing Fund
- Governorate Accounting Supervisor
- Road Directorate Financial Manager

(The General Director of the General Follow-up Dept. is not a member of its Board but attends the board meetings.)

5) Executive Council and Secretary General

In Egypt, administrative organ has generally strong authority. The Executive Council, organized by the following members, is the highest decision making agency responsible for enforcing policy measures in Alexandria.

- Governor
- Chief of Police
- Chief of Regional Military Forces
- Head of Public electricity company
- Head of Water Authority
- Head of Sewage Authority
- Head of Public Transport Authority
- Head of Alexandria University
- Secretary General
- Directors of some departments in the Governorate
- Six District Chiefs
- Heads of Directorates of the Ministries

The Council deliberates and decides on the Governorate budget and the institutional systems for the authorities of the Governorate, the public service charges in line with the conditions of the Ministry of Finance, etc.

The Secretary General is virtually responsible for the administration and has a large influence over policy making and decisions concerning the s.w.m. He is the chairman of the Cleansing Fund, a member of the Executive Council, and is deeply involved in selecting foreign aid projects. He also has the authority over the personnel administration of the Follow-up Dept.

6) Directorates of the Ministries

There are directorate offices of eleven central government agencies in Alexandria, and the directorates of the following three government agencies are particularly relevant to the s.w.m services.

a. Ministry of Housing and Public Utilities

This is the upper organ of the Central Workshop and also the competent authority of cleansing administration in the Central Government. The head of the Directorate is also a member of the Board of Directors of the Cleansing Fund.

b. Ministry of Health

This ministry is the competent authority in charge of environmental hygiene in the Central Government. Its Directorate supervises the condition of street wastes and is concerned with s.w.m. as a whole from the viewpoint of public health. The head of the Directorate is also a member of the Board of Directors of the Cleansing Fund.

c. Ministry of Agriculture and Food Security

Because of its standpoint of administrating farmland and preserving fishery resources of the Lake Maruit and irrigation function, it is relevant to the s.w.m. in securing landfill sites. And it is an agency with whom coordination has to be maintained. In the longer range, it is also the ministry with whom a close relationship will most likely be attained in forming the markets for compost.

d. Other government agencies which have directorates in Alexandria are as follows.

- Ministry of Education
- Ministry of Supply & Home Trade
- Ministry of Manpower & Vocational Training
- Ministry of Culture
- Ministry of Social Insurance & Social Affairs

- Ministry of Transport, Communication & Maritime Transport
- Ministry of Interior
- Ministry of Finance

7) Association for Development of Society (ADS)

ADS is a semi-governmental organization established in each of the six districts. The ones in Middle, East and West District were established in 1970 and the last one in Gomrok District in 1983. Legally, ADS, like all associations aiming at serving the society and established under the pertinent laws stipulating the establishment and operation of such associations, is under the supervision of the the Ministry of Social Insurance and Social Affairs and is therefore independent from the district. But actually it may be claimed as being under the control of each district by the reasons of the following three points.

- a. Most of ADS's personnel are those of the district, and most of the vehicles and other equipments for the cleansing services are also borrowed from each District.
- b. The District chief concurrently serves as the chief of ADS.
- c. Most of the members of the Council which determines the activities and operating policies of ADS are the district personnel.

The ADS aims to contribute to solving the problems of the local communities and to improving the social, cultural and economical levels of the inhabitants. Its activities also include the operation of car parks and the like.

The following background facts can be cited as reasons for the participation of ADS in the cleansing services.

- a. Local governments are legally prohibited to charge fees as remuneration for their public services unless specifically provided otherwise by law. Because of this, financial resources for operating the services are limited to the Cleansing Fund and the finance needed

for the basic salaries and the wages appropriated by the Central Government. Thus, it is difficult for them to secure additional funds needed for the improvement of cleansing works.

- b. Zabbaleen who used to carry out collection services in the past have decreased drastically in number since many of their offsprings opted for other blue collar jobs in the Middle East Countries in the 1970s and also due to other reasons.
- c. Contrary to the local governments, ADS is collecting as remuneration for its services which enables it to be self-supporting finance.

It is with such a background that ADS began to participate in the waste collection services. They collect left over wastes after the district working hours (6:00 to 14:00) have ended, by effectively utilizing the district personnel and collection vehicles until 20:00.

In other words, collection services offered by ADS have the function of supplementing the limited collection services provided by the districts whose own fund is limited to the Cleansing Fund which falls short in meeting the requirements for overtime allowance and incentive payments, etc. And as it now stands, the waste collection services in Alexandria are to be secured by the both of these two organizations.

However, such a dual system has a contradiction in itself, considering that only a part of the citizens actually pay fees despite the fact that the same level of collection service is offered by all. For instance, the low income class peoples who are not receiving adequate collection service of the district have to pay a fee of 0.5 - 1.0 LE/month in order to receive the collection service by ADS. Furthermore when the cleansing operation is reviewed, ADS tends to collect from shops and the like for whom fees are easy to charge.

8) Zabbaleen

Zabbaleen, who had been undertaking waste collection throughout Alexandria once, have rapidly decreased since the 1970. The number of bosses, which was about 580 in 1974, decreased to 132 by 1984 as shown in Table 2-5-2, and their activities are now limited to the three districts of East, Montazah and West.

As a consequence, the Governorate which used to discharge only the street sweeping came to take charge of waste collection, too, and the collection services by ADS also came to be developed, starting with West District in 1981.

Table 2-5-2 NUMBER OF ZABBALEEN BOSSES (1984)

	(person)
Montazah	22
East	75
Gomrok	5 (4 are female)
Middle	0
West	30
Ameriyah	0
Total	132

It is apparent that the position of Zabbaleen in waste collection today has declined sharply from the fact that they handle only 6.5% of the total amount of wastes being collected. Many of them today have entered into a contractual relationship with ADS and their work is incorporated into the collection activities of ADS.

As the Governorate intends to eliminate waste collection by Zabbaleen eventually and to incorporate their activities into the domain of recovery of useful materials and the like, the collection service by Zabbaleen is anticipated to be phased out in the next few years.

Incidentally, in many other cities of Egypt, typically in Cairo, Zabbaleen still play the central role in waste collection. The decreases in the number of Zabbaleen constitutes a favorable condition in reorganizing the s.w.m. system of Alexandria, particularly in restructuring relevant organizations.

The foregoing has reviewed the individual organizations concerned with s.w.m. Table 2-5-3 presents the relationship among various sections in s.w.m. and each organization involved.

Table 2-5-3 RELATIONSHIP AMONG VARIOUS SECTIONS IN S.W.M. AND EACH ORGANIZATION INVOLVED

Type of Activities	Responsible Organization
1. CLEANSING SERVICES	
(1) Street sweeping	o Each cleansing department of six districts.
(2) Waste collection haulage, dumping at dump sites	o Each cleansing department of six districts. o ADS of six districts o Zabbaleen
2. FINAL DISPOSAL	
(1) Levelling dumped wastes at the dump sites	o Central Workshop
(2) Management of dump sites	o General Follow-up Dept.
(3) Planning of final disposal (to find and plan new dump sites)	o No organization is specialized for the systematic planning. o General Follow-up Dept. might assume the responsibility when needed.
3. PROCESSING	
(1) Construction & operation of compost plant	o General Follow-up Dept.
(2) Sales of compost products	o Abis Compost Plant
(3) Incineration	o No incineration is carried out. Note: There used to be an incinerator in Montazah District, but it has ceased operation due to breakdown.
4. MAINTENANCE OF VEHICLES & EQUIPMENT	
(1) Daily simple maintenance	o Each garage of six districts

Type of Activities	Responsible Organization
(2) Overhauling and complicated repair	o Central Workshop
(3) Financing the maintenance costs	o Cleansing Fund o Governorate (Budget Chapter 2)
(4) Construction of District Garages and Central Workshop	o Directorate of Housing
5. PROCUREMENT OF VEHICLES, CONTAINERS & CARTS	
(1) Planning	o Central Workshop o Committee Note: The Committee members comprise manager of Directorate of Housing, manager of the Central Workshop, Financial Supervisor of the Governorate and the manager of General Follow-up Dept. o Cleansing Fund Board
(2) Procurement	o Central Workshop o ADS o Zabbaleen (Procuring of their own donkies and donkey carts.)
(3) Financing vehicles procured by Central Workshop	o Governorate (Budget Chapter 3) Note: Big portion of the Chapter 3 is financed by foreign loans.
6. INSPECTION & FOLLOW-UP OF CLEANSING OPERATION EXECUTED BY DISTRICTS & ADS, AND REPORTING CLEANSING SITUATION	
(1) Daily inspection & follow-up and reporting	o General Follow-up Dept. o Environmental Health Offices of Directorate of Health Note: Environmental Health Offices (there are 27 altogether) share the responsibility for daily inspection of street waste.

Type of Activities	Responsible Organization
(2) Other Inspection and Reporting	<ul style="list-style-type: none"> o Planning & Follow-up Dept. of six districts o Utility police o Governor and Secretary General's Office
7. COLLECTION OF WASTE COLLECTION FEE	<ul style="list-style-type: none"> o ADS o Zabbaleen
8. PERSONNEL MANAGEMENT	
(1) Recruitment, allocation and appointment	
a. Recruitment and allocation to Governorate Office and public sector establishments	o Directorate of Manpower
b. Allocation of freshmen within the Governorate Departments and six Districts	o Personnel Dept. and Committee of Governorate
c. Allocation of freshmen within each district	o Personnel Dept. and Committee of each district
d. High ranking personnel such as Secretary General and District Chiefs	o Ministry of Local Government
e. Allocation of handicapped persons and former prisoners	<ul style="list-style-type: none"> o Ministry of Social Affairs Note: The General Supervisor of the West District said that 4 or 5% of the cleansing workers of the district are those allocated by the Ministry of Social Affairs.
f. Recruitment of some cleansing workers by advertisement (to make up for the shortage)	o Districts
(2) Punishment	o Employees' superiors
9. PAYMENT OF SALARY, INCENTIVES AND OTHERS	
(1) Salary, some allowances benefits	o Governorate (Chapter 1)

Type of Activities	Responsible Organization
(2) Incentives, and wages for seasonal workers, etc.	o Cleansing Fund
(3) Bonus, wages and incentives for the employees working for ADS cleansing service	o ADS
10. ISSUING REPORTS FOR CHARGING FINES FOR THE VIOLATORS OF CLEANSING LAW	o Inspectors of districts o Inspectors of Directorate of Health o Utilities Police
11. ADVERTISEMENT CALLING FOR CITIZENS' COOPERATION FOR PROPER WASTE DISCHARGE	
(1) Nation-wide TV and radio advertisement	o Ministry of Information
(2) Advertisement by radio & leaflets	o Information Office and concerned authorities
12. DECISION MAKING FOR REQUESTING FOREIGN AIDS RELATED TO THE S.W.M. IMPROVEMENT	o Secretary General Note: At present, Secretary General makes this decision in cooperation with the manager of General Follow-up Dept. and Deputy Director of Directorates Ministry of Housing & Utilities. o District Chiefs Note: In the case of the Neighborhood Urban Service (NUS) projects of the USAID, the District Chiefs directly deal with the USAID.
13. PLANNING FOR THE S.W.M. IN ALEXANDRIA	
(1) Total planning	o None
(2) Policy making for cleansing	o Manager of General Follow-up Dept. o Secretary General

Type of Activities	Responsible Organization
14. S.W.M. IN EGYPT	
(1) Total Management	o None
(2) Drafting laws	o Ministry of Housing & Utilities
(3) Public health	o Ministry of Health
(4) Study of compost	o Agricultural Research Center (ARC) o A Committee in Ministry of Agriculture o Some university professors and private consultants
(5) Decision making concerning investment and foreign aid projects	o Higher Committee for Investment Note: This committee comprises the ministers of relevant ministries such as Ministry of Finance, Ministry of Planning and International Cooperation, Ministry of Industry, Ministry of Economy and Foreign Trade, etc. In the case of loan projects, approval by the parliament has to be obtained. Ministry of Planning and International Cooperation is responsible for the affairs concerning investment and international cooperation.

2.5.2 Field Work Sectors in S.W.M. Services

The preceding paragraph has overviewed the organizations concerned with s.w.m. as a whole. Table 2-5-4 presents the field work sectors which is considered the virtual executing functions of this undertaking.

Table 2-5-4 ACTIVITIES RELATED TO THE S.W.M.
AND RESPONSIBLE ORGANIZATIONS

Type of Activities	Responsible Organization
1. Cleansing	
(1) Street sweeping	Districts
(2) Collection, haulage	Districts, ADS & Zabbaleen
(3) Maintenance of collection vehicles and equipment	Central Workshop & District Garages
2. Final disposal	
(1) Levelling dumped waste at dump sites	Central Workshop
(2) Dump site management	General Follow-up Dept.
3. Compost plant management	General Follow-up Dept.

The following overviews the working setup (manpower allocation) by each field work sector.

1) Collection and Street Sweeping

Waste collection and street sweeping are undertaken by each district, ADS and Zabbaleen under the supervision and the guidance of the inspectors of the General Follow-up Dept. Table 2-5-5 presents the number of personnel and Zabbaleen.

As can be seen from this table, the number of personnel for waste collection and street sweeping activities excluding Zabbaleen is approximately 2,300 persons, of which 70% is for street sweeping.

Table 2-5-5 NUMBER OF PERSONNEL ENGAGED IN COLLECTION AND SWEEPING

(person)

Street sweeper	1,660
Assistants for collection	400
Drivers	130
Inspectors of the 6 districts	50
Inspectors of the General Follow-up Dept.	50
Zabbaleen	130
Total	2,420

Source: Monthly Report prepared by the General Follow-up Dept. for October 1984.

Table 2-5-6 NUMBER OF PERSONNEL IN MIDDLE DISTRICT

(person)

	District	ADS
General Supervisor	1	1
Assistant Supervisor	3	3
Inspectors	10	5
First Workmasters	7	5
Workmasters	41	31
Drivers	40	23
Collection Workers	131	106
Sweepers	570	22
Dumpsite Workers	13	-
Public WC Keepers	132	-
Store Keepers	8	-
Sick Workers	28	-
Total	984	196

Table 2-5-6 lists the manpower allocation of the Cleansing Section of Middle District. It has a personnel of almost 1,000 persons including dumpsite workers, public W.C. keepers and store keepers for the custody of fixtures and fittings which are not included in Table 2-5-5. They include personnel engaged in the collection service of ADS, mostly drivers, collection workers and their managerial and supervisory staff, who account for 20% of the total manpower or for 75% of the manpower if confined only to the above named job categories.

The number of the cleansing service-related personnel carries quite a large weight in the 16,700 personnel of the Governorate including the aforementioned districts.

The maintenance duty is taken care of by the Central Workshop and District Garages. The former has a personnel of 600, and the latter, several tens of personnel in each garage. As these organizations also handle vehicles of other public institutions, their number of the personnel does not represent the number of personnel engaged in cleansing service.

2) Compost Section

The compost section is currently being operated by a total of 74 personnel shown in Fig. 2-5-4 under the supervision of the General Follow-up Dept.

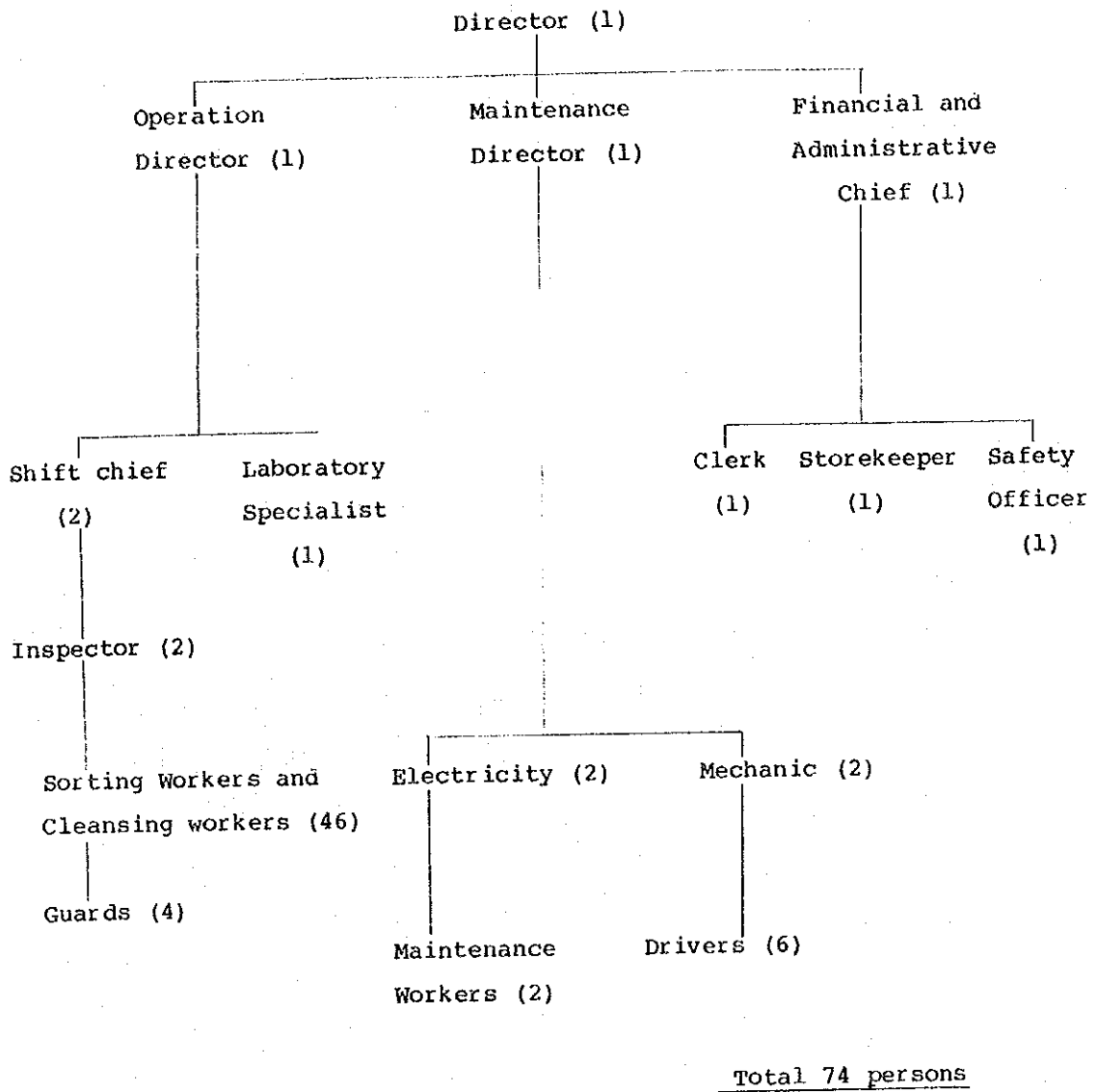


Fig. 2-5-4 ORGANIZATION AND NUMBER OF PERSONNEL OF ABIS COMPOST PLANT

3) Final Disposal Section

There are some districts which have their own disposal sites, such as East and Montazah District. But the main disposal site is MBSDS, into which the wastes collected from Middle, Gomrok and a part of West Districts are hauled in and disposed of. Manpower allocation of MBSDS is as Table 2-5-7 with a total of 44 persons.

