6.2 Institutional Aspects

(1) Institutional Organization without an Increase in Bureaucracy

The organizational restructuring of the Public Cleansing Service proposes its development without any new personnel increase. Rather it will depend on the transfer of a very limited number of personnel from other municipal departments, the training of its own personnel, and the improved systematization of its departments.

(2) Feasible Organization Restructuring

Since it is not possible for the Municipal Public Cleansing Service (DLPM) to be self-financing in the medium term, which in fact makes the creation of a Municipal Corporation unnecessary, the restructuring of the Public Cleansing Service, as a municipal department at the institutional level that the importance of this service warrants, is a realistic and feasible proposal and, in addition, is one that is possible to implement immediately.

(3) Ensure the Continuity and Improvement of Collection Services and Expand their Coverage

By incorporating the corresponding unit to formalize relations with private collectors in the new organization, promoting, supervising and controlling operations and proposing an improvements in private collection services through the gradual granting of concessions.

(4) Improve the Efficiency of Municipal Operations such as the Sweeping of Public Roads, and the Collection, Transportation and Final Disposal of Solid Waste

The new organization establishes a planning and evaluation system, introducing the handling of indicators which will permit management to evaluate and make decisions, in order to improve the operating efficiency and reduce costs.

(5) Expand Municipal Collection Services in Outlying Areas

The organization of the Maintenance Unit will permit the permanent establishment of a preventive maintenance program which, in turn, will result in making equipment available to extend collection services to outlying areas.

(6) Long-term Strategic Planning

The planning unit of the new organization will permit the preparation of long-term plans, such as for example, the study of possible future sanitary landfills, the prospects of reuse and recycling of waste components, etc.

(7) Community education and participation is a priority program for the new organization, which will be handled by the Planning Unit. Although the results will be seen in the medium and long term, the achievements obtained will be permanent, and will include among other things the reduction of service cost.

(8) Permit economies of scale by giving the new institutional organization which allows a metropolitan approach in final disposal and private collection.

(9) Avoid social problems which may arise by considering the new organization

The continuation of private collection, the development

of DLPM's human resources and training, as well as the establishment of agreements with "El Trebol" scavengers will avoid social conflicts.

(10) The new organization proposes to use all present DLPM personnel, while providing opportunities for training, and relocation within the structure.

6.3 Operational Aspects

6.3.1 Collection and Transport

(1) Actual man power in the DLPM will be maintained as it is. Neither increase nor decrease in the number of workers will take place.

(2) A drastic increase in the number of collection vehicles will not be considered in the MP, except a necessary renewal and an inevitable replacement of vehicle.

(3) Workability or collection efficiency will be improved by means of the increase of trip number and a practicable preventive maintenance program.

(4) Loading efficiency of collection vehicles will be raised by programming systematically service shifts and collection route design.

(5) The dual collection of the DLPM and private sector will be so coordinated that the municipal service will cover marginal areas as well as the isolated areas while the private sector carries out collection service in the ECA and PCA under a due surveillance of competent authorities.

(6) Zone concessions to the private sector will be granted gradually and in a stepwise manner so that a severe socio-economic confusion may not take place. Thus,

collection efficiency and service level will be raised gradually in conceded areas.

(7) Collection and transport service in actual self-disposal areas in the PCA will be possible through municipal collection vehicles which will be affordable after zone concession to private collectors. Service covered areas, therefore, will expand gradually to the surrounding districts.

(8) As for the isolated areas, collection systems suitable to zone characteristics and geographical conditions will be developed, such as collection system conceded to private collectors, communal collection method, self-disposal etc., under a due municipal guidance and directions.

(9) The above proposed collection and transport framework conforms to the organizational, institutional and financial subsystems which are treated in the MP.

The collection and transport plan will be therefore feasible, realistic and practicable. But implementation of the proposed collection and transport plan will be gradual and step-by-step, because concession process of zones, the key point of this collection system, is gradual and step-by-step: this means steadiness of the total plan of this report.

6.3.2 Final Disposal

In this Master Plan, regarding the final disposal, two points were mentioned as main theme: the planning for the improvement of El Trebol landfill site, and the opening of new landfill site of Las Guacamayas.

