Table L.1.4d Results of Interview with Community Leaders and District Offices' Authorities

Candidate Area		HIALEAH	CESAR SANDINO	VILLA CANADA	CARLOS MARX	WASPAN NORTE
Community Leaders	Type of Association	JCOP	Community Association/ Community Movement	Association of House-holders	Community Movement	JCOP
	Demand for Collection Service	YES	YES	YES	YES	YES
	Extension of Cooperation to the project	YES	YES	YES	YES	YES
	Experiment with other community works	YES	YES	NO	YES	YES
District Office Authorities	District Identification	3	5	6	6	6
	Interest in the Project	YES	YES	YES	YES	YES
	Approval of the project	YES	YES	YES	YES	YES

L.1.5 Execution

a. Preparation Work

The following preparation works were executed prior to the commencement of the experiment:

- meeting with related agencies and persons in the Municipality to ask for their cooperation in the experiment
- meeting with community leaders
- meeting with residents
- Implementation of education programs on sanitation

aa. Preparation Schedule for the Experiment

The preparation works were executed according to the following schedule.

Table L.1.5a Preparation Schedule for the Experiment

DATE	Schedule
17 November (Thu)	Meeting with counterparts about basic plan of experiment
18 November (Fri)	Meeting with counterparts about basic plan of experiment
19 November (Sat)	Area condition survey
20 November (Sun)	Area condition survey
21 November (Mon)	Area condition survey
22 November (Tue)	Meeting with delegates of District Offices
23 November (Wed)	Meeting with district officers (District 3, 5, 6)
24 November (Thu)	Meeting with community leaders (Hialeah)
25 November (Fri)	
26 November (Sat)	Meeting with community leaders (Villa Canada, Carlos Marx, Waspan Norte)
27 November (Sun)	Meeting with residents (Waspan)
28 November (Mon)	Meeting with community leaders (Sandino, Hialeah)
29 November (Tue)	Meeting with residents (Hialeah)
30 November (Wed)	Meeting with residents (Villa Canada)
01 December (Thu)	
02 December (Fri)	Meeting with residents (Carlos Marx)
03 December (Sat)	Meeting with residents (Waspan Norte, Cesar Sandino)
04 December (Sun)	
05 December (Mon)	Selection of experiment area(s)
06 December (Tue)	Meeting with district officers and community leaders
07 December (Wed)	Meeting with district officers and community leaders
08 December (Thu)	Detailed design
09 December (Fri)	Detailed design
10 December (Sat)	Area cleansing and improvement activity
11 December (Sun)	Area cleansing and improvement activity
12 December (Mon)	Commencement of collection service
13 December (Tue)	

ab. Request for the cooperation of related agencies and Municipal officials

The meetings were held in order to achieve the following objectives:

- to explain the objectives and details of the experiment
- to request for cooperation and participation in the experiment
- to involve all related agencies and persons

The following structure of executing organizations was established during the meeting to assist the experiment.