Table 2-5-7 NUMBER OF PERSONNEL OF MBSDS

(persons)				
Organizations	No. of Workers	Person/Items		Job
General Follow-up Dept.	3	Gnl. Supervisor	1	Supervision and Inspection
		Inspector	2	
Middle District	15	Supervisor	2	Inspection of Middle District car and guiding
		Clerk	4	
		Inspector	2	
		Worker	5	
		Guard	2	
Gomrok District	3	Inspector	1	Car Inspection of Gomrok District
		Clerk	2	
West District	1	Inspector	1	Car Inspection of West District
Central Workshop	11	Supervisor	1	Operation and Maintenance of Landfill Equipment
		Operator	6	
		Driver	2	
		Assistant	2	
Utility Police	4	Officer	4	Safety Guard
Fire Police	6	Fireman	6	Fire Service
Health Dept.	1	Officer	1	Disinfection
Total	44	--	44	--

2.5.3 Organizational Problems of S.W.M. System

The foregoing has reviewed the organizations concerned with s.w.m. in Alexandria. This section, on smoothly performing the s.w.m. services, will identify the types of problems in such organizational systems that exist presently as well as the problems related to institutional aspect.

1) Basic Problems

The basic law ruling the s.w.m. in Egypt is the Law No. 38/1967 which was enacted in 1967 and partially amended by the Law No. 129/1982 and still in force today.

This Law No. 38/1967 stipulates the duties and obligations of dischargers and local self-governing bodies, supervisory responsibility of land owners, penalty regulations, etc. Particularly the following two articles can be cited as provisions that affect the way the institutional aspects ought to be.

- Article 1

It is prohibited to discharge wastes at places other than designated by the Local Council.

Local Council refers to the Executive Council mentioned previously.

- Article 8

The Local Council may charge fees not in excess of 2% of the house rental fee as a revenue source to cover the expense of cleansing and city beautification.

Also, the Decree No. 134/1968 which is enacted as a related one of the said Law incorporates regulations such as technical standards which are equivalent to government ordinances and regulations in Japan. Article 9 of this decree stipulates that the Local Council might determine the ceiling on the number of permits granted to those who engage in the waste collection in each district.

Furthermore, the Law No. 43/1979, which is the basic law concerning local government, stipulates that the basic responsibility for public health and city beautification rests upon the local government which shall not charge any fee other than those stipulated by law in return for its public services.

The basic problem with the organizational system for the s.w.m. in Alexandria can be claimed to lie in the fact that the local governments such as the Governorate and Districts themselves are providing services as the main bodies of the s.w.m. under the foregoing statutory provisions.

In other words, although the local government is legally allowed to undertake waste collection services, with the basic salaries of personnel required for that purpose being paid by the Central Government, it is prohibited under the Law No. 43/1979 from levying charges for collection and disposal services except fees of not more than 2% of house rental for cleansing services and beautification of the cities including street sweeping.

It may be argued that the actual ongoing system is to utilize ADS as a fee collecting mechanism so to speak in order to cope with the foregoing restriction on fund raising by incorporating the waste collection service into the activities of ADS. This invites dualization of the s.w.m., and as a matter of fact, that organizational contradictions come up on the various activities.

The second basic problem is that the cleansing sections of districts which actually shoulder almost all of the field work are positioned as the terminal organs of the Governorate have little to say in general and administrative works such as planning, finance, personnel administration, purchasing of vehicles and other equipments and materials and technological development.

This situation is more or less the same with the General Follow-up Dept., which is the department in charge of cleansing services in the Governorate. It shares the same problem with the Cleansing Section of districts particularly in not having any funds it can use for its own sake.

As above, the fact that the districts and the Follow-up Dept. which together form the s.w.m. are unable to fully participate in overall administration and decision making on the basic policies is giving rise to many problems in developing the s.w.m. services in Alexandria.

2) Other problems

Many of the organizational problems are related to the aforementioned two fundamental problems, and the following discusses in detail each organizational problem.

(1) Problems in organization and system

a. Inadequacy of provisions on waste collection, and related ordinances and regulations

The Law No. 38/1967 and the Decree No. 134/1968 prescribe the dischargers' obligations and prohibited acts in connection with the s.w.m. However, as Zabbaleen had for a long time been collecting wastes in Alexandria under contract with the dischargers themselves, a mode of discharging waste suitable to the collection service of Zabbaleen had become established among the citizens, and even though collection by Zabbaleen has shifted to the one by each district, the citizens seem to think it only natural that they should continue to discharge waste in front of their doors.

Also, some of the citizens misunderstand the 2 % of house rental charge which essentially should constitute the resource of the fund for street sweeping and prevention of epidemics as a fee charged for waste collection.

As above, the present situation is that the citizens of Alexandria have no clear understanding of the collection system of the Governorate prescribed by national laws and decrees. Nor do they fully understand their obligation to discharge waste in a manner matching the above system.

One of the reasons for the above is Alexandria's failure to amend its collection regulations and ordinances pertaining to the duties as citizenry and its lack of efforts to publicize them. These are matters that demand improved the s.w.m.

b. Administration of the system for supervising and guidance

Alexandria enforces the system of supervising by District inspectors and Utility Police and of punishing violators with a fine. Although this system of fining is being applied with stricter measure every year, it is applied only to the business establishment which violate the regulations prohibiting illegal dumping of waste or otherwise, so that it has only a small effect in guiding the citizens in the proper way of discharging wastes.

Districts and ADS, too, are holding campaigns to prevent littering of wastes, but in addition to such campaigns and improvements in the collection service, a system of closely supervising and guiding the citizens should be enforced, and the standards in issuing tickets to violators and classification of fines should be clearly defined so that the fining system is applied systematically and fairly.

The most fundamental problem of the organizational system is, as mentioned previously, the prohibition on collection of fees other than the cleansing fund by the local government in operating the s.w.m. system.

(2) Problems with the organizational structure

Almost all of the organizational problems stem from the fact that the General Follow-up Dept. and District Cleansing Section which are actually responsible for the s.w.m. are both devoid of the authority to make important decisions. This is described in concrete terms below.

a. Authority to determine and execute operating budget

Of the s.w.m. budget, the fund for the basic wages is appropriated in a sum corresponding to the personnel, but in the determination and the execution of the budget for other items such as incentive payment, investment funds, the purchased and maintenance of collection vehicles, both the General Follow-up Dept. and districts are in weak positions.

The actual situation is that the budget of the Cleansing Fund which is the resource of funds for incentive payment, and other operating expenses is determined by the Fund's Board of Directors, but the functions which actually perform the s.w.m. services are represented by only six of District Chief, and even the Director of the General Follow-up Dept. attends the Board meetings only in the position of an observer.

Also, the setup is such that most of the expenses for the vehicle furnishings and the maintenance which account for the largest portion of the operating expenses cannot be defrayed without the approval and control of the Central Workshop and other departments. Furthermore, the plan for purchasing of collection vehicles as well as other vehicles are drawn up by the Central Workshop which is not directly involved in s.w.m.

As above, the departments responsible for the s.w.m. are greatly restricted in exercising the authority with respect to preparation, determination and execution of the operating budget. This constitutes a big obstacle to developing an autonomous s.w.m. system.

b. Intervention by the Central Workshop

As stated above, the problem with the present organizational structure is the involvement of the Central Workshop in an important aspect of the s.w.m. system.

At present, daily maintenance is undertaken by the District Garages, but the fund to purchase the necessary parts for maintenance is

disbursed by the Central Workshop in the amount of only 200 LE each time. When the 200 LE is used up, details of the payments are reported to the Central Workshop in order to receive the next payment of 200 LE, and when the budgeted amount has been used up in this way, all subsequent payments are stopped. Also, when the purchasing parts which cost more than 40 LE each, the District Chief have to obtain the approval of the Manager of the Central Workshop.

This procedure is perpetually restricting the District Garages funds for such purchases. Lack of proper daily maintenance due to the restrictions in making systematic disbursements is inviting breakdowns of vehicles and lowering their performance.

In view of this, the District Chiefs are requesting that they be provided with an annual budget to cover maintenance expenses and purchasing of parts. Their request, however, has not been granted as yet.

The duties of the Central Workshop also include the overhauling of vehicles and the repairs of disabled vehicles and the purchasing and the allocation of collection vehicles, and these duties are often carried out on the Central Workshop's judgements which do not necessarily reflect the needs of the field work sector.

In developing the s.w.m. system in Alexandria, the purchasing of collection vehicles, the vehicle allocation plan, preservation of vehicle performance by routine maintenance and overhaul are basic activities, but the involvement of the Cental Workshop, which takes a different standpoint in the execution of these duties and in the decision making, proves to be a critical problem.

c. Problems arising from co-existence with ADS

As stated previously, ADS has taken an indispensable role in supplementing the collection function of the districts' and in making up for the shortage of funds by charging fees. The coexistence of ADS, however, is giving rise to the following concrete problems.

- i) Because ADS offers a higher incentive, District collection workers tend to become perfunctory in district work time.
- ii) Because of the dual system, systematic collection and control are not strictly enforced, and the overall collection efficiency is lowered.
- iii) The citizens cannot distinguish District collection from ADS collection. In some instances, ADS is found collecting charges from inhabitants in the District collection service areas. There is also the inconsistency that inhabitants in ADS service area are made to pay for the same services which are given to other areas for free. This is a reason the system of charging fee is not working well.

d. Inadequacy of planning function

The s.w.m. requires planning in various section, such as in securing and developing landfilling sites, purchasing, maintenance and dispatching of collection vehicles and heavy equipment, developing of facilities, securing technical staff, financing, etc. The ongoing organization hardly has the planning unit and staff necessary to carry out these functions systematically.

Because of this, the s.w.m. activities are carried out on the basis of past empirical rules and on the judgement of a few personnel or other departments such as the Central Workshop, and such activities on the whole are quite poorly planned.

e. Overlapping of the supervising system and publicity

Supervising and guiding the citizens to discharge their wastes properly, and banning of illegal dumping, are carried out by the Inspectors of each district, the Utility Police and also by the Environmental Health Office. Each, however, is a different the organization so that as a consequence there is no unified policy for supervising and guidance which, in effect, is not proving to be effective at all.

On the other hand, despite the fact that a work force of more than 2,000 personnels, including both waste collection and street sweeping, maintains daily contact with the citizens, it is unable to guide or induce the citizens to discontinue illegal discharging of waste.

The ongoing organization lacks functions which have dischargers observe the proper way, which is a contact point between execution agency of the s.w.m. and citizens, and also is the most vital function of the s.w.m.

(3) Problems in organizational functions

a. Inadequacy of planning, managing and financing capabilities

As described previously, the present organization is quite poor in planning and financing capabilities partly due to the lack of a planning unit and its system of entrusting managerial and financial aspects to other departments.

The lowness of these capabilities stems from the fundamental problem of the organization and is therefore difficult to improve without changing the organizational structure and systems. However, it is necessary to recognize the importance of planning, managerial and financial capabilities in every activity and to endeavor to improve these capabilities within the framework of the existing organization.

b. Low working efficiency of administrative and clerical personnel

The inspectors and clerical personnel of the Follow-up Dept. in charge of services of each district are poor in working efficiency and are not fulfilling their actual functions, which fact can be attributed to their low wage levels and the small incentives allocated to them. The low working morale of the administrative sections, despite the fact the collection workers and sweepers are assigned a heavy workload, constitutes one of the factors for unsuccessful operation within their overall performance.

c. Shortage of technical staff

The low wage level is making it difficult to secure the competent technical staff and is lowering the technical level in its activities. Other authorities are endeavoring to raise the wage level to bring it closer, even in a bit, to the wage level of the private sector. Unless the wage level is improved for the s.w.m. system as well, the difficulty in securing technical staff is unlikely to be alleviated.

d. Inadequacy of daily maintenance function

In addition to the shortage of technical staff, the inadequate allocation of funds is drastically lowering the level of daily maintenance function of the District Garages. This is shortening the service life of the collection vehicles and increasing their failure rate and, in effect, lowering the overall collection capacity.

2.5.4 Plan to Establish a Cleansing Authority

In Egypt, many public affairs are performed in the form of Authority because of the considerable limitations imposed on charging of fees by the local government for its public services under the Law No. 43/1979 (the Law of Local Government) mentioned previously and also with a view to pursue efficiency of the public service sector by operating it in the form on a highly self-supporting system.

Many authorities have been established based on the Law of General Authority No. 61/1963 enacted in 1963.

In Alexandria, waterworks is performed by the Alexandria Water General Authority which was established in 1968, and sewerage is also operated by the Alexandria General Organization for Sanitary Drainage (AGOSD) which was established in 1979, and the Water General Authority in particular has already established an operating basis which is almost close to self-supporting.

Regarding the cleansing work including street sweeping, the establishment of an Authority was considered in 1975 when the "Agency for Follow-up of Cleansing Activities and Project of Beautifying the City", which is the predecessor of the present General Follow-up Dept., was established, but it was foregone because of various reasons.

Since the turn of the 1980, however, the Central Government has held the view that it is reasonable to operate the s.w.m. under an Authority and approached various Governorates urging the establishment of an Authority. As a result, Authorities were established in Cairo and Guiza.

This time again, the idea was foregone in Alexandria. However, at the meeting of August 1985 among the Governor, Secretary General and the District Chiefs of six districts, a need to shift to the Authority was unanimously verified, and its establishment was agreed upon at the meeting of the Governor and the Prime Minister.

As above, the organizational system which forms the very basis of the s.w.m. in Alexandria was decided to undergo reorganization in the midst of this study project.

This shift to unified management under an Authority established by the law, the provisions of which are highly likely to lead to the solution of existing basic problems on the s.w.m. described before, and in this respect, it is expected to mark a big stride toward the improvement the s.w.m. in Alexandria.

With the agreement of the Egyptian counterpart, investigation and review under this study project were pushed forward on the premise that said Authority will be established.

2.6 Budget and Finance

2.6.1 Money Flow

Money flow related to the s.w.m. is shown in Fig. 2-6-1.

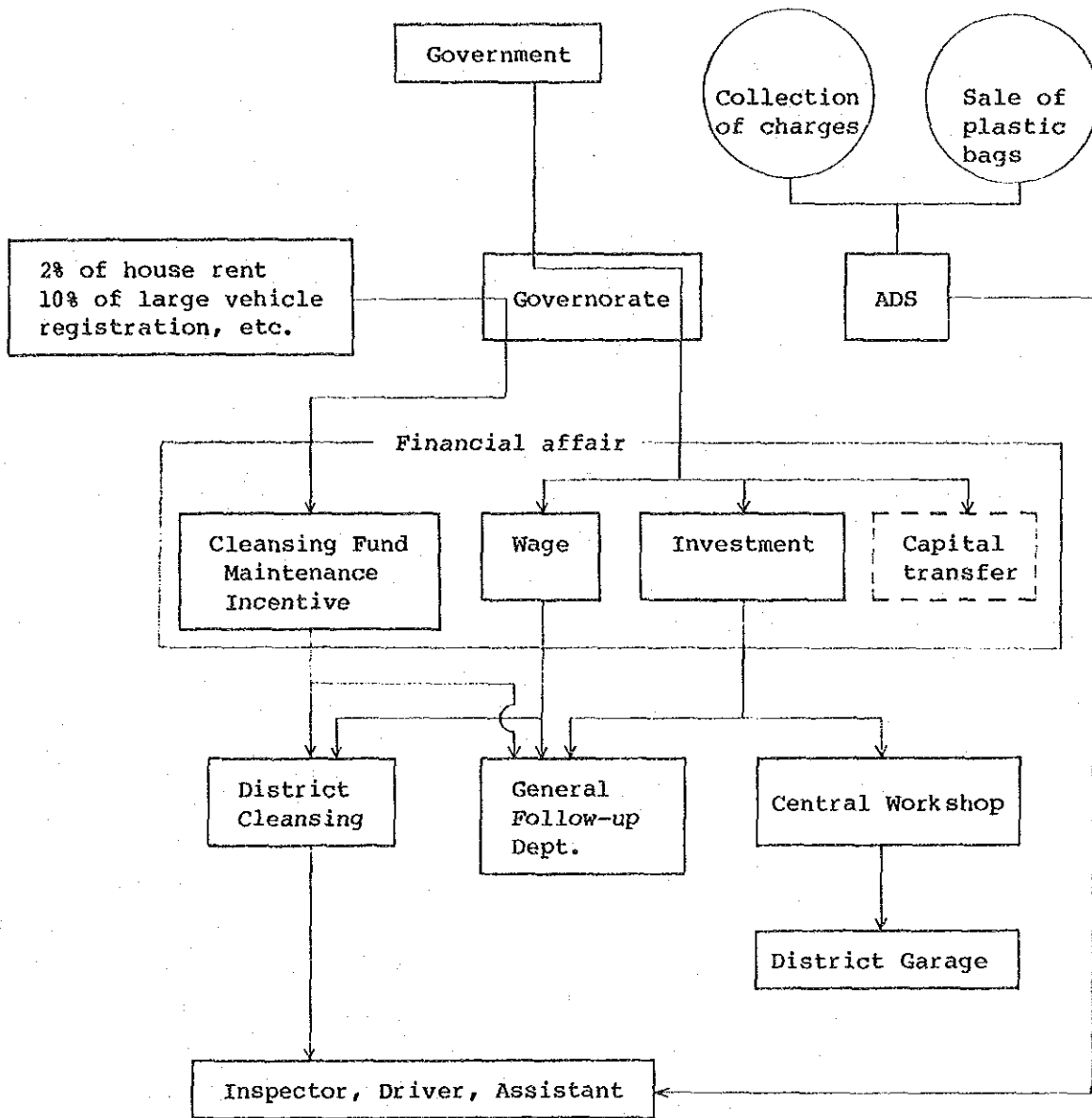


Fig. 2-6-1 MONEY FLOW

The money flow has the following characteristics.

- a. The practical works of waste collection is carried out by the Cleansing Section and ADS of each district, but the Cleansing Section itself does not have its own financial resources. The main financial resources for wages and a part of running cost are arranged by the Central Government.
- b. The Cleansing Fund is a part of the Chapter 2 as a special account and under the control of the Fund Board of Directors, chaired by Secretary General. The members of the Board are the Chief of each district, the head of the Directorate of Ministry of Housing and Utilities and the heads of concerned Authorities and Bureaus. They are in charge of the deliberation and decision-making concerning the budget and expenditure. They are also responsible for the settlement of accounts of the Cleansing Fund.
- c. A District Chief holds the additional post as for the ADS head, and is in charge of various activities in addition to cleansing activity. According to the financial statement of the ADS of the Middle District, the cleansing project often goes to deficit and is supplemented by earnings from other activities.
- d. The burden of the residents consists of two parts, 2% of the house rent and the payment (plastic bag cost and waste collection charge) to the ADS.
- e. As for commercial waste, whether it is collected or not depends on the characteristics of the ADS of each district. In the districts where it is collected, the corresponding charge is regarded as a revenue of the ADS, and does not go to the Cleansing Fund.
- f. As for the construction of facilities, purchase of equipments and vehicles, this is incorporated in the Budget Chapter 3 of the Governorate in accordance with the five year plan. In reality however, some of the vehicles are purchased by the ADS.

2.6.2 Financial Resources and Revenue

The financial resources for the s.w.m. consist of the Governorate Budget, the Cleansing Fund and the revenues of the cleansing project of the ADS.