(1) "El Trebol"

The actual situation of El Trebol presents a series of environmental problems such as air pollution caused by the waste burning and even the waste-slide such as the one occurred in January, 1991.

Even from the viewpoint mentioned above, the immediate improvement is required. Improving measures have been described in detail in this Study, among which the most important ones are: to cover the wastes by soil, to maintain the security of scavenger's operation, and to treat the leachate by recirculation, etc.

It is believed that the situation of El Trebol will greatly be improved by the implementation of those measures.

(2) "Las Guacamayas"

Same thing can be said also on Las Guacamayas. The solution depends upon the correct implementation of those measures.

Now that Las Guacamayas is the new site proposed for sanitary landfill, it is necessary to implement in the manner more complete than the measures of improvement to be applied to El Trebol. Also, the well considered planning is necessary on the conditions of Las Guacamayas, for example, the problem of spring water from the gully bottom, the existence of rivers contaminated by sewage.

The results of general comparisons of various aspects confirmed that Las Guacamayas is the most appropriate site for the new sanitary landfill.

However, the Guacamayas site suffers from erosion due

to underground and superficial water flows, according to EMPAGUA, with the risk of spoiling the natural topography. This will happen independent of the landfill usage. The Municipality should take special caution for the safety of nearby houses.

Considering that an existing untreated sewage stream via the Rio La Brigada enters Las Guacamayas gully and a few untreated sewage lines from nearby residents also feed into the gully, it is obvious that the environment of this area must be evaluated not only by the effects of solid waste landfilling in the gully, but also by considering integrally various aspects which provoke an environmental deterioration in "Las Guacamayas".

In short, the transformation of the landfill "El Trebol" to a controlled landfill which allow to improve the environmental conditions of the zone and the development of a sanitary landfill in the gully "Las Guacamayas" without provoking a major environmental deterioration in the area, are technically feasible to be carried out in its entirety.

6.4 Environmental Aspects

The Guatemala metropolitan area is suffering from an ever-increasing pollution, and people are being exposed to a wide variety of environmental hazards, at this time, especially, waste and sewage pollution.

There are currently several solid waste pollution problems including:

(1) Clandestine open dumping
(2) Uncontrolled landfills

In order to solve all of these problems, this project must be urgently implemented.

Without this project, the City, and especially the surrounding areas, will be overrun by solid waste, leading to unsanitary conditions and a general deterioration of the environment.

The implementation of the project, will have the following effects:

6.4.1 Decrease in the Number of Clandestine Open-dumping Sites

(1) A decrease in the number of clandestine open-dumping sites can be realized by improving the collection service coverage and increasing concern for public health among residents.

The effect of this project is very great in that it will prevent deterioration of public health resulting from the negligence of dumped waste over long periods of time. Furthermore, it will decrease the number of opportunities for residents to be exposed to garbage, and contribute to environmental improvement.

(2) Without this project, the City, especially its surrounding areas, will be overrun by solid waste.

	Generation	Landfills	Other place
1990	969 t/w.d	480 t/w.d	489 t/w.d
2000	1593	535	1058

If no improvements are implemented and the present collection system continues, by the year 2000, the daily quantity of illegally disposed waste will be 3500 m^3/w.d.

This quantity is equal to 1 cm-thick solid waste spreading over all of Guatemala City within approximately two years. This calculation indicates

that at this rate solid waste measuring one meter in height would completely spread over a soccer field within 5 days.

6.4.2 Improvement of Uncontrolled Landfills

By improving the El Trebol disposal site and by constructing a sanitary landfill at Las Guacamayas, the adverse effects of final disposal on the environment could be controlled.

(1) The El Trebol disposal site

1) Odor, smoke and fires could decreased by a weekly covering with soil.

2) Noise caused by waste transportation vehicles could be reduced by halving the traffic volume by opening a new sanitary landfill at Las Guacamayas.

3) Leachate could be controlled by a recirculation system from 1997, and by a weekly covering with soil from 1992.

(2) Las Guacamayas new sanitary landfill site

The new sanitary landfill site will influence the surrounding environment, but residents in the neighboring areas and in Guatemala City are expected to receive even greater benefits than that.