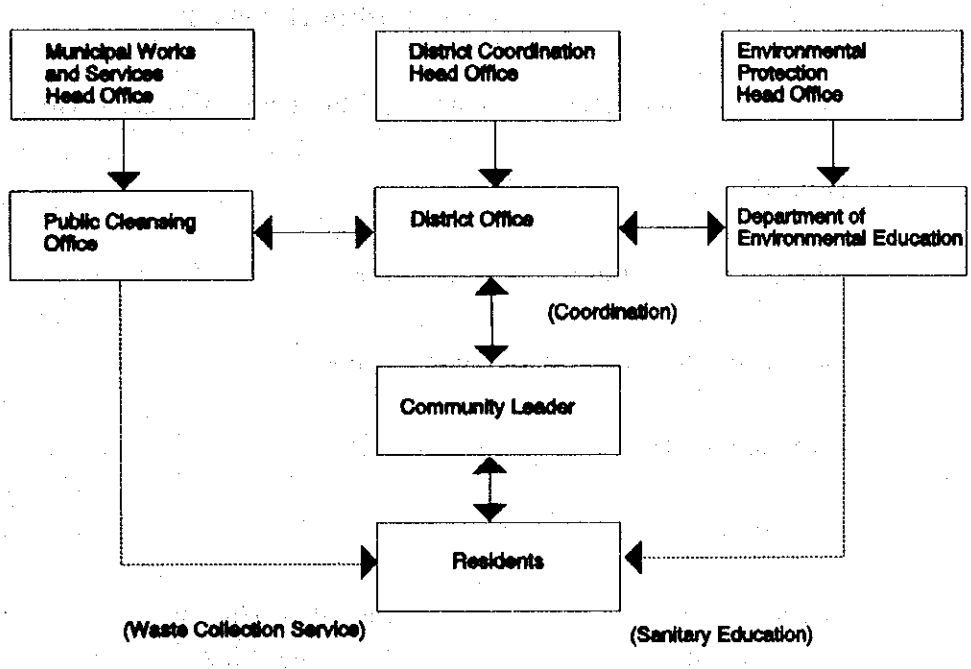


Figure L.1.5a Executing Organization in the Municipality

i Meeting with Vice Mayor

ii Meeting with Coordinating Committee

(Attendance)

General Director of Planning Head Office: Ing. Roger A. Zuñiga

General Director of Municipal Works and
Services Head Office: Ing. Carlos A. Morice Martinez

General Director of Environmental
Protection Head Office: Ing. Patricio G. Jerez P.

iii Meeting with the authorized persons of the Public Cleansing Office

(Attendance)

Director: Jorge A. Cisne Caceres

Asst. Director: Marvin E. Sanchez Tijerino

iv Meeting with Delegates of District Offices

(Attendance)

General Director	: Ing.Edgar Quitana
Asst. Director	: Mr. Augustin Acevedo
Delegate of District Office-1	: Mr. Marvin Perez
Delegate of District Office-2	: Mr. Roger Mayorga
Delegate of District Office-3	: Mr. Adolfo Brenes
Delegate of District Office-4	: Mr. Zenelia Madrigal
Delegate of District Office-5	: Mr. Jorge Ramirez
Delegate of District Office-6	: Mr. Rene Ruiz Tablada
Delegate of District Office-7	: Mrs. Maria Hoydee Ozuna

v Meetings with authorized persons of District Offices

- Attendance during the Meeting in District Office-3

Staff of the Dept. of Municipal Services : Ing. Hugh Kain hodgson
Social Worker : Mrs. Marcia Cruz

- Attendance during the Meeting in District Office-5

Delegate : Mr. Jorge Ramirez
Staff of the Dept. of Municipal Services : Mr. Raul Arteaga

- Attendance during the Meeting in District Office-6

Delegate : Mr. Rene Tablada
Staff of the Dept. of Municipal Services : Ing. Alvaro Tercero
Social Worker : Mr. Ramiro Trejos
Social Worker : Mr. Daniel Zapata

ac. Meetings with community leaders

The meetings with community leaders were held in order to achieve the following objectives:

- To explain the experiment and make them understandable to those present
- To request cooperation and participation in the experiment
- To educate the residents in the area on sanitation

- Attendance during the Meeting in District Office-3

Delegate : Mr. Adolfo Brenes
Staff of the Dept. of Municipal Services : Ing. Hugh Kain hodgson
Social Worker : Mrs. Marcia Cruz
Hialeah third block Community
Leader (J'COP) : Mr. Adolfo Mejia
Hialeah Community Member
(J'COP) : Mrs. Esterlina Rodriguez

- Attendance during the Meeting in District Office-5

Delegate : Mr. Jorge Ramirez
Staff of Dept. of Municipal Services : Mr. Raul Arteage
Cesar Sandino Community
Leader (J'COP) : Mr. Felix Yurinda
Cesar Sandino Community
Member (J'COP) : Mrs. Rosario Buldelomar