1) Governorate budget for the s.w.m.

The Governorate Budget for s.w.m. comprises three items, wages of employees (Chapter 1), investment for facilities, and purchase of vehicles both (Chapter 3).

Capital transfer expense like loan repayment is also one of the Governorate Budget, but there is no other budget for the cleansing operation.

- a. As for total sum of the basic salary of cleansing operation, it is estimated as 2,138,000 LE in 84/85 budget.
- b. According to the 84/85 budget, investment costs for facilities and vehicles is accounted as 2,330,000 LE for s.w.m. This budget is divided into two sectors, one is cleansing operation as the Utility Sector and other is compost plant as the Industrial Sector.

2) Cleansing fund

Major sources of the Cleansing Fund consists of the charges collected from the residents and business establishments as well as from a part of the Governorate Budget and the supplementary one.

- a. The main portions of the financial resources collected from the residents and others consist of 2% of the house rent and 10% of the registration charge of large-sized trucks.
- b. The funds raised within the Governorate Budget are used to cover mainly fuel and spare parts costs.
- c. Supplementary budget make use of the accumulated surplus reserve.

The evolution of the Cleansing Fund is shown in S.R. 1.4. As may be seen, there is practically no increase in the basic portion (the first five items) of the Cleansing Fund.

3) ADS Cleansing Budget

Major sources of the ADS cleansing budget consist of the waste collection charges and the plastic bags sales revenue.

Each ADS cleansing activities are quite different from each others, it is, however, presumed that the revenues of the ADS of the six districts will amount to around 600,000 LE/year.

In case of the ADS in Middle District, 150,000 LE was collected from January to August in 1985 with the fees collected from the business establishment exceeding the amount from the residents by a rate of 7:5. Moreover, it also indicates that the benefit from the selling of plastic bags amounts to only 4%.

4) Total Budget

In view of the aforestated considerations, it is deduced that the annual financial resources for the s.w.m. is 6,433,000 LE, consisting of annual expenditures of 4,103,000 LE for wages, running and maintenance cost, and 2,330,000 LE for construction of facilities, purchase of vehicles, etc. Breakdown of the annual budget is summarized in Table 2-6-1.

Table 2-6-1 TOTAL BUDGET FOR S.W.M.

	(1,000 LE)
Governorate Budget	
Investment (Chapter III)	2,330
Wages (Chapter I)	2,138
Cleansing Fund	
2% of Rent	750
Others	615
ADS	
Residents	400
Shops	200
TOTAL	6,433

Compilation of the budget by payment items is shown in Table 2-6-2. It is clear that wages and incentives share about 50% in the total budget.

Table 2-6-2 COMPILATION OF THE BUDGET (84/85)

(1,000 LE)

	Wages & incentives	Maintenance	Fuel & oiles, etc.	Others	Investment	Total
Wages	2,138	-	-	-	-	2,138
Chapter 2	-	-	-	-	2,330	2,330
Cleansing Fund	709	320	200	36	100	1,365
ADS	348	17	-	166	69	600
Total	3,195	337	200	202	2,499	6,433

2.6.3 Cost Analysis for Cleansing Operation

Operation cost for the cleansing activities by collection, treatment and final disposal is not clearly classified at present, it can be estimated, however, as shown on Table 2-6-3 based on the cleansing operational records such as workers, collection vehicles, facilities, etc.

Table 2-6-3 TOTAL COST OF THE S.W.M. (1985)

(1,000 LE/year)

	Collection & sweeping	Intermediate treatment	Final disposal	Total
Depreciation	1,542	389	236	2,059
Wages and Incentives	3,070	118	152	3,340
Maintenance	685	102	106	893
Fuel & others	89	11	50	150
Total	5,386	620	544	6,442
Cost (LE/t)	(11.4)	(1.3)	(1.2)	(13.7)

2.6.4 Present Condition of Charge Collection System

The burden on citizens for the waste collection services consists of 2% of house rent and charges for door-to-door collection service carried out by ADS or Zabbaleen.

The collection rate of the 2% of house rent is almost 100% due to official registration for business rent of houses, in the meanwhile, it is only 20% for ADS with following reasons as a background:

- The service level is low for the waste collection.
- Wages of collectors is payed at a commission of collected amount, therefore collectors are apt not to go collecting at low income household.
- Unofficial collection.

On the contrary, according to the result of interviews for charging rate, citizenry willingness to pay is as high as 6 LE per household in a year including expenses for purchasing plastic bags.

2.6.5 Financial Problems

1) Problems related to the project operation

- a. The actual two-headed financial scheme consisting of the Cleansing Fund and the ADS can not be regarded as necessarily efficient from the managerial point of view, considering the fact that in reality the practical work of the ADS waste collection is carried out mainly by the employees of the districts as by-jobs, and furthermore, from the standpoint of the side of charge payer, the relation between the contents of the services and their fee is very ambiguous. In other words, it is not clear whether the charge paid to the ADS is related to the door-to-door collection or to the s.w.m. project of the districts. It is expected that the said fact will become a point at issue when implementing the beneficiaries-should-pay principle in a thorough-going way.

b. Problems similar to above are arising as a consequence of the fact that collection of commercial waste and the collection of the corresponding charge are being carried out by the ADS. In Alexandria it is estimated that the commercial waste accounts for approximately 1/3rd of the total amount, and therefore it is rightfully thought that commercial establishments should bear the s.w.m. cost to some extent.

2) Problems related to the financial resources

a. The financial scale per unit weight of waste amount to 8.7 LE/t, excluding costs for construction of facilities and purchase of vehicles, etc., and this is regarded as a reasonable level.

b. On the other hand, the sluggish growth of the Cleansing Fund compared with the growth of the expenditures has the risk of making subsidies unavoidable.

c. Furthermore, the big dependence on foreign aids for construction of facilities and purchase of vehicles, etc. makes it difficult to carry out systematic and planning improvement of the facilities and equipments. In addition, the burden of the maintenance and administrative sectors becomes considerably large because foreign aids bring in many different types of equipments and facilities.

3) Problems related to the expenditure

a. Wages and incentives share a considerable part of the expenditures. This fact is expected to become a serious problem in the future in view of the actual difference of wage level compared with private enterprises and the future wage growth trend. Manpower saving efforts, such as radical improvement in the street sweeping management system, etc., are required in this connection.

b. On the other hand, an overall improvement in the maintenance efficiency is required in order to cope with the growing cost of fuel and other expenditure items.

CHAPTER 3. MASTER PLAN

CHAPTER 3. MASTER PLAN

3.1 Goal and Preconditions of the Master Plan

3.1.1 General

In consideration of the situation outlined below, the Master Plan in this study was prepared with emphasis on the improvement measures with respect to the technical aspects as shown in Fig. 3-1-1, aiming at presenting blueprints in terms of organization, management and finance necessary to guarantee the improvements of s.w.m. in Alexandria.

- a. As Alexandria comprises extremely high density urban space, the improvement of the s.w.m. system, besides the sewerage system, is positioned as top priority task of the city administration in order to preserve its living environment and sanitary conditions.
- b. Although Alexandria has many problems in its present s.w.m. system, it employs as many as 2,500 cleansing workers and the system as a whole is considered to satisfy the minimum requirements to realize the technical tasks proposed in this master plan.
- c. Although the present s.w.m. system has various problems and restrictive elements in the managerial and financial aspects, it is difficult to modify the organization in a short term. Organizational problems, however, can be solved by the target year of 2000 and therefore, it is important to present the direction for the solution of the organizational problems.
- d. At present, Alexandria can heavily rely on foreign aid to finance the procurement of collection equipments and treatment facilities. However, in our study, a technical system shall be proposed on the condition that the future system should be operated under self-finance.

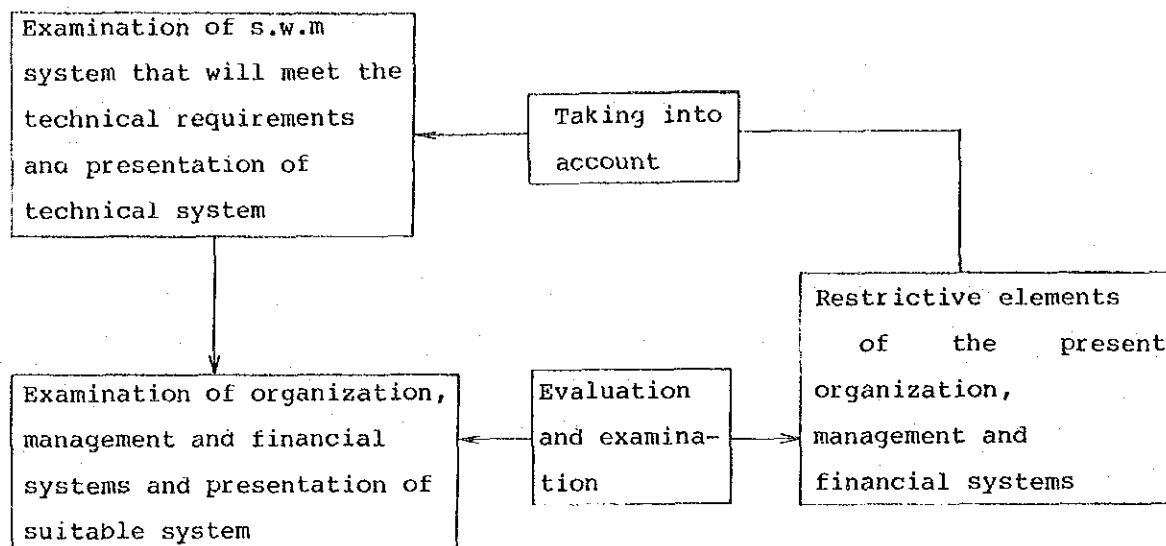


Fig. 3-1-1 CONCEPTUAL CHART ILLUSTRATING BASIC POLICY FOR PREPARATION OF MASTER PLAN

In line with these policies and in accordance with the procedure as illustrated in Fig. 3-1-2 the individual technical systems for collection, street sweeping, haulage, treatment and disposal were studied, and with due regard to local conditions of Alexandria, various alternatives for the total technical system were prepared and evaluated, and the optimum plan was proposed.

Subsequently the basic frame for the organization, management and finance system which support the proposed total technical system was presented.

3.1.2 Goals of the Master Plan

The tasks of the s.w.m system of Alexandria can be summarized as Fig. 3-1-3.

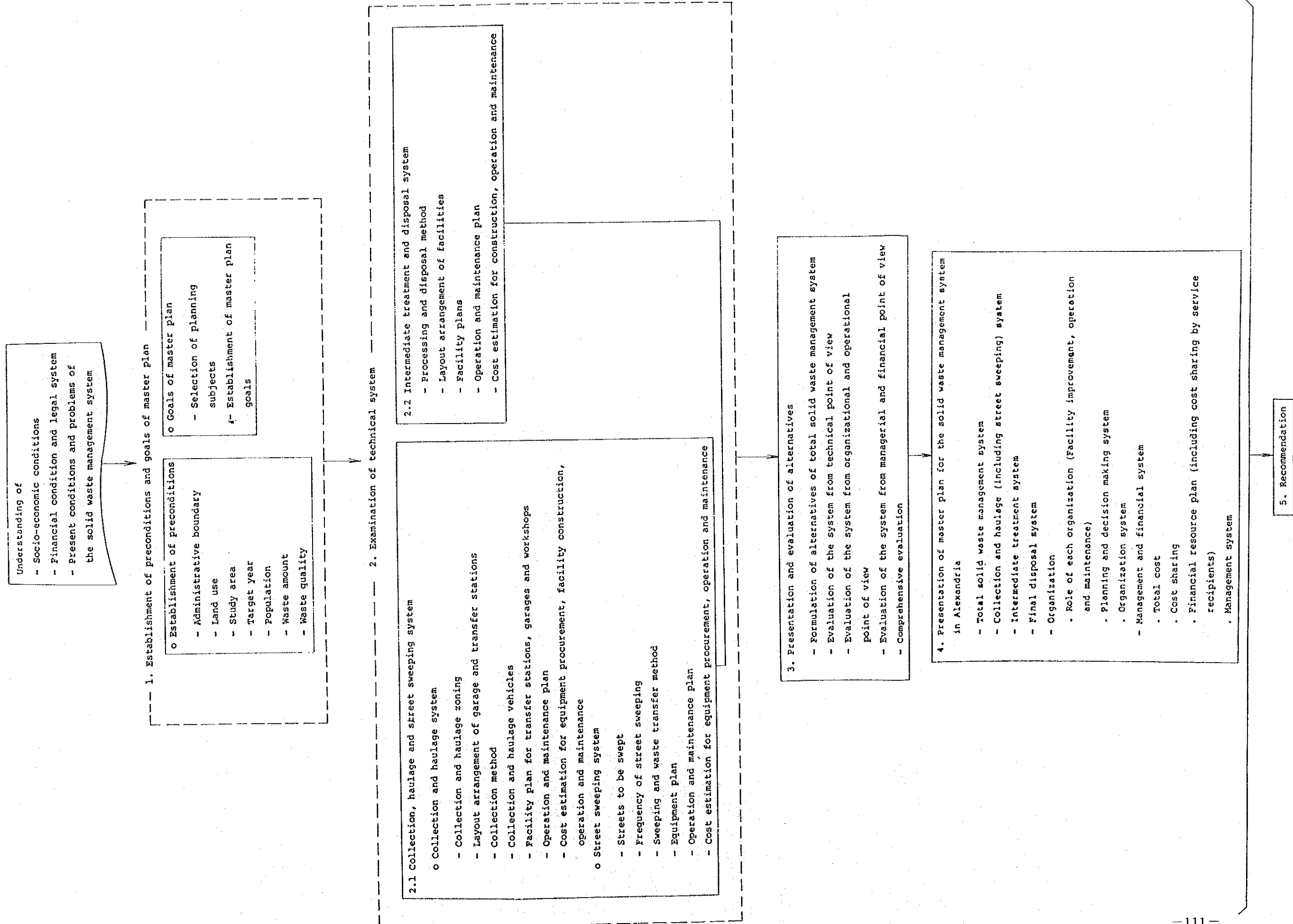


Fig. 3-1-2 METHODOLOGICAL FLOW FOR PREPARATION OF MASTER PLAN

1. Improvement in the collection service and containment of littering on streets

Even now, there are still uncollected areas, and the irregularity of collection and low collection frequency are inviting garbage throwing and littering on the streets and the need for street sweeping over the entire area. The cost of street sweeping must be reduced by improving the collection service, reducing street sweeping frequency to once a week in sub-streets and gaining the cooperation of the citizenry to discharge waste properly.

2. Improvement of street sweeping activities

Inadequacy of the collection system is inviting an increase in waste littering on the streets and the need for street sweeping over the entire area. The cost of street sweeping must be reduced by improving the collection service, reducing street sweeping frequency to once a week in sub-streets and gaining the cooperation of the citizenry to discharge waste properly.

3. Securing the cooperation of inhabitants

Even if the collection service were to be improved, its effect would not be secured without the cooperation of the inhabitants in the manner of waste discharge (abiding by the rules and, as the case may be, cooperating in separate discharge), and such cooperation is also important in rationalizing waste collection and street sweeping.

5. Formation of proper treatment and disposal system

- o In Alexandria, open dumping and open-air burning of waste in the fields are practiced now, which is helping to reduce the volume of wastes and leading to the extended use of the landfill sites. Deterioration of the environment near the landfill sites is so serious now that a shift to sanitary landfilling is being called for.
- o Acquisition of landfill sites will become increasingly difficult in the longer range so that it is necessary to secure disposal sites systematically and also to be prepared for haulage to more distant locations.
- o Treatment for waste volume reduction is needed considering the difficulty in finding suitable disposal sites in near places.
- o Attention must also be paid to the kinds of wastes which are currently excluded from the objects of the solid waste management by the city.

6. Formation of recycling system

In Egypt, urban wastes have large potential value as resources, and it is highly probable that the formation of a recycling system for composting of organic wastes, and utilization of metals, glass, plastics will lead to resources conservation and waste volume reduction.

4. Formation of a rational collection, haulage and street sweeping system

To solve the foregoing problems in collection and street sweeping, the collection, haulage and street sweeping system must be expanded, and in view of the limited financial resources available to the city, it must be rationalized to the maximum extent possible. For this purpose, the following measures necessary for rationalization must be taken upon review of the available technical systems.

[Collection & haulage]

- o Optimization of the method, frequency and time schedule of collection and conditions of stations, etc.
- o Formation of a collection system for narrow streets.
- o Replenishment of equipment and supplies for collection and haulage and establishment of a setup for maintenance.
- o Optimization of work sharing in street sweeping and waste collection activities (Division of responsibility, scope of work assigned to each worker, etc.)
- o Improvement in technical competence and morale of workers
- o Optimization of geographic distribution of garages and transfer stations and strengthening of hauling function
- o Proper handling of summer vacationers' waste

[Street sweeping]

- o Use of mechanical sweepers for main streets and optimum placement of waste stations
- o Improvement of sweeping frequency and method
- o Intensification of sweeping equipment and supplies and improved maintenance
- o Raising of workers' morale

7. Formation of a rational treatment and disposal system

[Treatment]

- o Optimum geographical distribution and improvement of the treatment system and facilities (composting, sorting, etc.)
- o Improvement in efficiency of maintenance, operation and control
- o Improvement in the technical competence of personnel and reduction in the rate of employee turnover
- o Preservation of environmental sanitation in the neighborhood
- o Integration of the salvaging work at open stations and disposal sites into the process of the intermediate treatment facilities

[Disposal]

- o Systematic securing disposal sites
- o Adoption of proper method for sanitary landfilling
- o Formation of a market system for compost and other recovered materials
- o Observation of the disposal regulations
- o Preservation of environmental sanitation in the neighborhood of disposal sites

Improvement in organization and management

- o Reorganization for integration of systems (particularly strengthening of the planning unit and integration of the collection vehicle management system and the collection activity operating system)
- o Reduction in the rate of worker turnover by improving working environment and wage rate (method of collection and sweeping [cleansing], improvement and fuller provision of equipment, supplies and clothings, training system)
- o Betterment in the work and manpower management and appraisal system and fostering of technical personnel

[Collection, haulage and street sweeping]

- o Optimization of the division of responsibility in waste collection and street sweeping among Governorate, district and citizens and sharing of work between districts and ADS (Separation of street sweeping, waste collection from household, and collection of commercial and industrial wastes in each zone)
- o Establishment of a mutually cooperative relationship with citizens' and local organizations (formation of a system and program to enlighten the inhabitants)

[Intermediate treatment and final disposal]

- o Formation of a regional waste treatment and disposal system and clarification of division of responsibility and work sharing
- o Formation of a market for salvaged reusable materials
- o Rationality in operating the treatment and disposal system

Improvement in the financial and institutional arrangement

- o Clarification of organizational responsibilities, optimization of service and charge by systematic collection of charges, complete enforcement of the waste management charge (Establishment of a system, regulation for collection of charges, system for collecting charges)
- o Increase in financial resources and efficient distribution of financial resources (effective utilization of various sources of fund)
- o Operation of business activities such as waste treatment and disposal, composting, etc. and clarification of the sharing of operating cost
- o Sound management of money flow for operating the system and handing out incentive money
- o Establishment of a self-supporting financial arrangement without depending on foreign aid in the longer range
- o Administration of a system of levying a fine against illegal throwing of wastes
- o Enactment of a legislation with respect to the responsibility for street sweeping
- o Establishment of a system for collecting fees on voluntarily hauled in wastes

Fig. 3-1-3 THINGS TO BE DONE FOR THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM

As the Master Plan set its target year at a fairly distant future of 2000, the planning goals shown in Fig. 3-1-4 were established to accomplish the subject figured above as much as possible.