1) For residents in the neighboring area

a) Advantages

- Protection against soil erosion
  Soil erosion that has spread about 40 meters over the past 20 years may be prevented.

(For details, refer to the supporting report)

- Improvement of residential conditions
  By the effective use of the sanitary landfill, the completed areas will be converted into refilled land for the construction of parks, sports fields, etc.
  (See Fig. III-6.4-1)

- Suppression of odor caused by the open dumping of waste.
  After the sanitary landfills are created, odor will be more suppressed than at present.

b) Disadvantages

- An increase in the traffic volume due to the activity of waste transportation vehicles and a resulting rise in noise levels.
  (Refer to the supporting report)

2) For Guatemala City

a) Advantages

- A decrease in the number of clandestine open-dumping sites.

- Suppression of odor, smoke and dust caused by the open dumping of waste.

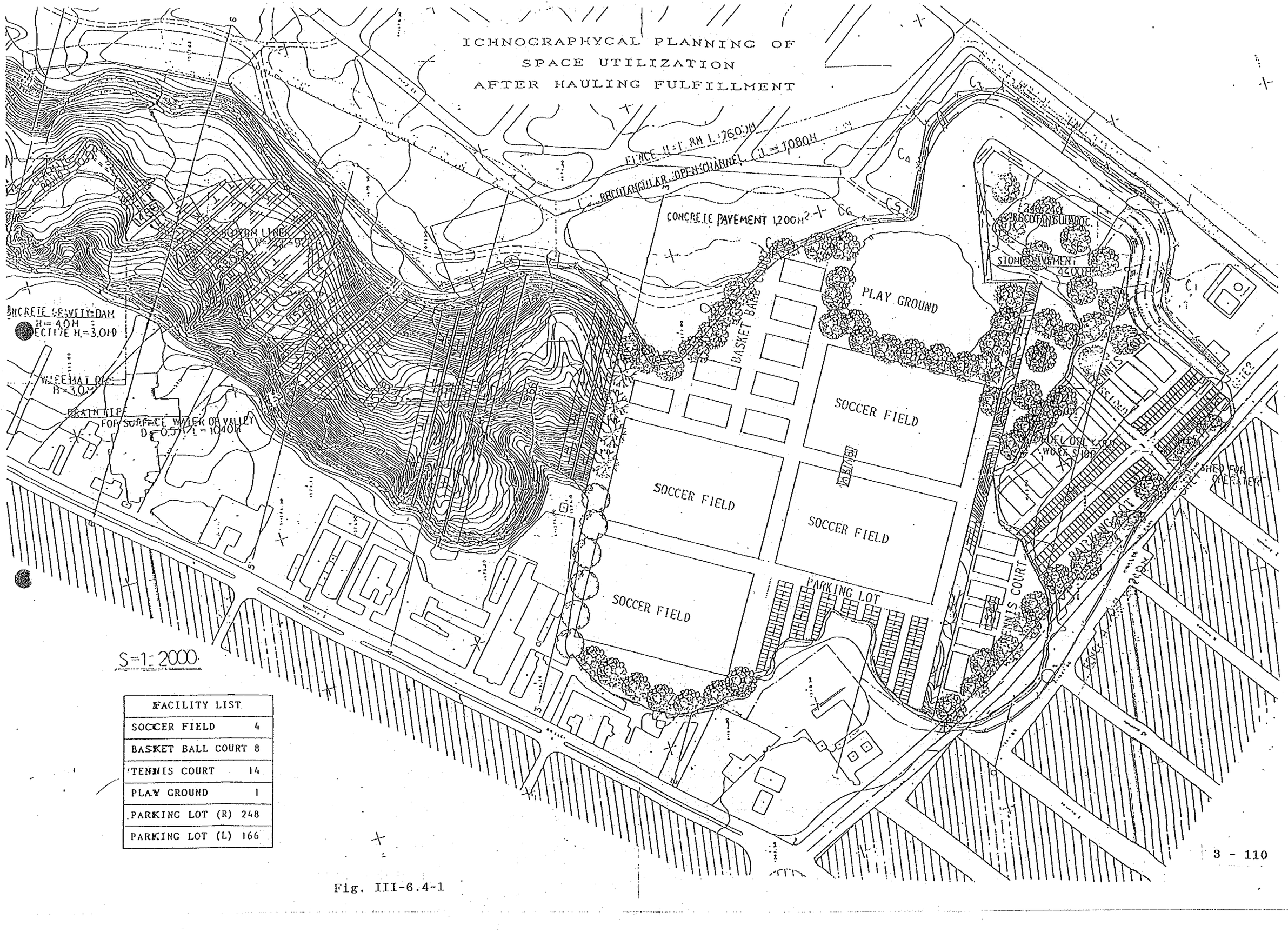
- Suppression of the outbreak of secondary diseases such as scabies and conjunctivities.