- Attendance during the Meeting in District Office-6

Social Worker : Mr. Ramiro Trejos

(Villa Canada Community Members)
J'COP : Mrs. Pastora Lezcano
J'COP : Mrs. Aurelia Baez
J'COP : Mr. Rafael Garcia

(Carlos Marx Community Members)
J'COP : Mrs. Alba Mayela Alvarez

(Waspan Norte Community Members)
J'COP : Mr.Julio Cesar Awna
J'COP : Mr.Bamiro Sanchez R

ad. Meetings with residents

ada. Objectives

The meetings with residents were held according to the following objectives:

- to execute education campaigns on sanitation
- to confirm the demand for collection services
- to confirm the amount of cooperation available to the experiment
- to count the number of households willing to participate in the experiment

adb. Schedule

Meetings with residents were held according to the following schedule. Due to the absence of any community facility, the meetings were held in vacant areas in the communities.

Waspan Norte	- 27 November (Sun),	10:00 - 12:00
Hialeah	- 29 November (Tue),	17:00 - 19:00
Villa Canada	- 30 November (Wed),	16:00 - 18:00
Carlos Marx	- 2 December (Fri),	17:00 - 19:00
Waspan Norte	- 3 December (Sat),	10:00 - 12:00
Cesar Sandino	- 3 December (Sat),	15:00 - 17:00

adc. Sanitary Public Education

Various issues on sanitation were touched during the meetings with the residents. The contents of this education program are detailed in L.3, Public Education Campaign.

ae. Determination of execution areas

As described in the previous chapter, the objective of the collection experiment is to examine the workability of the manner of collection proposed in the Basic Plan. In addition, due to the very limited financial capability of the Municipality and difficulties in obtaining public cooperation, a stepwise approach is proposed in order to achieve the targets of the Basic Plan. The Study Team set up the following criteria for the final selection of the experimental areas with due consideration of the basic policies of the study and the limited period allotted to the experiment (1 month):

i The Municipality should continue carrying out the activities in the experiment which were meant for the following: 1) extension of collection services, 2) establishment of the Beneficiary-Pay-Principle, 3) establishment of an efficient and reliable collection system, and 4) establishment of public cooperation, even after the Study Team has completed the experiment. In so doing, favorable results may be obtained.

ii Public cooperation is especially essential to the container and bell collection system. The results of the experiment will be able to prove the extent of the residents' willingness to cooperate and participate.

iii Consequently, a participation ratio of more than 20% should be achieved for the experiment and collection work.

iv New strategies should be formulated for the expansion of collection services in other areas.

Based on the above mentioned criteria, Cesar Sandino (D-5), Carlos Marx (D-6) and Waspan Norte (D-6) were selected as areas for the collection experiment. The community in Hialeah was not able to submit the list of willing household participants by the closing day, while Villa Canada was excluded due to low participation ratio.

The number and percentage of households wishing to participate are shown in Table L.1.5b.