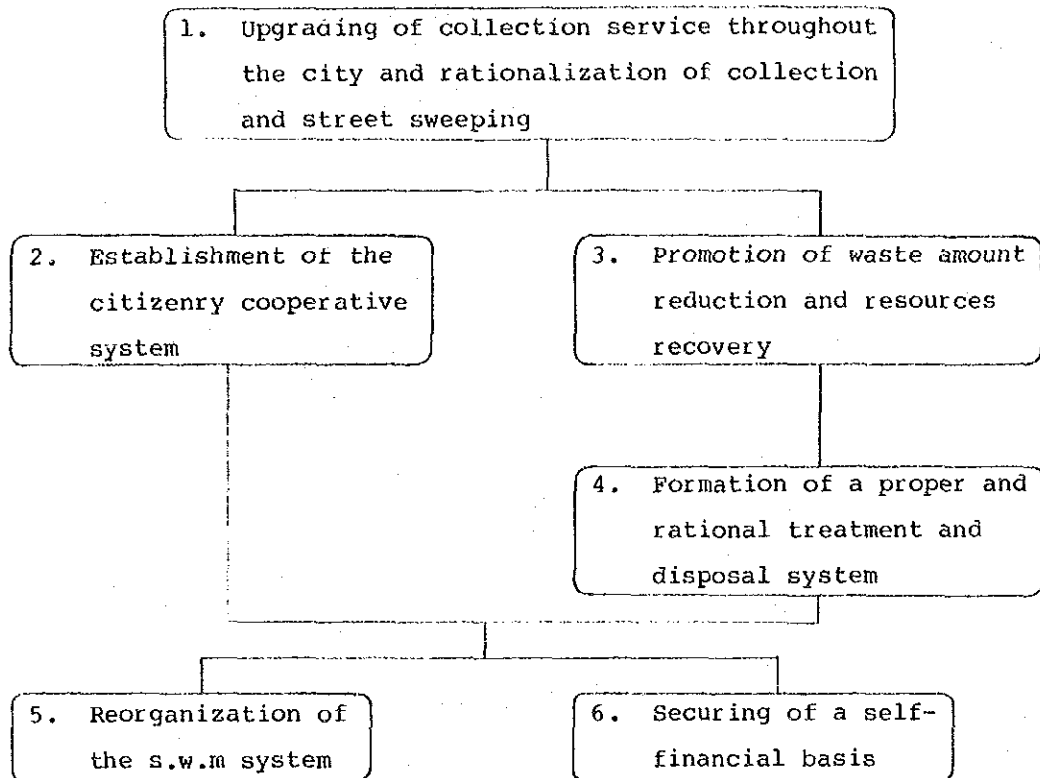


Fig. 3-1-4 PLANNING GOALS OF THE MASTER PLAN

3.1.3 Preconditions for the Master Plan

The preconditions for the planning include the following items.

1) Target year for planning

The target year for planning shall be 2000, and the year of the present state shall be 1984.

2) Administrative boundaries and land use

Area inside the Green Belt shown in Plan 2005 was defined as the administrative area of Alexandria (deserts outside the Green Belt were excluded), and the boundaries of six districts are as shown in Fig. 3-1-5.

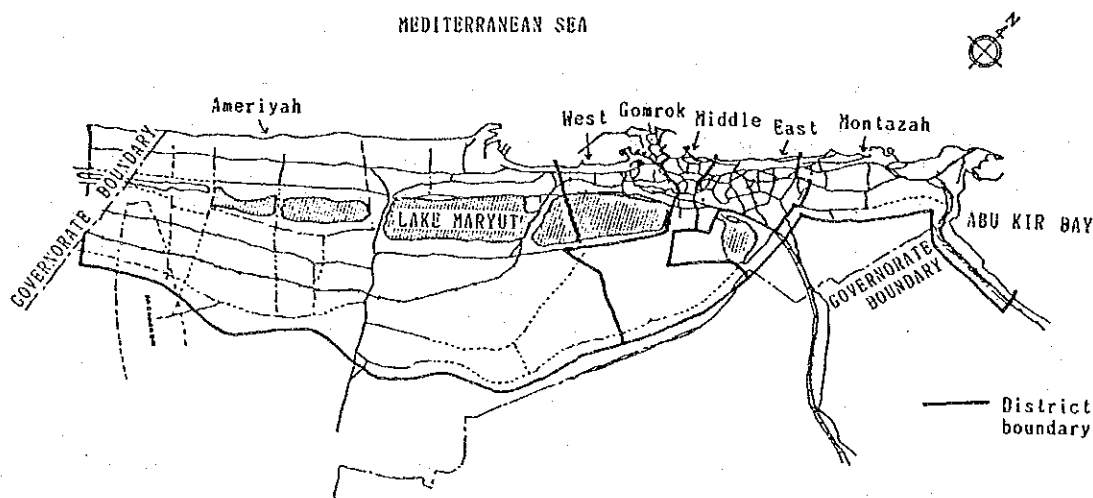


Fig. 3-1-5 DIVISION OF THE ADMINISTRATIVE AREA OF ALEXANDRIA

The land use inside this Green Belt, and the land use of the urban area for 2000 to be covered by the collection service are as shown in Table. 3-1-1.

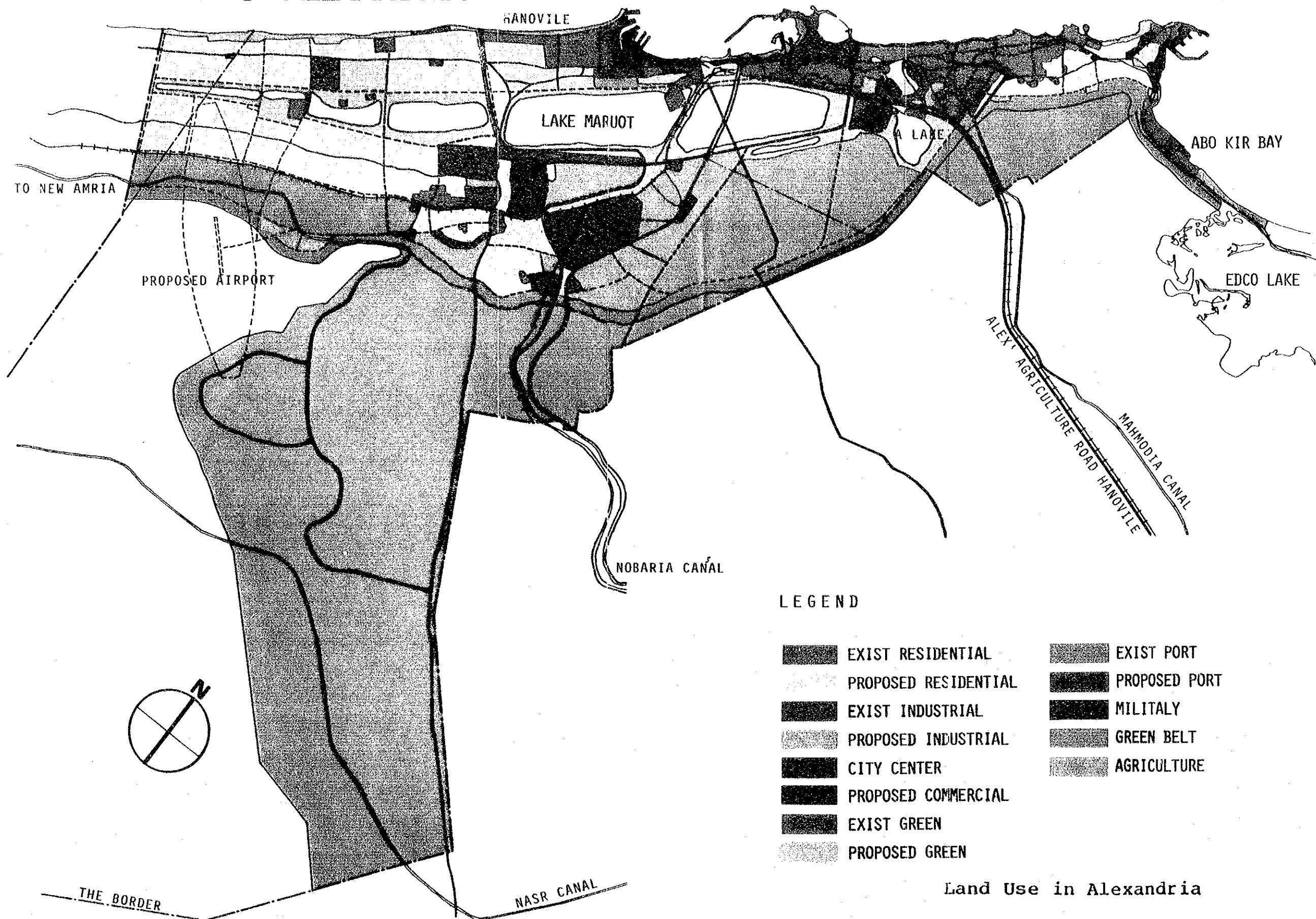
3) Estimated population

The population was estimated for each district and Sub-District on the basis of the existing population and the future population estimates (Table 3-1-2) indicated in Plan 2005.














The estimated population for each district is shown in Table 3-1-3 and Fig. 3-1-6, which indicates the total city population of about 4.1 million for 2000, an increase of a little more than 40% compared to that of 1984.

LAND USE OF ALEXANDRIA

MEDITERRANEAN SEA



LEGEND

- | | |
|--|---|
|  EXIST RESIDENTIAL |  EXIST PORT |
|  PROPOSED RESIDENTIAL |  PROPOSED PORT |
|  EXIST INDUSTRIAL |  MILITARY |
|  PROPOSED INDUSTRIAL |  GREEN BELT |
|  CITY CENTER |  AGRICULTURE |
|  PROPOSED COMMERCIAL | |
|  EXIST GREEN | |
|  PROPOSED GREEN | |

Land Use in Alexandria

Table 3-1-1 LAND USE IN ALEXANDRIA FOR 2000

								(km ²)
District	City Center	Residential	Industrial	Green	Agricultural	Military, etc.	Lake	Total
Montazah	-	32.3	9.0	50.5	29.7	2.6	7.7	131.8
A	-	32.3	2.3	4.1	-	1.9	-	40.6
B	-	-	6.7	46.4	29.7	0.7	7.7	91.2
East	-	12.0	7.7	1.7	3.8	3.0	-	28.2
A	-	12.0	7.7	1.7	3.8	-	-	25.2
B	-	-	-	-	-	3.0	-	3.0
Middle	2.4	5.3	3.3	3.1	-	1.2	0.6	15.9
A	2.4	5.3	3.3	0.9	-	-	-	11.9
B	-	-	-	2.2	-	1.2	0.6	4.0
West	-	4.8	11.6	4.3	-	-	15.0	35.7
A	-	4.8	11.6	0.4	-	-	-	16.8
B	-	-	-	3.9	-	-	15.0	18.9
Gomrok	2.7	-	0.8	0.7	-	0.3	-	4.5
A	2.7	-	0.8	0.7	-	0.3	-	4.5
B	-	-	-	-	-	-	-	-
Ameriyah	2.9	172.4	112.4	100.7	63.5	10.4	53.5	515.6
A	2.9	172.4	32.4	20.5	-	10.4	-	238.6
B	-	-	80.0	80.2	63.5	-	53.3	277.0
Total	8.0	226.8	144.8	161.0	97.0	17.5	76.6	731.7
A	8.0	226.8	58.1	28.3	3.8	12.6	-	337.6
B	-	-	86.7	132.7	93.2	4.9	76.6	394.1

Note) A: Within the collection service area

B: Outside the collection service area

Table 3-1-2 POPULATION ESTIMATES SHOWN IN THE PLAN 2005

(1000 persons)

Year	Total city population	Incremental population above the 1980 population	
1980	2,710		
1990	3,191		
2000	4,099		
2005	4,750	Incremental population in the existing urban area	270
		Population settled in the coastal zone	200
		Incremental population in the new urban area	1,570

Table 3-1-3 ESTIMATED POPULATION FOR EACH DISTRICT

(1000 persons)

DISTRICT	1984	1990	2000	
Montazah	441	575	818	
East	723	756	817	
Middle	755	767	787	
Gomrok	321	326	335	
West	531	544	567	
Ameriyah	113	223	775	
Entire Alexandria	Population	2,884	3,191	4,099
	Multiples of 1984 population	1.0	1.11	1.42

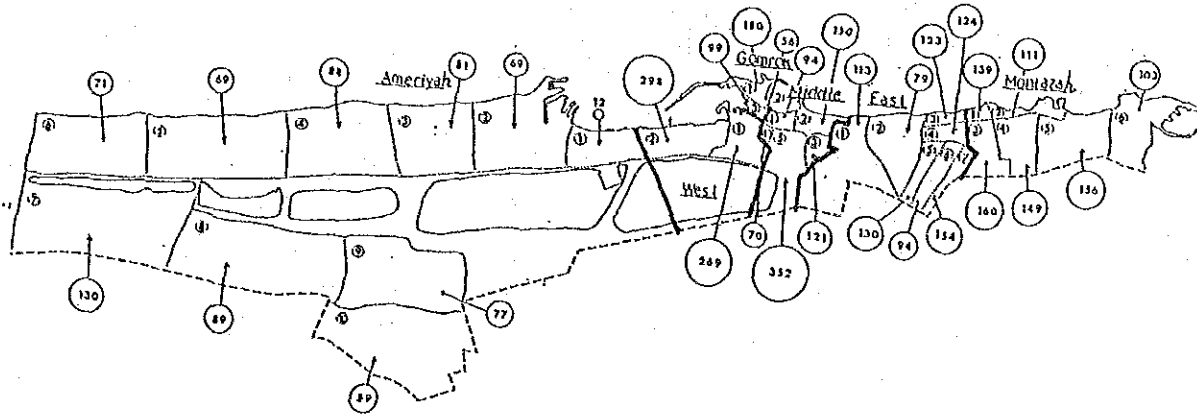


Fig. 3-1-6 POPULATION DISTRIBUTION FOR 2000

(1000 persons)

Summer vacationers, shown in Table 3-1-4 for each district are also taken into account for the period of June to August.

Table 3-1-4 SUMMER VACATIONERS' POPULATION(JUNE TO AUGUST)

(1000 persons)

District	Summer Vacationers (1000 persons)
Montazah	500
East	350
Middle	50
Gomrok	0
West	0
Ameriyah	100
Total	1,000

Note: The number was obtained from the Bureau of Tourism.

3.2 Design Amount and Composition of Wastes

3.2.1 Wastes Covered by the Plan

Wastes generated from the city area of Alexandria include the following types.

- Domestic waste
- Commercial waste
- Summer vacationers' waste
- Street waste
- Factory and port wastes
- Sewage sludge

Among these wastes, the industrial wastes such as factory and port wastes and sewage sludge will not be included in this plan as wastes to be managed, although they will be kept in mind in formulating the plan.

3.2.2 Design Amount

The design amount of wastes for Alexandria is shown in Table 3-2-1 and Fig. 3-2-1. The amount of wastes subject to the management will be 2,219 t/d (2,579 t/d for the summer) for the entire city in 2000, of which two-thirds will be accounted for by domestic waste.

Table 3-2-1 DESIGN AMOUNT OF WASTES IN ALEXANDRIA

	(t/d)		
	1984	1990	2000
Domestic Waste	822	983	1,460
Commercial Waste	430	511	759
Vacationers' Waste	(360)	(360)	(360)
Total	1,252	1,494	2,219
	(1,612)	(1,854)	(2,579)

Note: The figures in parentheses are summer vacationers' waste to be accounted for between June and August.

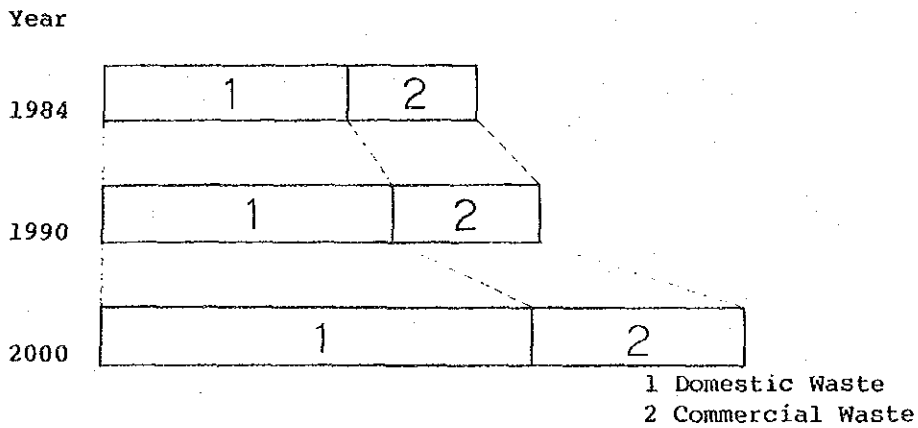


Fig. 3-2-1 CHANGES IN THE DESIGN AMOUNT OF WASTES (excluding tourist waste)

The design amount of wastes for each district is shown in Table 3-2-2 and Fig. 3-2-2. At present, a large amount of wastes are generated from East and Middle Districts, but in 2000, the amount of wastes to be generated in Montazah and Ameriyah Districts, where the development of the new urban areas is planned, is expected to rise sharply.

Table 3-2-2 DESIGN AMOUNT OF WASTES FOR EACH DISTRICT

District	1984	1990	2000	Vacationers Waste (t/d)
Montazah	154	220	365	180
East	306	349	452	126
Middle	389	433	550	18
Gomrok	192	215	276	0
west	174	195	236	0
Ameriyah	37	83	340	36
Total	1,252	1,494	2,219	360

Note: Vacationers' waste is accounted for between June and August every year.

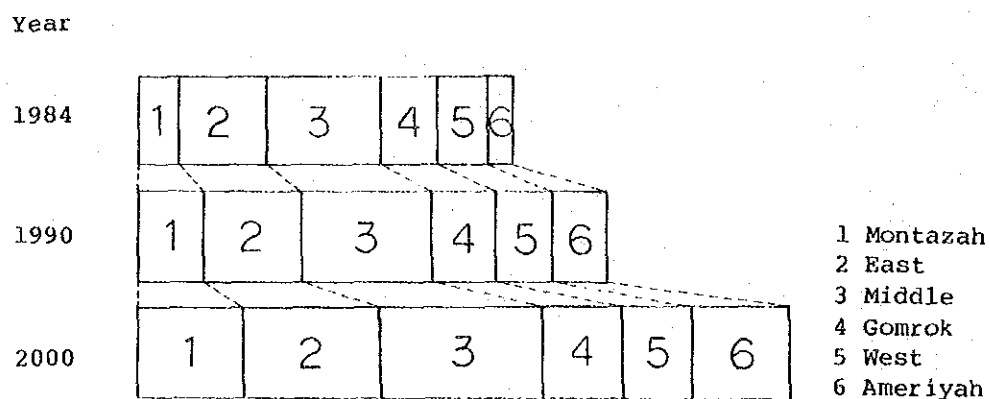


Fig. 3-2-2 DESIGN AMOUNT OF WASTES FOR EACH DISTRICT

In addition to these wastes, normal street waste other than those domestic wastes thrown on the streets is generated at a rate of approximately 15 t/d.