- Others

b) Disadvantages

- Water pollution caused by the discharge of leachate into the river. Based on a comparison with the present water quality, the impact on the surrounding environment will amount to about 15% additional pollution in terms of BOD level in the river, which would be within the range of a reasonable environmental allowance.

ICHNOGRAPHYCAL PLANNING OF SPACE UTILIZATION AFTER HAULING FULFILLMENT



FACILITY LIST	
SOCCER FIELD	4
BASKET BALL COURT	8
TENNIS COURT	14
PLAY GROUND	1
PARKING LOT (R)	248
PARKING LOT (L)	166

Fig. III-6.4-1

The improvement of the existing disposal site, and the establishment of a new disposal site will be extremely effective in improving the environment in the sense that the openly dumped waste scattered all over Guatemala City will be gathered up collectively in one place and buried in an appropriate way.

(3) Leachate at Las Gucamayas new sanitary landfill site

Comparative studies were conducted to determine environmental effects on the lower reaches of the river during the rainy season through changes in the BOD level if a new disposal site is used for open dumping just as the existing disposal site at El Trebol and if a sanitary landfill method is applied as has been proposed.

Table III-6.4-1 Evaluation of Additional BOD Concentration

	Leachate		Downstream		
	BOD (mg/l)	Volume (m^3/day)	Present BOD (mg/l)	Estimated BOD (mg/l)	Increase Rate
Case 1	12,000	338+780	440	710	62%
Case 2	4,500	700	440	500	15%
Case 3	200	1500	440	432	-2%

Case 1: Open dumping same as El Trebol

- Cover soil is insufficient and no measures are taken for leachate.

Case 2: Sanitary landfilling with recirculation system

- Soil is applied as cover everyday, and the amount of leachate is controlled through the rain water drainage system and leachate circulation system.

Case 3: Sanitary landfilling with activated sludge method

- Soil is applied as cover everyday. Amount of leachate is controlled through the rain water drainage system. Collected leachate is treated by activated sludge method.

As the above Table II-6.4-1 shows, the increase of BOD level in Case 1 would have a great environmental impact, contradictory to the concept of environmental improvement. The effect of the BOD level increase has been estimated at about 60%.

In Case 3 the treated leachate will slightly dilute the sewage water in the river. However, it will require extremely high cost to carry out the activated sludge method.

In this case, a total analysis of any system requires consideration of balance of the environmental protection and costs. From this point of view, Case 3 can be said to be an infeasible solution.

Although the environment would be affected slightly, the effects would be within the range of environmental allowance in Case 2, considering the present state of the quality of the river water, which is already polluted by sewage water having a BOD level about 400 - 500 mg/l.

Therefore it will not cause any serious adverse environmental impact on the vicinity of the final disposal site.

Case 2 which does not require so much as Case 3 can achieve the balance of the environmental protection and costs. Therefore, Case 2 is considered as the feasible solution.

6.5 Overall Evaluation

After evaluating each item stated above, the three prospects ranked as high priority projects have been comprehensively evaluated as feasible, realistic and practical. In other words, these projects should be feasible when an appropriate budget distribution, organizational reforms, and improving of operational efficiency are implemented, having an efficient use of current numbers of personnel and equipments.

Through the implementation of these projects, solid waste collection service for residents will be improved, numbers of clandestine open-dumping sites will be decreased, and environmental improvement will be guaranteed in the areas surrounding the landfilling site, thus the sanitary conditions and overall living environment for residents in the metropolitan areas of Guatemala City will be ensured.