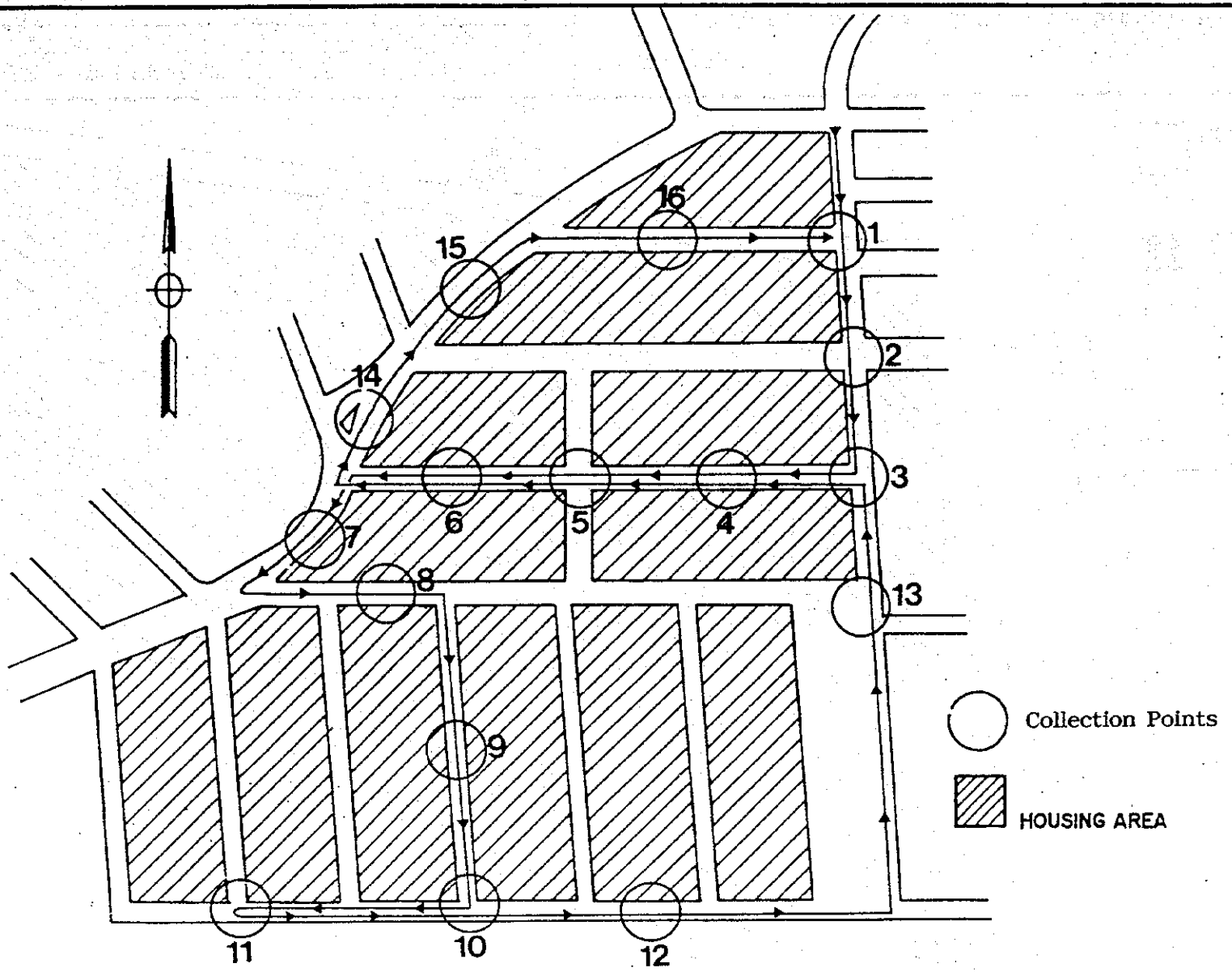
Table L.1.5b Determination of Collection Experiment areas

		Hialeah (D-3)	Cesar Sandino (D-5)	Villa Canada (D-6)	Carlos Marx (D-6)	Waspan Norte (D-6)
1.	Proposed collection system	Compactor	Compactor	Container	Container	Container
2.	Total Number of household	200	300	425	197	163
3.	Number of household wishing to participate	-	63	45	72	82
4.	Ratio (%) (1/2)	-	21.0	10.5	36.5	50.3
5.	Final selection	No	Yes	No	Yes	Yes