3.2.3 Design Waste Composition

The design waste composition was determined based on the analysis of wastes during the field survey in Alexandria and by using the yearly changes in waste composition in Japan as a reference.

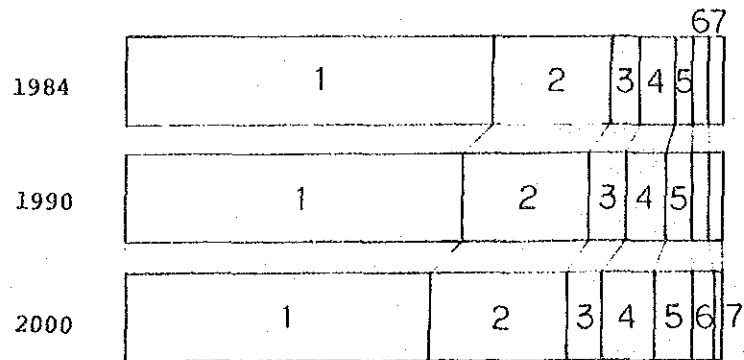
The design waste composition thus determined is shown in Table 3-2-3 and Fig. 3-2-3, on the basis of which the discharged amount for each waste component was estimated, and is shown in Table 3-2-4.

Table 3-2-3 DESIGN WASTE COMPOSITION

(weight % in wet base)

Classification	1984	1990	2000	Waste Composition Including Vacationer Waste, 1984
Garbage/Grass	62	57	51	62
Paper	20	21	23	21
Textile	5	6	6	5
Plastic	6	7	9	6
Metal	3	4	6	3
Glass & the like	2	3	4	2
Others	2	2	1	1
Total	100	100	100	100

(weight % in wet base)



- (1) Garbage/Grass
- (2) Paper
- (3) Textile
- (4) Plastic
- (5) Metals
- (6) Glass & the like
- (7) Others

Fig. 3-2-3 CHANGES IN WASTE COMPOSITION IN ALEXANDRIA

Table 3-2-4 DISCHARGE AMOUNT FOR EACH WASTE COMPONENT (excluding vacationers' waste)

	(t/d)		
	1984	1990	2000
Garbage/Grass	776	822	999
Paper	250	314	510
Textile	63	90	133
Plastic	75	120	244
Metal	38	75	178
Glass & the like	25	45	111
Others	25	28	44
Total	1,252	1,494	2,219

The design waste composition was determined for each district. However, as there was not much difference in the design waste composition among districts the same composition was assumed for the entire city.

The waste composition of street waste was determined from the results of field survey and is shown in Table 3-2-5.

Table 3-2-5 STREET WASTE COMPOSITION
(weight % in wet base)

Classification	
Garbage/Grass *1	19
Paper	22
Textile	0
Plastic	7
Metal	2
Glass and the like	0
Others *2	50

Notes: *1 Includes cigarette butts
*2 Mostly sand

3.3 Preparation of Alternatives

3.3.1 Alternatives for Technical Systems

The s.w.m system will be composed of individual technical systems shown in Fig. 3-3-1 where only the major ones have been picked up for each process.

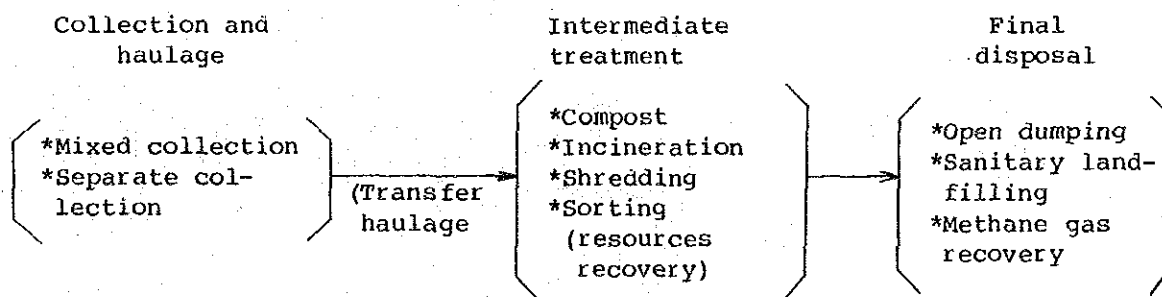


Fig. 3-3-1 MAJOR TECHNICAL SYSTEMS FOR EACH PROCESS

In order to select a system suitable for the s.w.m in Alexandria among the many potential treatment systems which are combinations of abovestated individual technical systems, the ones that are qualitatively feasible for Alexandria were selected at first.

As a result, separate collection, incineration, shredding, methane gas recovery, open dumping were excluded from each process on the basis of the criteria shown in Table 3-3-1.

Table 3-3-1 CRITERIA FOR SCREENING ALTERNATIVES

	Criteria	
Collection	o Separate collection	<p>There is a great advantage in introducing separate collection system since it can improve the quality of compost and reduce the sizes of treatment facilities. However, the citizenry cooperation is a prerequisite for separate collection; in other words, it is necessary first of all to secure the cooperation of the inhabitants to discharge separated wastes at the specified place on a specified day and time. However, due to the difficulty in securing such cooperation it is doubtful that separate collection can be actualized.</p> <p>Although the difference in cost between mixed and separate collection systems becomes relatively small in the areas like Alexandria where the density of waste discharge is relatively high, a fixed-time discharge becomes necessary except in the case container collection for the entire area for fear that the incremental cost burden accompanying the separation of wastes becomes fairly substantial. Based on the foregoing reasons, the collection method shall be mixed collection.</p>
	o Mixed collection	<p>The collection method in each area, vehicle dispatching plan, the allocation transfer stations and garages, and street sweeping system will be collectively considered as problems within the collection system.</p>

	Criteria	
Haulage	o Transfer station	If disposal sites can be found within 20 km from the city, no transfer station is necessary. However, if wastes should be disposed of in the desert area (70 km from the city), then the transfer station will have to be contracted.
Inter- mediate treatment	o Incineration/ shredding	The introduction of incineration/shredding will bring about a tremendous increase in the cost of s.w.m. From financial capability of this city, these cost cannot be considered to be the systems that ought to be adopted. (The effects of waste amount reduction and surplus heat utilization are not sufficient to realistically justify the introduction of these two treatment methods.)
	o Compost	The demand for compost as soil conditioner does exist in Alexandria, but its marketability and price are highly uncertain. However, compost may be feasible under the present conditions (e.g. low treatment cost) and thus it is considered as an alternative.
	o Sorting	Possibility of introduction of sorting as a pretreatment facility for composting or as an independent sorting facility will be investigated. The sorting method, however, shall be limited to manual sorting due to low labor cost.
Final disposal	o Open dumping	Open dumping is excluded from consideration as it is unable to satisfy the environmental hygienic level which is one of the planning goals.
	o Recovery of methane gas	Recovery of methane gas is excluded from consideration as the rain fall in the area is quite small, fuel prices are low, and the demand for heat in the vicinity of landfill site is small.
	o Sanitary landfilling	Because of the foregoing reasons, the final disposal method shall be sanitary landfilling. In-place composting system which utilizes compost as cover material shall be included in this sanitary landfilling method.

The following five alternatives for the total s.w.m system were determined as combinations of the various technical systems selected for consideration.

(1) Alternative-1

The entire amount of the waste collected will be used for the compost, and compost rejects will be disposed of at the disposal sites within the 20 km range by the sanitary landfilling.

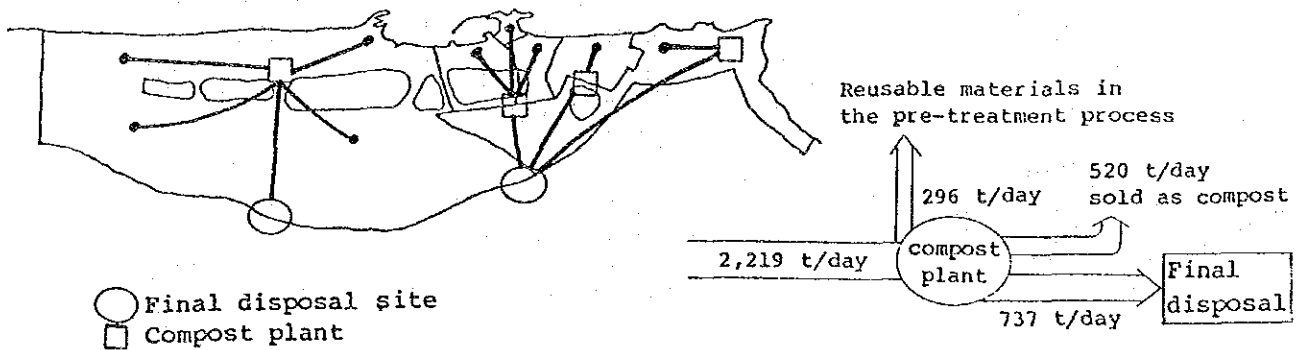


Fig. 3-3-2 LAYOUT OF FACILITIES AND PROCESS FLOW OF ALTERNATIVE-1

(2) Alternative-2

The entire amount of the waste collected will be disposed of at the disposal sites within the 20 km range by the sanitary landfilling.

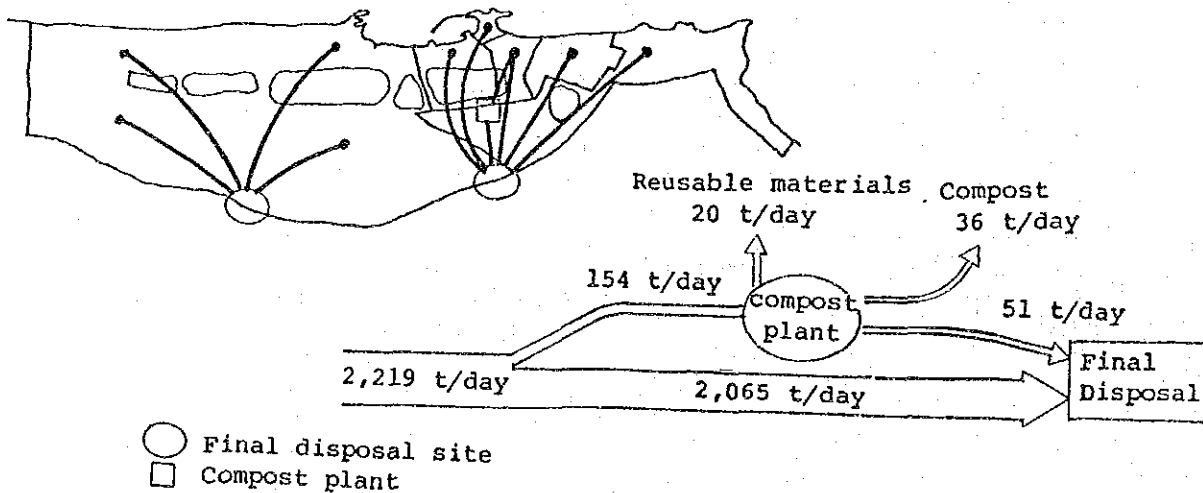


Fig. 3-3-3 LAYOUT OF FACILITIES AND PROCESS FLOW OF ALTERNATIVE-2

(3) Alternative-3

The entire amount of the waste collected will be hauled via transfer stations to the disposal sites within the 70 km range and disposed of by the sanitary landfilling.

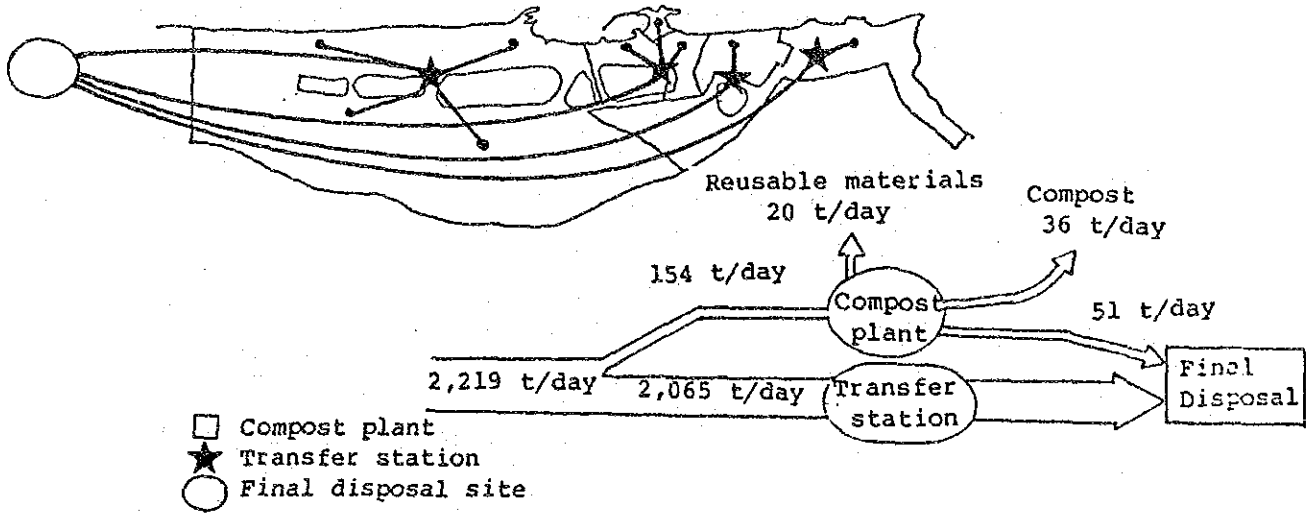


Fig. 3-3-4 LAYOUT OF FACILITIES AND PROCESS FLOW OF ALTERNATIVE-3

(4) Alternative-4

The entire amount of the waste collected will be sorted, reusable materials will be recovered at the disposal sites within the 20 km range, and the rejects will then be disposed of by the sanitary landfilling.

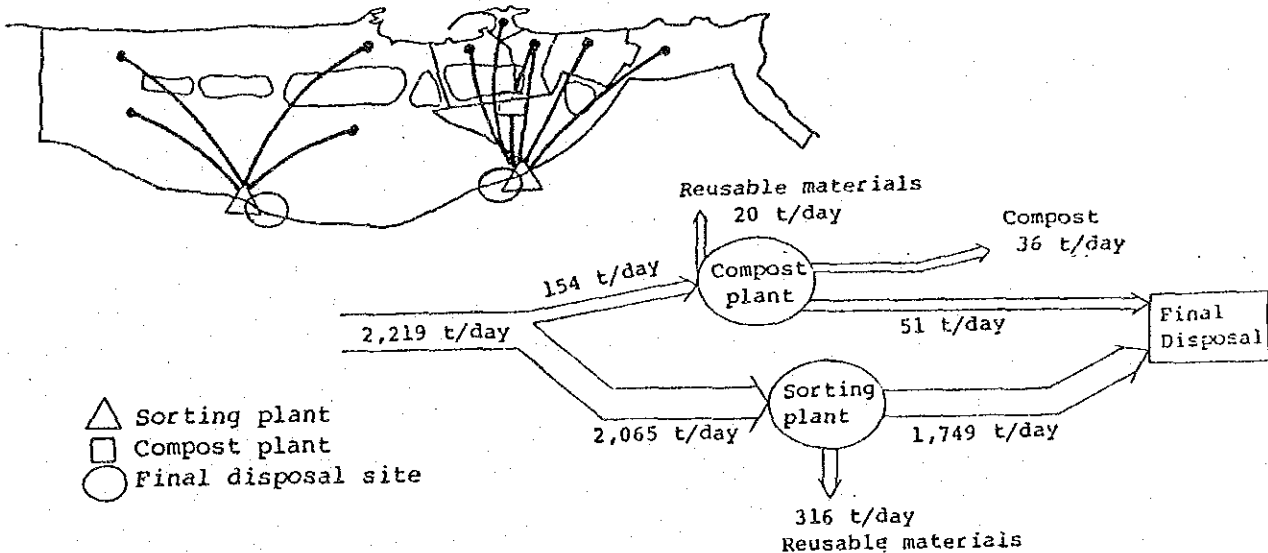


Fig. 3-3-5 LAYOUT OF FACILITIES AND PROCESS FLOW OF ALTERNATIVE-4

(5) Alternative-5

The waste collected from Middle, Gomrok and West Districts will be treated for compost, and the compost will be used as covering material for landfilling. Other waste collected will be sorted, reusable materials will be recovered at the landfill sites within the 20 km range and the rejects after sorting will be disposed of by sanitary landfilling.

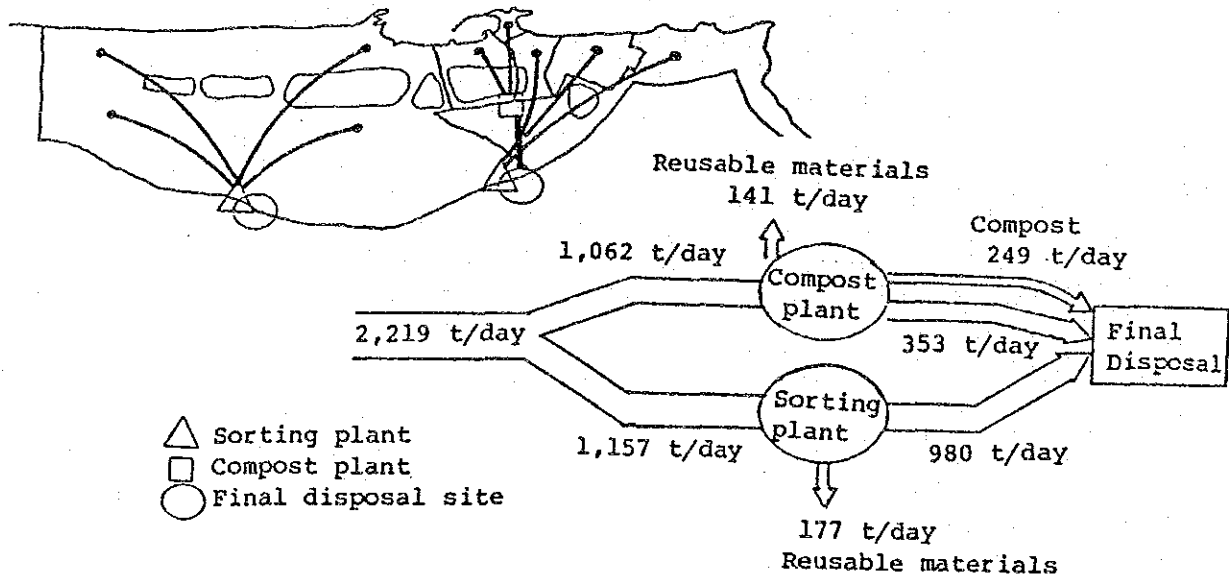


Fig. 3-3-6 LAYOUT OF FACILITIES AND PROCESS FLOW OF ALTERNATIVE-5

3.3.2 Examination of technical systems

In order to evaluate the above-mentioned five alternatives and also to use as a basis for examining the s.w.m system in the Master Plan, technical systems for collection, street sweeping, treatment for compost, sorting, and sanitary landfilling were roughly examined. Based on the results of this examination, the framework of the s.w.m system was established to the extent necessary for evaluation, and various design items, personnel requirements, cost, etc. were calculated for each alternative.