7. Implementation Schedule

7.1 Technical Aspect

7.1.1 Collection and Transport

Implementation schedule in every five years from 1990 to 2000 is shown in the follwoing two tables.

The schedule to grant concessions are as follows.

Year	Zone Number
1992	11
1993	5, 6, 12
1994	8, 9, 10
1995	1, 2, 3, 4
1996	7, 13, 14, 15

Table III-7.1-1 Implementation Schedule (Collection) (F/S)

	1990	1991	1992	1993	1994	1995	1996
Zone concession to private collectors			Z.11	Z.5,6 12	Z.8,9 10	Z.1,2 3,4	Z.7,13 14,15
Zone exchange between BCA & PCA					→	→	→
Collection BCA Regular Service Areas		Municipal support →	→	→	→	→	→
Marginal		Private sectors →	→	→	→	→	→
PCA Regular Service Areas		Municipal collection →	→	→	→	→	→
Marginal Areas				Private sectors →	→	→	→
		Education program		Municipal collection →	→	→	→
Self-disposal Areas (On site collection)		Education program →	→	→	→	Municipal activity →	→
IA Self-disposal Areas (On site collection)		Education program →	→	→	→	Municipal activity →	→

Implementation Schedule of the El Trebol Landfill Site

1. Construction Work

Sort of Construction	1991	1992	1993	1994	1995
(1) Ground preparation		o———	———o		
(2) Access road					
Pavement work		o———	———o		
Inner access		o———	———o		
(3) Drainage system					
Open ditch		o———	———o		
(4) Administrative facilities					
1) Fence		o———	———o		
2) Gate		o———	———o		
3) Work shop		o———	———o		
4) Fuel-oil-yard		o———	———o		
5) Parking lot		o———	———o		
6) Shed for operator		o———	———o		
(5) Dam construction					
1) Concrete dam					
2) Wire-mat dam					
(6) Leachate pond					
1) Pump Foundation					
2) Pump house					
3) Electric supply facility					
(7) Truck-scale construction		o———	———o		

2. Purchase Planning of Equipment

		4 units			
Bulldozers		o———	———o		
		2 units			
Shovel loader		o———	———o		
		2 sets			
Aerator		o———	———o		
		1 unit			
Truck scale		o———	———o		
Circulation pump					

The construction of Leachate pond and Dam is implemented when the landfill work proceeds at the mentioned site. During that period, a temporary leachate pond is constructed.

Implementation Schedule of the Sanitary Landfill
in Las Guacamayas

1. Construction Work

Sort of Construction	1992	1993	1994	1995
(1) Ground preparation in the landfill	o———	———o		
(2) Access road (inside of landfill)	o———	———o		
(3) Slope in the landfill	o———	———o		
(4) Administrative facilities	o———	———o		
1) Fence	o———	———o		
2) Gate	o———	———o		
3) Maintenance shop	o———	———o		
4) Fuel-oil-yard	o———	———o		
5) Parking lot	o———	———o		
6) Shed for operator	o———	———o		
(5) Dam construction				
1) Concrete dam (to be executed in 1998)				
2) Wire-mat dam (to be executed in 1998)				
(6) Leachate pond				
1) Pump Foundation (to be executed in 1998)				
2) Pump house (to be executed in 1998)				
3) Electric supply facility (to be executed in 1998)				
(7) Leachate collection ditch				
(8) Installation of truck scale				

2. Purchase Planning of Equipment

(1) Bulldozers	o———	6 units ———o		
(2) Backhoe loader	o———	2 units ———o		
(3) Circulation pump	o———	2 sets ———o		
(4) Aerator	o———	2 sets ———o		
(5) Truck scale	o———	1 unit ———o		