1) Scheme of the technical system established for evaluation

The scheme of the technical system established to the extent necessary for evaluating the five alternatives are as follows. The scheme described here is intended only for the evaluation of alternatives and is slightly different from the one in the Master Plan which is constructed from the information obtained during the feasibility study.

Table 3-3-2 THE SCHEME ESTABLISHED FOR THE COLLECTION SYSTEM

Element	Scheme
Waste discharge station	Waste discharge stations will be placed on the shoulder of road or on the sidewalk so that the waste carrying distance from homes would be 50-100m or less. Three stations/ha will be placed in the highly populated areas like Middle, Gomrok, West and East Districts and two stations/ha in the low density areas like Ameriyah and Montazah Districts.
Waste collection frequency	As the waste generation density is quite high in Middle, Gomrok, West and East Districts, collection will be made daily for these districts, while for the low waste generation density areas like Montazah and Ameriyah Districts, collection will be twice a week as a rule with due regard to household storage and collection efficiency.

Element	Scheme
Waste discharge method	Present practice of discharging into communal container or in open space shall be terminated. Instead, waste should be discharged by using specified bag or containers.
Waste collection method	All solid wastes shall be collected at waste discharge stations. In the areas where discharge is possible by bags, collection by open dump trucks shall be acceptable, while in other areas, compactor vehicles should be dispatched.
Waste collection equipment	Compactor vehicles or open dump trucks should be dispatched depending on how much the practice of discharging by bags has been implemented, and on pavement conditions of roads. To improve the service level, medium sized vehicles passable through a 4 to 6m wide road should be mainly provided.

Table 3-3-3 THE SCHEME FOR THE STREET SWEEPING SYSTEM

Element	Scheme
Street sweeping method	Street sweeping shall be done by hands, and a certain section or area should be assigned to each sweeper.
Frequency	The main streets shall be swept daily, while other streets shall be swept once a week.
Manpower allocation	One sweeper per 0.7km shall be allocated for main streets and one sweeper per 1.0km shall be allocated for other streets.

Table 3-3-4 THE SCHEME ESTABLISHED FOR THE INTERMEDIATE TREATMENT SYSTEM

Element	Scheme									
<p>Compost</p> <ul style="list-style-type: none"> - Treatment method - Standard Capacity - Materials to be recovered by manual sorting) - Material balance - Outline of facilities - Revenue from sale of recovered materials 	<p>Windrow system with manual sorting process incorporated in the system</p> <p>Standard processing capacity per line: 200t/16h</p> <p>Paper, Plastic, Textile, Metal, Glass</p> <table data-bbox="630 873 1332 996"> <tr> <td>Recovery rate (in 2000)</td> <td>Compost</td> <td>23.4%</td> </tr> <tr> <td></td> <td>Recycled materials</td> <td>6.9%</td> </tr> <tr> <td></td> <td>Rejects</td> <td>30.3%</td> </tr> </table> <p>The outline of a compost plant with a treatment capacity of 400t/d (2 lines) is as follows. Plant site area 10 ha. Operating staff 84 persons</p> <p>The sum of revenue from compost and recycled materials per ton of waste treated: 1.87 LE</p>	Recovery rate (in 2000)	Compost	23.4%		Recycled materials	6.9%		Rejects	30.3%
Recovery rate (in 2000)	Compost	23.4%								
	Recycled materials	6.9%								
	Rejects	30.3%								
<p>Sorting</p> <ul style="list-style-type: none"> - Treatment method - Standard capacity) - Materials to be sorted - Material balance - Outline of facilities - Revenue from sale of recycled materials 	<p>Manual sorting</p> <p>Treatment capacity per line: 200t/16h</p> <p>Paper, Plastic, Textile, Metal, Glass</p> <table data-bbox="630 1601 1316 1702"> <tr> <td>Recovery rate (in 2000)</td> <td>Recycled materials</td> <td>15.3%</td> </tr> <tr> <td></td> <td>Rejects</td> <td>84.7%</td> </tr> </table> <p>The outline of a sorting plant with a treatment capacity of 200t/d (1 line) is as follows: Plant site area 1 ha. Operating staff 33 persons</p> <p>4.48 LE per ton of waste treated</p>	Recovery rate (in 2000)	Recycled materials	15.3%		Rejects	84.7%			
Recovery rate (in 2000)	Recycled materials	15.3%								
	Rejects	84.7%								

Table 3-3-5 THE SCHEME ESTABLISHED FOR THE FINAL DISPOSAL SYSTEM

Element	Scheme						
Green Belt							
- Landfill method	Sanitary landfilling						
- Composition of landfill layers	<table> <tr> <td>Waste layer</td> <td>3m</td> </tr> <tr> <td>Intermediate covering material</td> <td>0.3m</td> </tr> <tr> <td>Final covering material</td> <td>1m</td> </tr> </table>	Waste layer	3m	Intermediate covering material	0.3m	Final covering material	1m
Waste layer	3m						
Intermediate covering material	0.3m						
Final covering material	1m						
- Landfill capacity	2,000,000 m ³ of waste for one block						
- Outline of facilities	<p>The outline of one block of landfill site is as follows.</p> <p>Area 81 ha.</p>						
- Major facilities	Embankment, road, administration facilities, truck scale.						
Desert							
- Landfill method	Sanitary landfilling						
- Composition of landfill layers	<table> <tr> <td>Waste layer</td> <td>3m</td> </tr> <tr> <td>Intermediate covering material</td> <td>0.3m</td> </tr> <tr> <td>Final covering material</td> <td>0.5m</td> </tr> </table>	Waste layer	3m	Intermediate covering material	0.3m	Final covering material	0.5m
Waste layer	3m						
Intermediate covering material	0.3m						
Final covering material	0.5m						
- Landfill capacity	About 45,000,000 m ³						
- Covering material	Material generated in the area						
- Major facilities	Administration facilities, truck scale.						

3.3.3 The System Elements and the Costs of Each Alternative

The system elements and the costs of each alternative estimated on the basis of the schemes for each technical system described above are as shown in Table 3-3-6 and 3-3-7.

Table 3-3-6 SYSTEM ELEMENT

Element	Alt.-1	Alt.-2	Alt.-3	Alt.-4	Alt.-5
1. Collection & street sweeping:					
- Required manpower (persons)					
Supervisory & managerial	209	241	225	241	233
Technical (incl. drivers)	390	479	582	479	456
Workers	2,066	2,356	2,142	2,345	2,280
- Fuel consumption (kl/year)	2,378	4,665	9,365	4,665	3,654
- Vehicles (Nos.)					
Compactor vehicles (3 ton), etc.)	391	483	391	483	461
Vehicle for secondary haulage	0	0	192	0	0
2. Intermediate treatment					
- Required manpower					
Supervisory & managerial	66	5	5	47	55
Technical (incl. drivers)	210	12	18	113	160
Workers	294	21	21	281	287
- Fuel consumption (kl/year)	5,203	252	479	2,158	3,634
- Heavy equipment (Nos.)	78	4	4	27	51
- Vehicle for secondary haulage (Nos.)	23	1	7	28	29
- Compost produced (1,000 t/year)	190	13	13	13	91
- Materials recovered (1,000 t/year)	108	7	7	123	116
3. Final disposal					
- Amount of waste disposed (1,000 m ³ /year)	489	1,012	1,012	869	702
- Required manpower					
Supervisory & managerial	5	5	3	5	5
Technical (incl. drivers)	34	46	37	46	39
Workers	10	13	10	13	11
- Fuel consumption (kl/year)	402	511	365	511	438
- Heavy equipment (Nos.)	11	14	10	14	12

Table 3-3-7 COST OF EACH ALTERNATIVES

(1000 LE)

Element	Alt.-1	Alt.-2	Alt.-3	Alt.-4	Alt.-5
Investment Cost					
1. Construction/improvement cost of facilities					
1) Collection & sweeping					
- Building & foundation	0	0	4,818	0	0
- Machinery & equipment	0	0	359	0	0
- Sub-total	0	0	5,177	0	0
2) Intermediate treatment					
- Building & foundation	30,751	2,130	2,130	22,522	26,158
- Machinery & equipment	51,302	3,553	3,553	31,579	40,294
- Sub-total	82,053	5,683	5,683	54,101	66,452
3) Final disposal					
- Building & foundation	8,421	11,768	203	11,768	8,444
- Machinery & equipment	194	323	323	323	258
- Sub-total	8,615	12,091	526	12,091	8,702
2. Purchasing cost of vehicles					
- Collection & sweeping	19,706	24,343	34,786	24,343	23,234
- Intermediate treatment	15,256	1,003	1,365	6,374	10,477
- Final disposal	1,943	3,171	3,012	3,171	2,485
2. Operating Expenses and Cost					
1) Collection & street sweeping					
- Depreciation	3,547	4,382	6,261	4,382	4,182
- Manpower	3,681	4,231	4,244	4,231	4,088
- Maintenance	1,576	1,947	2,812	1,947	1,859
- Others	357	699	1,510	699	609
- Sub-total	9,161	11,259	14,827	11,259	10,738
2) Intermediate treatment					
- Depreciation	7,191	489	554	4,003	5,444
- Manpower	1,021	66	80	735	871
- Maintenance	2,246	151	180	1,142	1,644
- Others	1,872	105	146	523	1,107
- Sub-total	12,330	811	960	6,403	9,066
3) Final disposal					
- Depreciation	886	1,291	578	1,248	1,024
- Manpower	97	126	98	126	108
- Maintenance	155	254	241	254	199
- Others	65	89	55	89	77
- Sub-total	1,203	1,760	972	1,717	1,408

Element	Alt.-1	Alt.-2	Alt.-3	Alt.-4	Alt.-5
4) Total for waste management (a)					
- Depreciation	11,624	6,162	7,393	9,633	10,650
- Manpower	4,799	4,423	4,422	5,092	5,067
- Maintenance	3,977	2,352	3,233	3,343	3,702
- Others	2,294	893	1,711	1,311	1,793
- Grand total	22,694	13,830	16,759	19,379	21,212
Revenue from sale of compost (b)	1,710	117	117	117	-
Revenue from sale of reusable materials (c)	1,533	107	107	1,746	1,652
Net expense (a-(b+c))	19,541	13,606	16,535	17,516	19,560
Cost of waste management (LE/t)					
- Collection & sweeping	11.3	13.9	18.3	13.9	13.3
- Intermediate treatment	15.2	1.0	1.2	7.9	11.2
- Final disposal	1.5	2.2	1.2	2.1	1.7
Total	28.0	17.0	20.7	23.9	26.2
Net cost after subtracting revenue from sale	24.0	16.8	20.4	21.6	26.2

3.4 Evaluation of Alternatives

The five alternatives were evaluated for their technical systems and organizational and financial aspects. After these individual evaluation, the overall evaluation was made.

3.4.1 Evaluation for Technical System

The total technical system was evaluated mainly on the basis of the system elements and costs of each alternative summarized in Table 3-3-6 and 3-3-7.

Fig. 3-4-1 summarizes the evaluation of alternatives for technical system.

As a result of these item-by-item evaluations, Alternative-2, which proposed "sanitary landfill of all solid wastes at disposal sites in a short hauling distance such as in the Green Belt area" was selected as most appropriate based on the following judgements.

- a. In terms of benefits, the alternatives vary in such as resource recycling, reutilization, and the burden of securing land space for disposal sites. However, there is no difference in their effects of improving the level of environmental sanitation within the city area, which is the fundamental criterion for evaluation.
- b. Alt.-2 is inferior to other alternatives in respect to inability of reducing waste amount, shorter life span of landfill sites, and the failure of converting waste into resources. On the other hand, the cost of the s.w.m is quite low compared to other alternatives, particularly to the alternative with composting all wastes for resource recovery with sorting wastes.
Also, because of sanitary landfilling, it is superior of equal to other alternatives in terms of secondary adverse environmental impacts.

In other words, it should be rated the highest as the alternative capable of achieving the basic goals of "improving the environmental sanitation standards within the city area and forming a treatment and disposal system which does not generate secondary adverse environmental impacts" with the minimum cost.

- c. Alt.-3 which seeks the location of landfill sites at a further distance of 70km and incorporates transfer stations can be evaluated as the second best, next only to Alt.-2.
- Its negative aspect of requiring large landfill sites does not constitute a basic deficiency because the minimum cost can be achieved even if the area for disposal sites is sought at a considerable distance.
- d. In terms of "incorporating a resource recycling and reutilization process", which is one of the goals, the sanitary landfill alternative is inferior to the compost and other resource recovery type alternatives. However, in view of the availability of funds for the s.w.m in Alexandria and the fact that its basic goal lies in "the improvement of environmental sanitation within the city area" whereas "the conversion of waste into resources" is a secondary goal in improving the s.w.m system, Alt.-2, which is advantageous in terms of cost requirement, ought to be rated high.
- e. In other evaluation items such as required manpower, vehicles and heavy equipment, there is no significant difference among alternatives, and in fuel consumption, Alt.-2 consumes the least.

(1) S.W.M cost

In terms of the s.w.m cost in the target year, Alt.-2, which proposes sanitary landfilling at short hauling distance is the lowest at 17 LE/t, followed by the alternative which proposes sanitary landfilling at a farther hauling distance. Both of these exhibit fairly low costs compared to around 24-28 LE/t for alternatives incorporating recovery of reusable materials by sorting and composting. In terms of net cost after crediting revenues from sales of compost and reusable materials, the differences among five alternatives narrow to within the range of 5-10 LE/t.

(2) Required manpower

In terms of the required manpower, sanitary landfilling of Alt.-2 and Alt.-3 requires the smallest manpower, and increases in the order of Alt.-1 which incorporates composting, Alt.-4 and Alt.-5, both of which incorporate sorting. Particularly, if a transfer station is included, a considerable manpower reduction can be anticipated.

(3) Required number of collection vehicles and heavy equipments

The required number of collection vehicles is the smallest for Alt.-1 and Alt.-3, but each requires a larger number of heavy equipments and secondary haulage vehicles. The total number of required vehicles and heavy equipment as a whole is slightly smaller for Alt.-1 and slightly larger for Alt.-3, -4 and -5.

(4) Land area

The required area for landfill sites is 700 ha. for sanitary landfilling and 500 ha. for alternatives with compost. Even the alternatives with sorting require an area close to 700 ha. since the rate of amount reduction is low and they should largely resort to sanitary landfilling while construction/improvement of facilities is in progress. The sites for intermediate treatment facilities require a considerable space of about 70 ha. for Alt.-1.

(5) Fuel consumption

Fuel consumption is the smallest for Alt.-2 which proposes sanitary landfilling at a short hauling distance, followed by the alternatives incorporating compost and recovery of useful material, while Alt.-3 which proposes sanitary landfilling at a farther hauling distance consumes almost twice as much fuel as Alt.-2.

(6) Amount of waste disposed of

The amount of waste disposed of by Alt.-1 is less than 50% that of Alt.-2 and -3 and considerably smaller than Alt.-4 and -5. Thus, Alt.-1 has a large effect in reducing the burden of securing necessary disposal sites.

(7) Utilization of waste as resources

In respect to utilization of waste as resources, Alt.-1 deserves a high rate in terms of the amount of compost produced and reusable materials recovered, Alt.-4 and -5 also utilize waste to a considerable extent, whereas sanitary landfilling of Alt.-2 and -3 is evaluated low in this respect.

Fig. 3-4-1 EVALUATION OF ALTERNATIVES AS TECHNICAL SYSTEMS

3.4.2 Evaluation from Economical and Financial Aspects

Here, the five alternatives are evaluated by the minimum cost criterion. This is because s.w.m. is indispensable in terms of urban function, Japan's experience tells that its benefits cannot be expected to exceed costs, and the method of calculating benefits has not been well developed and tends to become subjective. Regarding the secondary benefits, as they are considered to be reflected in the respective market price, only financial evaluation is made. Accordingly, the scale of the funds to the finance s.w.m. in Alexandria and the possibility of expanding the sources of funds in the future is examined first, whereupon each alternative is evaluated individually.

- 1) Existing state and prospect of expansion of the financial resources for the s.w.m. in Alexandria

The financial resources and their amounts for the s.w.m. in 1985 is estimated as in Table 3-4-1.

Table 3-4-1 SOURCES OF FUNDS FOR S.W.M. IN ALEXANDRIA AS OF 1985

		(1,000 LE)
Central Government	Wages	2,138
	Vehicle purchasing, etc.	2,330
Governorate	Cleansing Fund (inc. 2% of house rent)	1,365
Payment by residents	ADS	400
Payment by business establishment	ADS	600
TOTAL		6,833

As of 2000, revenues from the sales of compost and recycled materials will be added to the foregoing sources of fund. The composition of financial resources as a result will become as follows.

- Central Government	Wages
	Vehicle purchasing, etc.
- Governorate	Cleansing Fund
	(inc. 2% of house rent)
- Payment by residents	Collection charges
- Payment by business establishment	Collection charges
- Compost sales	
- Reusable material sales	

The expansion of these financial resources is likely to vary depending on the terms and conditions to be agreed upon between the Central Government and the Governorate of Alexandria when the Cleansing Authority is established. However, the realistically conceivable scope of funds projected as an extension of the past trend would be as follows:

- a. Regarding wages paid by the Central Government, an amount matching the necessary manpower is considered to be obtained. Salaries and wages for supervisory and managerial staff, technical staff (including drivers), clerical staff, workers and sweepers are deemed to be as follows.

Supervisory and administrative staff	Grade 3 equivalent 1,100 LE/year
Technical staff	Grade 4 equivalent 800 LE/year
Clerical staff & workers	Grade 5 equivalent 700 LE/year
Sweepers	Grade 6 equivalent 600 LE/year

Adding bonus and other allowance, the revenue for wages are 1.2 multiplied by the abovementioned wage.

- b. The Cleansing Fund is assumed to increase in proportion to the population increase.
- c. Investment by the Central Government (Chapter 3) is assumed to remain the same.
- d. From the standpoint of establishing a self-supporting financial basis, neither new subsidies nor overseas grant aid are assumed.
- e. Regarding the burden on inhabitants, 6 LE/year per household is deemed as a standard. However, since 2% on rent is collected and contained in the Cleansing Fund, 4 LE/year per household is assumed.
- f. Regarding the burden on business establishments, 50% of the cost of collection, treatment and disposal per ton of waste shall be charged.
- g. The revenue from sale of compost is set at 9 LE/ton.
- h. The revenue from sale of recycled material is set at 1.87 LE/ton of waste collected.

These financial expansions will increase the operating funds in 2000 to be about 12,000,000 LE at the 1985 price (which is about double that in 1985) even without including the revenue from sales of compost and recycled materials.

2) Expenses and balance

The expenses required for manpower, fuel, equipment, etc. are shown in Table 3-3-7. For estimating expenses, the following factors are used.

(1) Personnel expenses

- Supervisory & managerial staff	Grade 3 equivalent	1,800 LE/year
- Technical staff	Grade 4 equivalent	1,800 LE/year
- Drivers	Grade 4 equivalent	2,400 LE/year
- Clerical staff & workers	Grade 5 equivalent	1,440 LE/year
- Sweepers	Grade 6 equivalent	960 LE/year

(2) Depreciation costs

Depreciation shall be a straight line fixed amount, assuming the following depreciable lies.