7.2 Institutional Aspect

7.2.1 Institutional Organization

(1)	Approval of the new organizational structure of the Public Cleansing Service by the Municipal Corporation	OCT. 1991
(2)	Formation of a Work Group (GT), to facilitate the transition of the present DLPM to a new organization	OCT.-DEC. 1991
(3)	Preparation of the draft of budget of the Public Cleansing Service for 1992	AUG.-OCT. 1991
(4)	Use of management indicators, commencing preparation from January 1991 to 1995 as first stage	1992-1995
(5)	Collection of information and setting up of a database during 1992, commencing its use, and to be continued after 1995 too.	1992-2000
(6)	Organize the Metropolitan Solid Waste Committee (CMDS) and commence intermunicipal coordination activities	OCT. 1991-MAR. 1992
(7)	Evaluate and carry out the necessary adjustments regarding institutional, organizational and financial aspects and others proposed in the M.P.	OCT.-DEC. 1995

(8) Preparation of the long-term plan for the selection of new sites for future sanitary fills in the Metropolitan Area. 1993 - 1995

(9) Preparation of the solid waste usable component recovery and recycling program, in an attempt to obtain 7% recovery of solid waste in the year 2000 1992-1995

7.2.2 Community Education and Participation

(1) Preparation of a program for the community education and participation in solid waste handling by the Planning Unit AUG.-DEC. 1991

(2) Incorporation of a professional (social worker) to the DLP, to take charge of the community education and participation program AUG. 1991

(3) Development of the community education and participation program, including the use of the video prepared by JICA, and continuation will be recommended 1992-1995

7.2.3 Personnel Training

(1) Establish a permanent training program of Municipal Public Cleansing personnel, monitored by the Planning and Evaluation Unit 1992-1995

(2) Training of personnel at three levels:

1) Management level:
One official per year and continuation has to be kept 1991-1995

2) Intermediate level:
Fifteen persons per year and continuation has to be kept 1991-1995

3) Operational level: Two sessions for 80 persons per year and continuation has to be kept 1992-1995

(3) Obtaining of financing for this program from international and bilateral technical cooperation and credit organizations 1992-1995

7.2.4 Organizational Aspects of Private Collection

(1) Continue operating during this decade with the dual collection system, private and municipal, with the participation of the present private collectors. 1991-2000

(2) Approval of concession zoning by the Municipal Corporation Jan.-Apr. 1992

(3) Gradual granting of concessions:

1) One zone 1992
2) Three zones 1993
3) Three zones 1994
4) Four zones 1995

(4) Monitoring of the entire private collection process by the corresponding department of the Municipal Service and its continuation has to be kept with a review 1992-1995

7.3 Environmental Aspect

By 1995, 11 zones will be conceded to private collectors. Thus, the amount of clandestine open dumping will decrease, and the environmental condition in fringe areas will be improved.

Through the sanitary education program begun in 1990, the sanitary awareness of residents has been improved, open dumped waste has been collected, and sanitary condition will be greatly improved.

The change of the Trebol landfill into controlled landfill beginning in 1992 is expected to improve the environment of surrounding area. In concrete terms, a decrease in leachate, odor, and smoke will be effected by an improved reclamation method.

The opening of a new sanitary landfill in 1992 will decrease the amount of waste delivered to the El Trebol landfill site and will promote other improvements.

The operation of leachate and ground water monitoring from 1992 will control the effect of landfills on water resource. Also, the situation of SWM will be clarified by monitoring of clandestine open dumping condition.

Appendix

The Organizational Structure and Members for the Study

The organizational structure for the study is shown as below.