Table 3-4-2 DEPRECIATION COSTS

	Depreciable life	Residual book value	Remark
Vehicle	5 (years)	10 (%)	Civil works related to disposal, are effective only during the disposal period, so that the disposal period is used as the depreciable life.
Equipment	15	0	
Building and civil structures	30	0	

(3) Utility cost

- Fuel 15 PT/l
- Electricity for business use 4.82 PT/kwh
- Water for business use 15 PT/m³

(4) Maintenance cost

- Vehicle 40% of purchase cost for useful life (5 years)
- Facility of Compost Plant 2% of construction cost
- Civil Work Ignored
- Others 15% of the depreciation

The operating expense of each alternative in 2000, and the operating balance based on the projected sources of fund mentioned above, are shown in Table 3-4-3 and 3-4-4.

Table 3-4-3 SOURCES OF REVENUE AND EXPENSES

(1,000 LE)

	Alt.-1	Alt.-2	Alt.-3	Alt.-4	Alt.-5
Sources of revenue					
Central Governorate					
Basic wages	2,969	2,855	2,744	3,226	3,304
Investment & purchasing	2,330	2,330	2,330	2,330	2,330
Cleansing Fund	1,906	1,906	1,906	1,906	1,906
Payment by residents	3,279	3,279	3,279	3,279	3,279
Payment by business establishment	3,532	2,161	2,576	3,019	3,061
Sale of compost	1,710	117	117	117	-
Sale of reusable materials	1,533	107	107	1,746	1,652
TOTAL (A)	17,259	12,755	13,059	15,623	15,532
Expenses					
Collection & sweeping	9,161	11,259	14,827	11,259	10,738
Intermediate treatment	12,330	811	960	6,403	9,066
Final disposal	1,203	1,760	972	1,717	1,408
TOTAL (B)	22,694	13,830	16,759	19,379	21,212
Expenses excluding depreciation (C)	11,070	7,668	9,366	9,746	10,562
BALANCE [(A) - (B)]	-5,435	-1,075	-3,700	-3,756	-5,680
[(A) - (C)]	6,189	5,087	3,693	5,877	4,970

Table 3-4-4 EVALUATION OF ALTERNATIVES

(million LE)

	Alt.-1	Alt.-2	Alt.-3	Alt.-4	Alt.-5
Operating expense	22.7	13.8	16.8	19.4	21.2
Rank	5	1	2	3	4
Scale of financial resource	17.3	12.8	13.1	15.6	15.5
Rank	1	5	4	2	3
Operating balance	-5.4	-1.1	-3.7	-3.8	-5.7
Rank	4	1	2	3	5
Balance excluding depreciation	6.2	5.1	3.7	5.9	5.0
Rank	1	3	5	2	4

a. Alt.-1

The operating expense is the largest, but the scale of financial sources is also the largest with the additional income from sales of compost and recycled materials. The consequent operating balance shows a fund shortage of 5,400,000 LE. If this shortage were to be covered by charging the inhabitants, the financial burden on them would be more than doubled. Furthermore, if compost, etc. were unsalable for some reasons, the fund shortage will reach 7,100,000 LE, and may possibly lead the s.w.m in Alexandria into bankruptcy. However, the operating balance excluding depreciation shows a surplus of 6,200,000 LE, indicating that the operation will be rated high if foreign aid or subsidy from the Central Government can be counted on to finance the provision and the improvement of facilities.

b. Alt.-2

The operating expense is the smallest, and in the light of the financial strength of Alexandria and the cost bearing capacity of its inhabitants, it is considered the most realistic of all five alternatives. Since it hardly contains any uncertain financial sources like compost, it is the best in terms of operational stability.

c. Alt.-3

The operating balance of Alt.-3 is inferior to that of Alt.-2 but more advantageous than the other three resource recovery type alternatives. Evaluations in other respects are more or less similar to those of Alt.-2.

d. Alt.-4

Although its operating balance is the most favorable among the three resource recycling type alternatives, the operating balance deteriorates remarkably when its disposal sites are located farther way. In other words, this alternative contains two intrinsic uncertainties, namely the locational condition of disposal sites and marketability of recycled materials. In this respect, it is operationally and financially precarious.

e. Alt.-5

Evaluation is the poorest both operationally and financially, as compost is used as covering material.

As a consequence of foregoing evaluation, Alt.-2 is considered to be superior to other alternatives from the viewpoint of the financial aspect of s.w.m.

However, Egypt entertains great hopes in promotion of agriculture and greening of deserts, and when these economic effects are taken into account, the significance of compost will increase. In this event, the alternatives must be evaluated from the standpoint which is different from s.w.m.

3.4.3 Overall evaluation

The foregoing comparative evaluation results are summarized in Table 3-4-5.

Table 3-4-5 SUMMARY TABLE OF EVALUATION OF ALTERNATIVES

Evaluation as technical system	Evaluation from organizational and financial aspects
<p><u>Alt.-1</u></p> <ul style="list-style-type: none"> o High operating expenses and treatment cost o A large volume reduction effect that makes it easier to cope with the difficulty in securing disposal sites. o Potential value of waste as resources can be effectively utilized by composting and recycled material recovery. 	<ul style="list-style-type: none"> o About 570 persons for the composting facility, which results an organizational expansion. o Large investment in facilities, high treatment cost and risk associated with the uncertainty in revenue from sale of compost and recycled materials. o Higher organizational and financial uncertainties than other alternatives.
<p><u>Alt.-2</u></p> <ul style="list-style-type: none"> o The smallest operating expense among all alternatives. o Low degree of utilization of the potential value of waste as resources. o The largest scale of landfill sites required and thus its feasibility depends on the predicated availability of landfill sites. 	<ul style="list-style-type: none"> o The smallest required manpower, small operating expenditure, and high organizational and financial stability. o The certainty should be associated with securing landfill sites near the city.

Evaluation as technical system	Evaluation from organizational and financial aspects
<p><u>Alt.-3</u></p> <ul style="list-style-type: none"> o Low degree of utilization of the potential value of waste as resources. o The largest scale of landfill sites required and thus, its feasibility depends on the predicated availability of landfill sites. o The area for selecting landfill sites is expanded so that securing of sites is much easier than Alt.-2. o Sanitary landfilling in deserts enables lower disposal cost than Alt.-2 but the higher haulage costs more than offsets that saving. 	<ul style="list-style-type: none"> o Fairly large haulage cost compared to Alt.-2 and the need for transfer stations resulting in expansion of organization. o Organizationally and financially inferior to Alt.-2 which attempts to secure landfill sites in the 20km range.
<p><u>Alt.-4</u></p> <ul style="list-style-type: none"> o The attempt to recover useful material reduces the demand for landfill sites, but the volume of landfill is larger by 50% or more than Alt.-1. o Quality of waste to be landfilled becomes relatively suitable for landfilling. o Additional manpower for sorting becomes necessary. o Cost is approximately the same as Alt.-1 but the required manpower and the number of vehicles become fairly large. 	<ul style="list-style-type: none"> o Manpower for sorting reusable materials required. o Requires investment in sorting facility and additional expenses for sorting, but a considerable portion of expenses can be recovered by revenues from sale of useful materials and reduced landfill volume. (Facility investment less than 70% that of Alt.-1.)

Evaluation as technical system	Evaluation from organizational and financial aspects
<p><u>Alt.-5</u></p> <ul style="list-style-type: none"> o This alternative utilizes the value of waste as resources most effectively in case where difficulty is encountered in forming market for compost. o It is an intermediate alternative between Alt.-1 and Alt.-4. 	<ul style="list-style-type: none"> o Financially worst among the five alternatives. o Since compost is used as covering material, no uncertainty in marketing exists.

Based on this summary table and the following considerations, the alternative of disposing the entire amount of waste by sanitary landfilling in the neighborhood area was considered a recommendable plan for the s.w.m system in Alexandria.

- a. When the landfill sites are sought in the desert area, the disposal cost declines as a result of simpler landfill method. However, the haulage cost including transfer stations becomes larger. Facilities, manpower, and of vehicles also expand. Thus, it is at a considerable disadvantage compared to the case in which the landfill sites are secured in nearby areas.
Hence, the landfill sites should be sought in neighboring areas as much as possible.
- b. In case the landfill sites can be secured in close-by areas, sanitary landfilling is the most realistic alternative in the light of Alexandria's financial scale because the disposal cost is the lowest and the required manpower and number of vehicles are the smallest. It is also financially very stable.
In respect to recycling of resources and reutilization, it is inferior to the three resource utilization type alternatives, but in so far as the primary objective of s.w.m that is to remove waste from the living environment in a sanitary manner is concerned, it can be regarded as being the most superior.

- c. Incineration and shredding which are popular means for volume reduction in Japan result in high waste treatment cost although the effect of volume reduction can be expected, as stated previously. Heat recovery by incineration has very few merits in Egypt where the energy cost is relatively low. Furthermore, these two systems require advanced maintenance and operation technologies, and the burden of maintenance is considerable.
- d. Compost, including recovery of useful materials as its pre-treatment, has a large volume reduction effect. Reutilization of materials is of course meaningful, and also the demand for compost as an indispensable soil conditioner for greening of deserts is considered large. Therefore, compost has a great expectation. When viewed from the financial aspect, however, large scale introduction of compost cannot be adopted as a recommendable plan since it may encroach upon the financial resources for the cleansing work in Alexandria and also because the top priority goal for improving the s.w.m system is to improve the environmental sanitation within the city.
- e. Both the sorting alternative and the alternative of combining compost and sorting when compared to the compost alternative result in lower evaluation relatively.

As discussed above, the alternative of sanitary landfilling for the entire amount of waste is considered the most appropriate as the basis for the s.w.m system of Alexandria. In this evaluation, the priority was given to emphasizing the reduction of financial burden rather than to resource recycling, reutilization and waste amount reduction effects of the resource recovery type in s.w.m systems.

Of the three resource recovery type alternatives, the compost alternative (Alt.-2) is capable of volume reduction at lower cost compared to treatment by incineration and others. It can be highly evaluated for its ability to supply soil conditioner which is indispensable for greening of the deserts and which is difficult to bring in from other areas.

As we have seen previously, the Abis Compost Plant with a 160 t/day capacity constructed by the aid of the World Bank is technically feasible with stable operation.

Therefore, if the burden on the financial resources for s.w.m can be alleviated by receiving financial assistance from the Central Government to subsidize a part of the facility construction and compost products sale (from the viewpoint of national economy such as improvement of agricultural productivity), the construction of compost plant should be considered as a part of the s.w.m. system. This is a step forward in attaining the goal of incorporating resource recycling and reutilization in the s.w.m. system.

3.5 Master Plan for S. W. M. in Alexandria

Based on the foregoing study results, the followings are proposed as the contents of the Master Plan for s.w.m. in Alexandria.

3.5.1 Preconditions and Goals for Planning

1) Preconditions for planning

The preconditions for this Master Plan are as shown in Table 3-5-1.

Table 3-5-1 PRECONDITIONS FOR PLANNING

Target year	2000						
Study area	Whole urban area in Alexandria in 2000						
Waste to be covered	Domestic, commercial, street sweeping and summer vacationers' waste generated from the above mentioned study area.						
Estimated daily waste amount in target year	1,460 ton of domestic waste, and 759 tons of commercial waste, totalling 2,219 ton. Besides this, 360 ton of summer vacationers' waste during the three months between June and August.						
	(Weight % in wet basis)						
Estimated waste composition*	Garbage/ Grass	Papers	Text- iles	Plas- tics	Metals	Glass	Others
	51	23	6	9	6	4	1

2) Goals for planning

The planning goals of this Master Plan are as shown in Table 3-5-2.

Table 3-5-2 PLANNING GOALS

Item	Planning Goals
Collection	By the system of periodical collection at specified discharge stations, wastes shall be collected every day in the densely inhabited areas and at least twice a week in other areas.
Citizenry cooperation	On the basis of periodical collection service, cooperation of the citizens in discharging waste with regularity (discharge to a specified station on a specified date and time) shall be secured.
Street sweeping	To rationalize street sweeping activities and improve street environment through reorganization of street sweeping management system based on the street waste reducing by improving the collection service and securing the cooperation of the citizens.
Treatment and disposal	The entire amount of collected wastes will be disposed of by sanitary landfilling. (However, the system of utilizing resources by composting while disposing of the residues by sanitary landfilling will be considered if the investment cost for facility improvement and/or the construction is available as subsidies from the Central Government so as not to put financial pressure on the s.w.m.)
Organization and management	The basic goal is to strive for unified management of planning, control and field operations by the Cleansing Authority. Also, efforts for progressive improvement of organization shall be made by improving the pay and technical skill of workers.
Finance and administration	Establishment of self-supporting financial basis by streamlining total s.w.m system and by securing financial resources.

3.5.2 Waste Collection, Haulage and Street Sweeping Plans

1) Waste collection plan

Stationary collection with combined solid wastes is applied for Alexandria. The collection frequency and numbers of collection stations in each district are as shown in Fig. 3-5-1. In Middle, Gomrok, East and West Districts where waste discharge rate is high, three stations are selected per one ha., and the wastes shall be collected every day. In Montazah and Ameriya Districts where the waste discharge rate is low, two stations are placed per one ha. and the wastes shall be collected twice a week.

Wastes shall be discharged in plastic bags as a rule, but in consideration of the financial burden this incurs on the inhabitants, discharging in containers may also be allowed. The collected wastes shall be hauled either to the Abis Compost Plant or to the final disposal sites.

Table 3-5-3 FRAME OF COLLECTION SYSTEM

Item	Frame
Discharge station	<p>Discharge stations shall be placed on the shoulder of road or on the sidewalk clearly marked as the station so that the waste carrying distance from homes would be 50-100 m or less. 3 stations/ha. shall be placed in highly populated areas like Middle, Gomrok, West and East Districts and 2 stations/ha in low population density areas like Ameriyah and Montazah Districts. Discharge station, however shall not be placed in the center area of Middle District.</p>
Collection frequency	<p>As waste generation rate is quite high in Middle, Gomrok, West and East Districts, collection service shall be daily, while for low waste generation rate areas like Montazah and Ameriyah Districts, collection shall be made twice a week as a rule with due regard to household storage and collection efficiency. Waste generated from markets shall be collected twice or three times per day, but the wastes in the suburban areas shall be collected twice or three times per week.</p>
Discharge method	<p>Present practice of waste discharge to communal container or open space in bulk shall be terminated. Instead, waste should be discharged by using specified bags. The bag discharge method shall be induced to the low income area with confirmation of its possibility. Special facilities such as hospital, hotel, market, etc., including suburban area shall continue to use the communal container system.</p>
Discharge time	<p>Waste discharge time shall be from 20:00 to 8:00 in the next morning.</p>
Collection method	<p>All solid wastes shall be collected at waste discharge stations. In areas where discharge by plastic bags is possible, collection by open dump trucks shall be acceptable, while in other areas, compactor vehicles shall be dispatched.</p>

Item	Frame
Collection equipment	<p>Compactor vehicles or open dump trucks shall be dispatched depending on how much the practice of discharging by bags has been implemented, and on pavement conditions of roads. To improve the service level, medium sized vehicles possible to enter into a 4 to 6 m wide road shall be mainly provided. Container vehicle shall be provided for the waste collection of special facilities.</p>

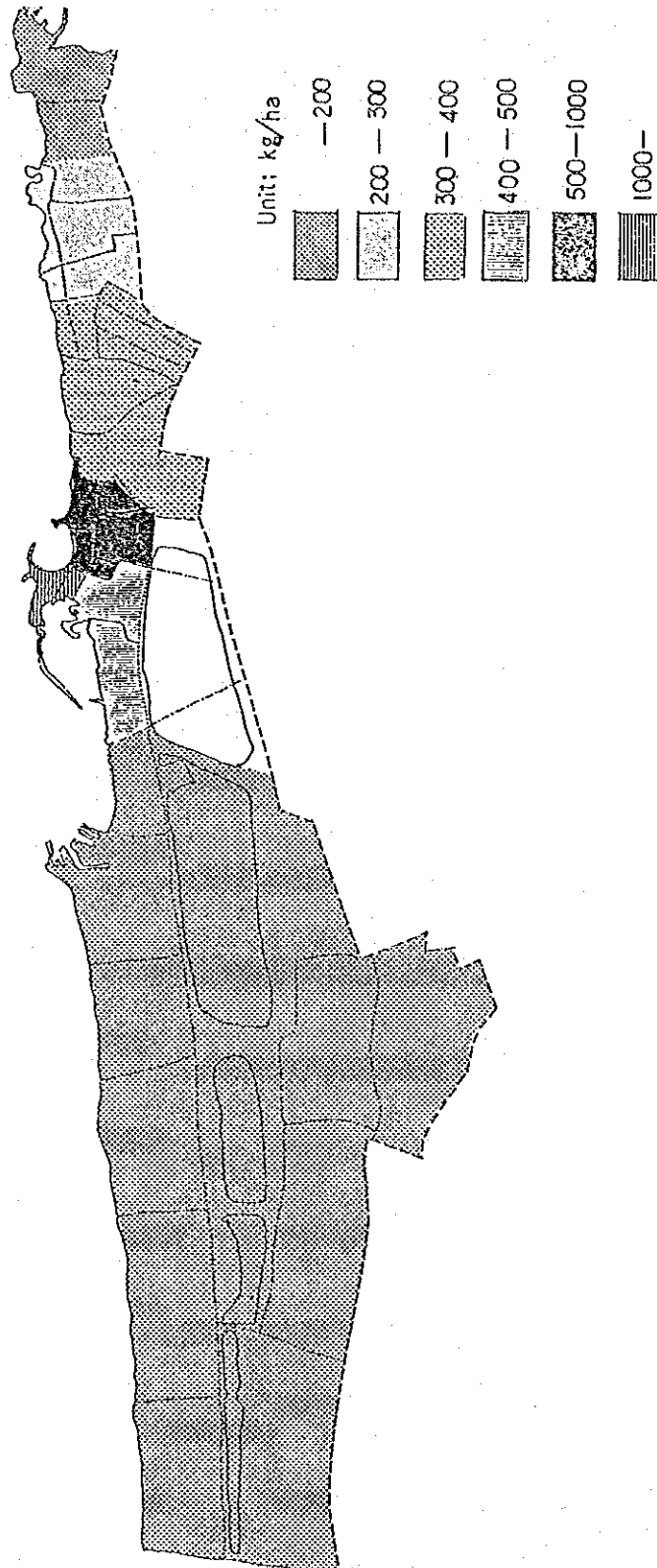


Fig. 3-5-1 COLLECTION FREQUENCY AND NUMBER OF COLLECTION OF STATIONS

2) Street sweeping plan

Street sweeping shall be carried out by manual operation and shall be separated from general waste collection in order to increase its efficiency.

Streets to be swept within the planned city area amount to 352.6 km for the main streets and 1,307 km for the secondary streets.

Sweeping frequency is determined at once to three times a day for the main streets and once to three times a week for the other streets depending on the condition of streets in each serving area.

Frame of the street sweeping system and length of street to be swept are shown in Table 3-5-4, 3-5-5 respectively.

Table 3-5-4 FRAME OF THE STREET SWEEPING SYSTEM

Item	Frame
Street sweeping system	Street sweeping shall be carried out manually, and each sweeper shall be assigned a street section or area to take care of. Mechanical sweeping shall be applied to the trunk roads.
Reloading system	Haulage vehicles shall be provided for street waste as exclusive use. All street wastes collected by hand cart shall be reloaded to the haulage vehicles.
System of storing collected street waste	Street waste collected by the sweepers shall be packed in plastic bags and placed in the stations for haulage.
Frequency	Main streets and secondary streets shall be swept once to three times a day. Other streets shall be swept once to three times a week. Actual frequency shall be determined with consideration of street or area conditions.
Sweeping hours	Sweeping of the main streets shall be carried out in the early morning in order to finish before the start of the daily activity of the people. Other streets shall be swept from 6:00 to 12:00 in the same schedule as the present practice in summer and 7:00 to 13:00 in winter.
Equipment	Each sweeper shall be provided with a broom and a green basket available in Alexandria. Furthermore, hand carts manufactured in the workshop shall be provided depending on the conditions of the street waste generation. And mechanical sweeper shall be used on the trunk roads.
Manpower plan	One sweeper shall be assigned for every 1.2 km of the main streets and every 0.5 km of the other streets.

Table 3-5-5 SELECTION OF STREETS TO BE SWEEPED

	Service Area (km) ²	Main Street (km)	Secondary Street (km)
Montazah	40.6	25.8	129
East	25.2	27.0	216
Middle	11.9	47.2	296
Gomrok	4.5	23.4	101
West	16.8	29.2	115
Ameriyah	238.6	100.0	450
Total	337.6	352.6	1,307

- Notes:
1. Main streets are measured by the applicable drawings.
 2. Total length of main streets in Ameriyah District is 200 km including the planned streets, of which 100 km was defined as secondary streets and included in the category of secondary alley.
 3. Streets in the category of secondary street to be swept were estimated on the assumption that such roads account for 40% of the total extended length of streets in the residential and central areas in Montazah and Ameriyah Districts, 60% in East and West Districts and 80% in Middle and Gomrok Districts, with due regard to the conditions in each district.
 4. Roads in residential and central areas were assumed to be 400 m/ha in Middle and West Districts, 300 m/ha in East and Gomrok Districts, 100 m/ha in Montazah District and 50 m/ha in Ameriyah District, based on the results of street survey.

3) Improvement plan on collection, haulage and street sweeping

The staged plan on collection, haulage and street sweeping is shown in Table 3-5-6. The years duration up to 2000 shall be divided into three stages. At the first stage, collection and street sweeping shall be completely improved in the Middle District, then this improvement plan shall be expanded to the other districts during the second and third stages.

Table 3-5-6 STAGED PLAN FOR COLLECTION, HAULAGE AND STREET SWEEPING

District	1st Stage	2nd Stage	3rd Stage
Middle District	Rearrangement of waste stations and communal containers, and establishment of bag-packed and regular discharge collection system in the north area. Tentative reorganization of the street sweeping system.	Gradual expansion of the bag-packed collection areas except for low income area and of the reorganization of the street sweeping system.	Expansion of the bag-packed collection system for the low income area.
Gomrok, West and East Districts	Preparatory stage for shifting to a new collection and street sweeping system, on the basis of the current system	Establishment of the bag-packed regular discharge. Rearrangement of stations and communal containers. Implementation of regular collection system. Expansion of the collection area. Gradual shift to once to three times street sweeping a week on the secondary streets.	Unification of the waste discharge method and abolition of the communal containers. Gradual expansion of the bag-packed collection areas and regular collection. Establishment of once to three times street sweeping a week on the secondary streets.
Ameriyah and Montazah Districts	Ditto	Twice a week collection and weekly street sweeping shall be induced for new urban area.	Service shall be extended to the urban area to be newly developed.

(1) Staged improvements of collection & street sweeping

The Master Plan proposes the following, as appropriate means of the collection and street sweeping by 2000.

- Bags should be used for discharging wastes, which will be collected daily in highly populated districts, and twice a week in the rest of the districts.
- Combined collection system should be employed, and compactor vehicles (3 to 4 ton) should be mainly used for collection.
- Reduction of the wastes scattered around streets should be well promoted, and the increasing cost of street sweeping will be suppressed through the improvement of collection service as mentioned above and the citizenry cooperation in regular discharge of wastes.

The achievement of these targets and the entire alteration of the system in a short period of time are, however, quite difficult due to the following reasons.

- Street sweeping operations are being implemented under the existing ways by using conventional facilities and equipments.
- A certain period of time is required in order to gain more effective cooperation of citizens, and to improve the technical skills of employees and the organizational strength.

Therefore, it will be imperative to introduce the collection and street sweeping systems in two steps as described in the following, and let these new systems take root in the community, except for districts where urbanization is not in progress yet.

a. First step

At the first step the drive to use plastic bags will not be too persistent, but rather set the priority to the improvement of collection service by means of efficient use of the existing facilities and equipments, so that the cooperation of citizens in regular discharge is encouraged, and the scattered wastes on streets will be reduced. Try to create a mutual understanding between the Governorate and the citizens regarding the implementation of the routine waste collection system. Even though this is the first step, make efforts to reinforce the collection service by the use of bags in some of middle to high income residential areas and commercial areas in the Middle District.

b. Second step

In the districts where the first step is completed try to make the bag collection system popular among citizens, starting from areas where it is relatively easy to adopt the new system, such as middle to high income residential areas, commercial and business areas, etc. Introduce the bag collection system from the beginning for newly planned urban areas.

As proposed in the improvement plan mentioned before, therefore, the trial implementation should be initiated for some zones in the Middle District, which is considered to be the top priority district, then to spread it gradually to the entire districts in order to ensure the staged implementation of the plan.

The next effort would be to make the first step widely known and well implemented in other districts, while promoting the second step in the Middle District where the first step is already well implemented. The attainment of the target in this manner is indispensable to complete the plan in all districts in the end. Since it would require a considerable amount of time to achieve this target, it would be vital to promote improvement measures in stages, while coordinating other various improvement plans set for each year and for each district.

(2) Flexible responses for procurement of collection equipments

The Master Plan aims at shifting to the bag collection system by the target year and the provision of mechanical collection vehicles supplemented by open dump trucks. The target, however, was established as a fairly high level system with the prediction of the long range prospective that the income level of the resident will rise to a considerably high level by 2000 and that the demand for street environment and others will make the installation of containers intensely difficult.

Accordingly, the shift from the prevalent state to the above targetted one will be confined to a very limited area, and in such areas, new and conventional systems are expected to co-exist for a considerably long time.

The major collection equipments are vehicles, which are broadly categorized into the following four types. Each type has its advantages and disadvantages depending on the waste discharging methods and street conditions.

- Mechanical collection vehicle with compacting device (Compactor)
- Container vehicle (Truxmore)
- Crane mounted dump truck
- Open dump truck

Several collection methods will co-exist during the transitional period, but the co-existence itself seldom causes the deterioration of the collection efficiency in a city like Alexandria with high density of waste generation rate. There are interchangeability of the vehicles within any collection systems except where the collection system is provided only by container vehicles and the minor adaptability of open dump trucks for container hauling. However, it is possible to use open dump trucks for the bag collection areas while the financial base remains low since the waste collection cost is considerably cheap although the open dump trucks are inferior to the compactor in terms of collection efficiency and health aspect of the workers.

Taking into account the fact that the service life of such vehicles are usually as short as 5 to 7 years at most, it will be noted that it is possible to change types of vehicles to more suitable ones at each stage to attain the goal.

(3) Rationalization of street sweeping service

One of the key points to improve the collection and street sweeping systems is how to relate the improvements in waste collection services to the rationalization of the street sweeping service.

With this regard, policies such as the rejection to collect illegally or inappropriately discharged wastes, or street sweeping thereof are necessary.

In other words, the street sweeping services have to be reorganized as an integral part of the collection system based on the understanding that street sweeping services in Alexandria can be rationalized by restructuring the sweeping frequency and consolidating the streets to be swept.

3.5.3 Intermediate Treatment and Final Disposal Plan

The basic subjects in intermediate treatment and final disposal system are developed with regard to shifting to sanitary landfilling. As composting will increase the financial burden, it shall be basically confined to the financially permissible extent.

The basic requirement for shifting to sanitary landfilling is securing the landfill site. Urgent task is to secure landfill sites at an early stage and to develop them into final disposal sites since the current landfill sites will be filled up in another two years or so if a shift is (and it should be) made to sanitary landfilling.

As discussed in the study on collection and haulage, increased use of remote landfill sites would remarkably lower the collection and haulage efficiency and accelerate the rise in the overall s.w.m. cost. It is therefore desirable to secure the landfill sites in the neighborhood of urban areas as much as possible. For this reason, the efforts to secure the landfill site systematically shall be made over the long range views.

In the case of Alexandria, the problem is not a shortage of vacant lots physically but the difficulty imposed on acquisition of landfill sites due to the administration's land use policy which emphasizes the development of land for greenery and farming and of restricting the use of land for other purposes.

In this respect, it is necessary for the cleansing agency to try to coordinate the differences in views existing among the administration offices by explaining the urgent need to secure landfill sites in nearby places and by presenting concrete data regarding the sanitary landfilling and mixing of compost with final cover material after landfilling which does not interfere the utilization of completed landfill site for agricultural purposes.

1) Intermediate treatment plan

The intermediate treatment facility shall be confined to the existing Abis Compost Plant (with a treatment capacity of 10 t/hr), where 48,000 tons of

waste is to be treated annually. Abis Compost Plan began operating in 1985 which means that, based on its service life, the facilities will have to be replaced in 15 years by 1999. In addition, heavy equipment and vehicles used in this plan will have to be replaced every five years.

Table 3-5-7 INTERMEDIATE TREATMENT FACILITIES PLAN

ITEM	
Location	The vicinity of ABIS*
Capacity	10 t/hr
Number of processing lines	1 line
Service Area	Middle District
Designed treatment amount	154 t/d
Site area	2.4 ha.

* The Existing Abis Compost plant

As composting will lead to the waste amount reduction to be disposed of, resource recovery and the possibility to contribute to deserts greening around

Alexandria, the composting project shall be evaluated economically, to confirm the feasibility and shall be promoted as much as the financial conditions permit.

2) Final disposal

The existing disposal sites are continuously used for the time being, while in the mid- and long-range aspect, sanitary landfill sites shall be secured in the neighborhood areas, including the Green Belt.

Fig. 3-5-2 shows the layout plan of the facilities and the treatment and disposal amount for each facility formulated on conditions of forming the system with 10 t/hr Abis Compost Plan and sanitary landfill sites. The plan for the final disposal sites is summarized as follows.

(1) Locations

The following two disposal sites shall be constructed on the Green Belt demarcated in the Plan 2005.

- Eastern Final Disposal Site (EDS)
- Western Final Disposal Site (WDS)

(2) Planned service area

The entire urban area of Alexandria

(3) Types of the waste to be disposed of

General domestic waste, commercial waste, street waste and summer vacationers' waste generated in the above-mentioned planned service area.

(4) Planned amount to be disposed of

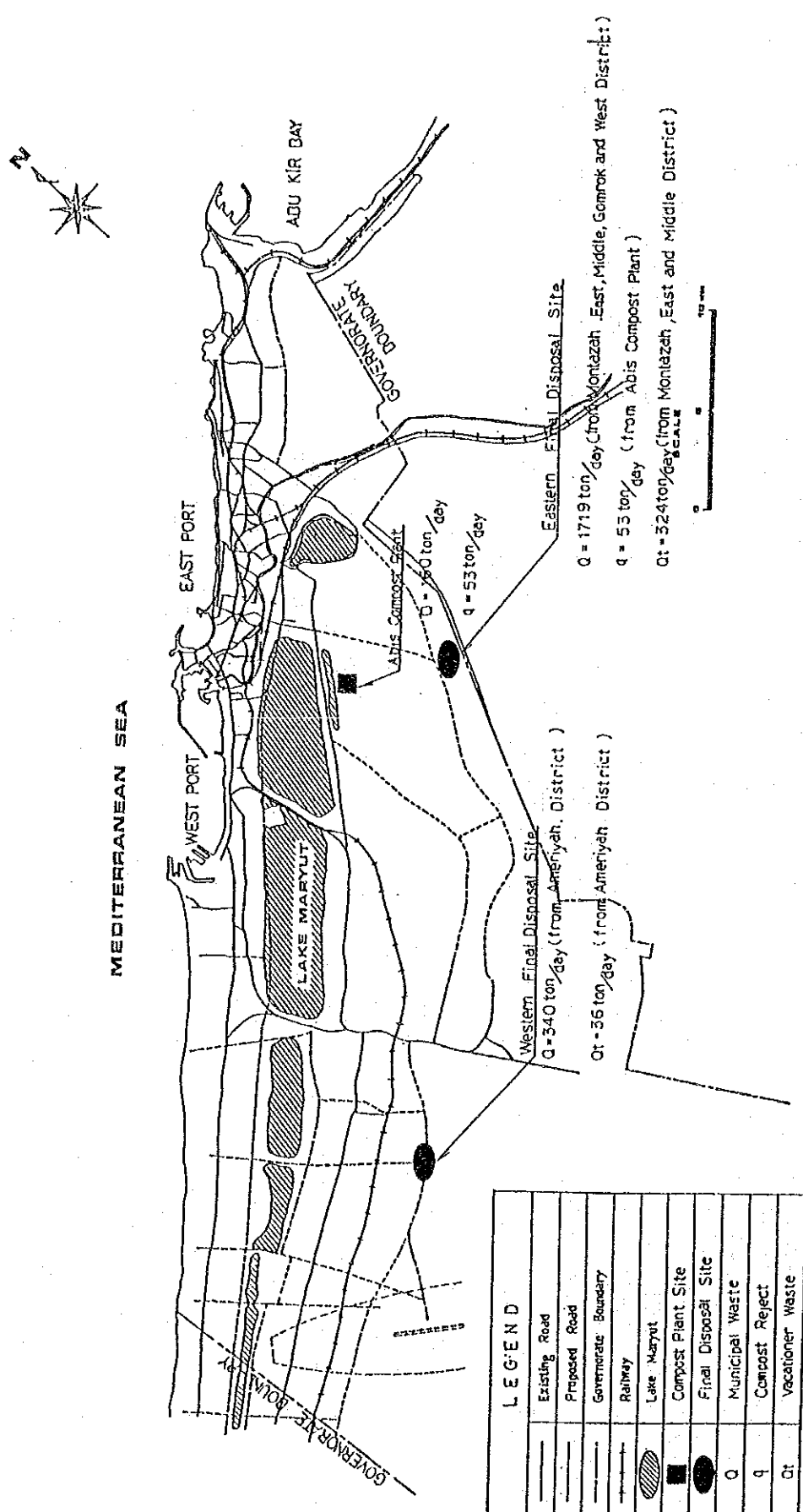
In estimating the capacity of landfill site, the unit weight of wastes filled up was assumed as follows:

Municipal waste	$r = 0.8 \text{ t/m}^3$
Compost reject	$r = 0.6 \text{ t/m}^3$

The amount to be disposed in 2000 is as shown below:

Municipal waste	939,000 m ³
Vacationers' waste	41,000 m ³
Compost rejects	32,000 m ³
Total	1,012,000 m ³

Cumulative disposed amounts reaches 12,419,000 m³ by 2000.



LEGEND	
—	Existing Road
- - -	Proposed Road
- - -	Governorate Boundary
—+—	Railway
▨	Lake Maryut
■	Compost Plant Site
●	Final Disposal Site
○	Municipal Waste
q	Compost Reject
Qt	Vacationer Waste

Fig. 3-5-2 LOCATION OF GREEN BELT FINAL DISPOSAL SITE

(5) Landfill plan

The landfill plan is briefly described below.

- a. Landfill method Sanitary landfilling
- b. Composition of landfill layers
 - Waste layer 3 m
 - Daily cover soil 0.3 m or less
 - Final cover soil 1 m
- c. Cover material Material generated locally will be used.
- d. Area of landfill site 86 ha/block
- e. Landfill capacity 2,570,000 m³/block
- f. Landfilling equipment
 - Back-hoe
 - Dump truck
 - Bulldozer
 - Landfill compactor
 - Motor sprinkler

(6) Construction plan

Both the Western and Eastern Disposal Sites shall have the following facilities.

- a. Embankment
 - Soil from the job site will be used. Gradient of embankment is 1:3.0.
- b. On site road
 - Total width: 10 m, pavement width: 8 m, paved with gravel (t = 30 cm)
- c. Gas removal facility
- d. Fence
- e. Monitoring well
- f. Administration building

- g. Workshop
- h. Truck scale
- i. Disposal site construction schedule

If all the waste generated in Alexandria is to be landfilled at the Western and Eastern Disposal Sites until 2000, the disposal sites would have to be constructed according to the following schedule.

Disposal Site	to 1990	1991 to 1995	1996 to 2000
Eastern D.S.	2 lots	2 lots	2 lots
Western D.S.	1 lot	-	-

3.5.4 Organization Plan

The Cleansing Authority is planned to be established to consolidate the integrated system for the s.w.m., because the establishment of the Cleansing Authority will be advantageous for achieving the planned goals related to the organizational and administrative aspects, and furthermore it is promoted as a national-policy in Egypt.

As things now stand, the waste collection service is executed with deficient planning, such as empirical allotment of the collection vehicles. And, there is no middle- and long-range plans for securing the landfill sites. Under the circumstances, the planning and administrative functions of the organization are ineffective and insufficient.

On the other hand, the technical level and social status of the workers are the problems to be solved appropriately with the improvement of the management system, as mentioned before in this study.

With regard to this points, the planning and administrative systems shall be strengthened by a radical reorganization, appropriate training programs, and planning and technical manuals, accompanied with measures for their practical utilization within the organization, so as to improve the technical standard of the personnel.

3.5.5 Financial Plan

For the time being the s.w.m. of Alexandria can count upon foreign aid for constructing its facilities, purchasing collection vehicles, etc., but it is indispensable to consolidate its independent financial base until 2000 so as to achieve an self-supporting operation of the system.

At the same time, additional financial resources shall be obtained for the improvement of waste collection services, the construction and operation of the compost plant, the execution of sanitary landfilling, the betterment for workers' welfare, and the subsequent increase of personnel involved to cope with advancing urbanization, which will exceeds the decreasing number of the workers by rationalization of street sweeping.

Therefore, measures shall be taken so as to establish the self-supporting financial base for consolidating the foundation for shifting the organizational structure to the Authority foundation, in addition to the aforementioned improvement of the planning and administrative functions of the organization and the cost-reduction through a thoroughgoing observation of the wastes collection, treatment and disposal schemes.

The basic lines for the consolidation of the financial base are as follows.

- The subsidies from the Central Government as the basic financial resources shall be expanded according to the expansion of the personnel. And the Cleansing Fund and the income from the charge for collection services shall be reinforced in the following lines.
- The revenue of the Cleansing Fund shall be increased through revision of the rental, and thoroughgoing collection of fine and 2% of house rental, etc.
- The charge collected from dischargers shall be fixed according to the suggestion that the burden to the citizenry should not surpass yearly 18 LE/household including the cost for plastic bags. On the other hand, the "beneficiaries-should-pay principle" shall be applied to the collection of waste discharged by business, commercial and other kinds of establishments.
- The portion of foreign aid in the financial resource will be reduced.