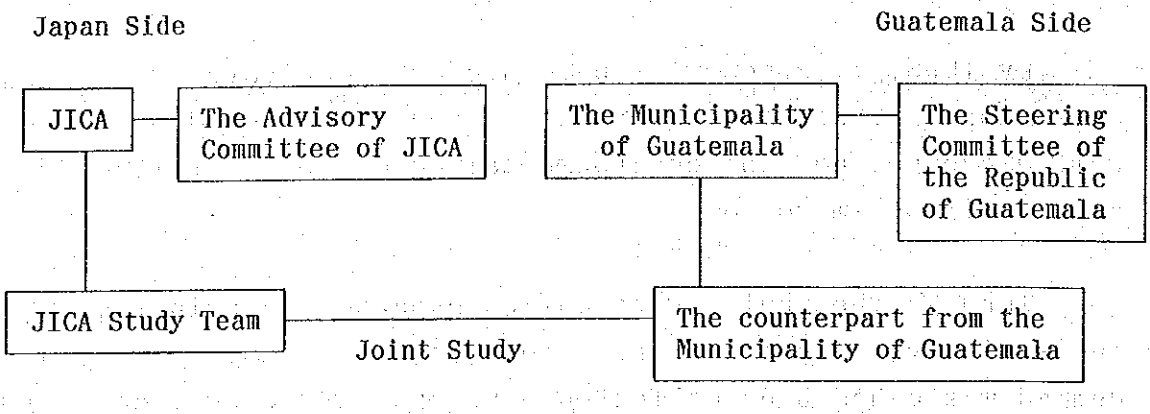


Fig. 3 The Organization Structure for the Study

1. JICA Study Team

SPECIALITY	NAME
Team Leader	Michio SAKAMOTO
Sub Leader (Planning of Collection/Transport)	Satoshi MAKIYAMA
Planniong of Collection/Transport	Akio KURAMOTI
Planning of Treatment and Disposal	Katsuhiro KAWAMURA
Urban Planning Institution/Contract	Keniti TAKASHIMA
Organization/Institution/Contract	GUIDO J. ACURIO
Organization/Institution/Contract	Masanori ITOH
Planning of Equipment Maintenance Management	JOSE ARELLANO
Designing of Facility	Mitsugu FUDAKA
Project Economist	Shigeru KIMURA
Environment/Sanitary Assessment	Tomoyuki KURODA
Analysis of Waste	Hiroshi SUMIKAWA

2. Guatemalan Counterpart

Name	Department	Institution
Ing. Julio Chavez	Industrial Control Dept.	Munic.
Sr. Alejandro Diaz de la Cruz	DLPM	Munic.
Arq. Wolfgang Gomez	Public Service Dept.	Munic.
Ing. Jose Molina	DLPM	Munic.
Arq. Olivia Chang	Architecture Official Planning	Munic.
Ing. Marco Turio Galvez	Institutional Development Dept.	Munic.
Licda. Anabella Ceballos	Administration Official Institutional Development Dept.	Munic.
Sr. Luis Fernando Flores	Official Cleansing Dept.	Munic.
Sr. Mario Jimenez	Planning Dept.	Empagua
Ing. Juan Manuel Mejia	Planning Dept.	Empagua
Sr. Mario Mendez	Official Public Service Dept.	Munic.
Lida. Leonor Rangel de Rivera	Official APT (Food for Work)	Munic.

3. Guatemalan Steering Committee Members

The members are as follows.

NAME	INSTITUTION	POSITION
Lic. S. Leal	MUNICIPALITY OF GUATEMALA	PUBLIC SERVICES DIRECTOR
Ing. J. Menaldo	SEGEPLAN	CONSULTANT
Ing. J. Guzman	SEGEPLAN	CONSULTANT
Ing. G. Garcia	PUBLIC HEALTH AND SOCIAL WELFARE MINISTRY	DIRECTOR
Arq. G. Mayen	CONAMA	TECHNICAL ADVISER
Sr. B. Amezquita	MUNICIPALITY OF MIXCO	PUBLIC SVC DEPTO
Sr. M. Hernandez	MUNICIPALITY OF VILLA NUEVA	PUBLIC SVC DEPTO
Ing. NAAMAN HERRERA	MUNICIPALITY OF VILLA NUEVA	PUBLIC SVC DEPTO

4. JICA Advisory Committee Members

SPECIALITY	NAME	POSITION
Chairman	Dr. S. NAITO	President Kanto Gakuin University
Treatment and Organization	Dr. M. TANAKA	Chief of Solid Waste Management Section The Institute of Public Health
Transport and Collectionon	Dr. K. SAKURAI	Environmental Sanitation Specialist Japan International Cooperation Agency
Management	Mr. K. FUKUI	Director (charged with technical development) Bureau of Solid Waste Problems TOKYO METROPOLITAN GOVERNMENT
Treatment and Disposal	Mr. M. SAWATI	Manager Public Cleansing Bureau, OSAKA CITY GOVERNMENT