af. Detailed Design

afa. Detailed Design for collection

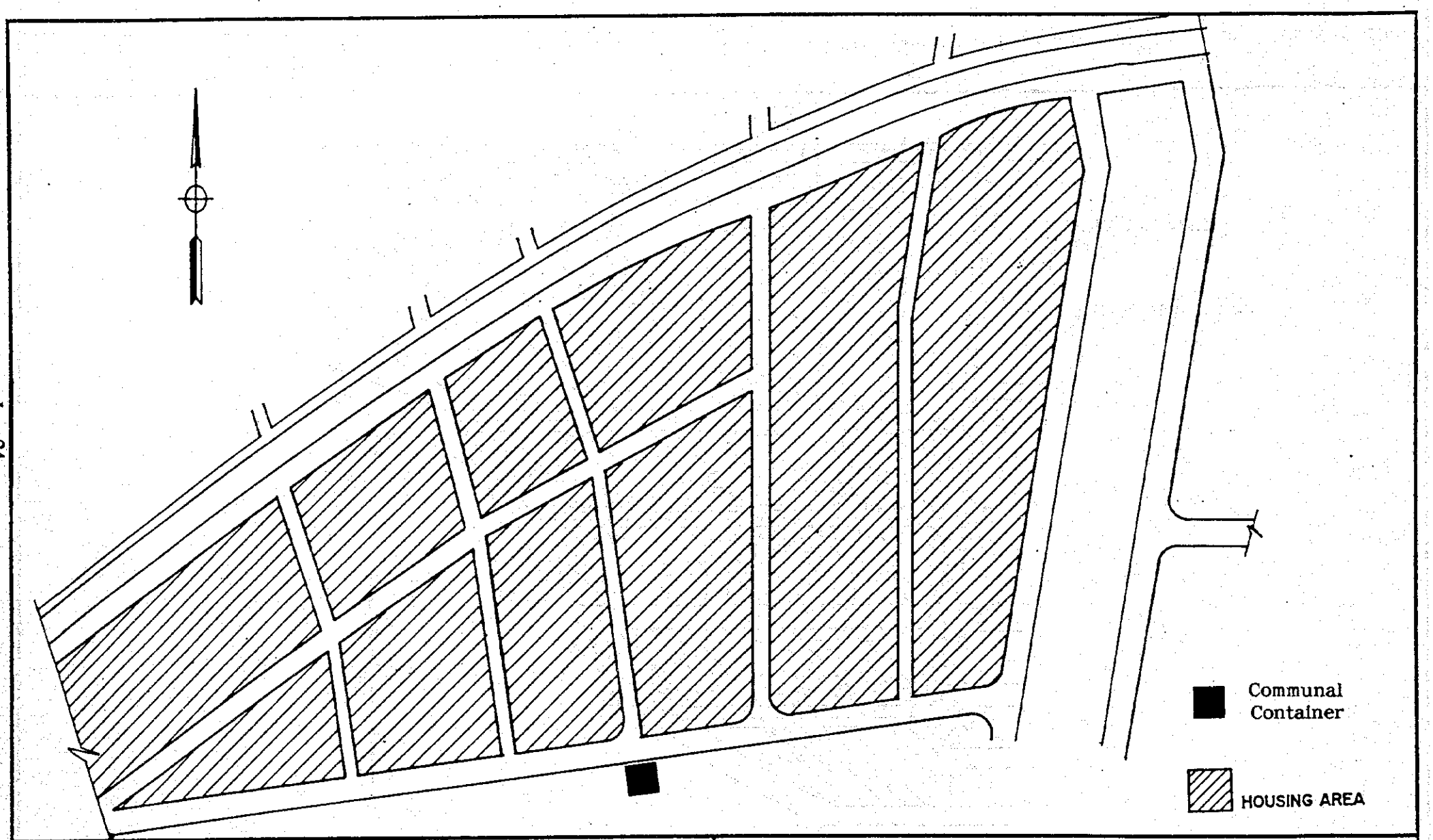
Detailed design (discharge method, primary collection system, collection frequency, collection days, time, point/route and fee) was planned based on the condition of the areas selected for the experiment, and is shown in Table L.1.5c, Figure L.1.5b -L.1.5d.



THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure L.1.5b Collection Route and Collection Points Cesar Sandino

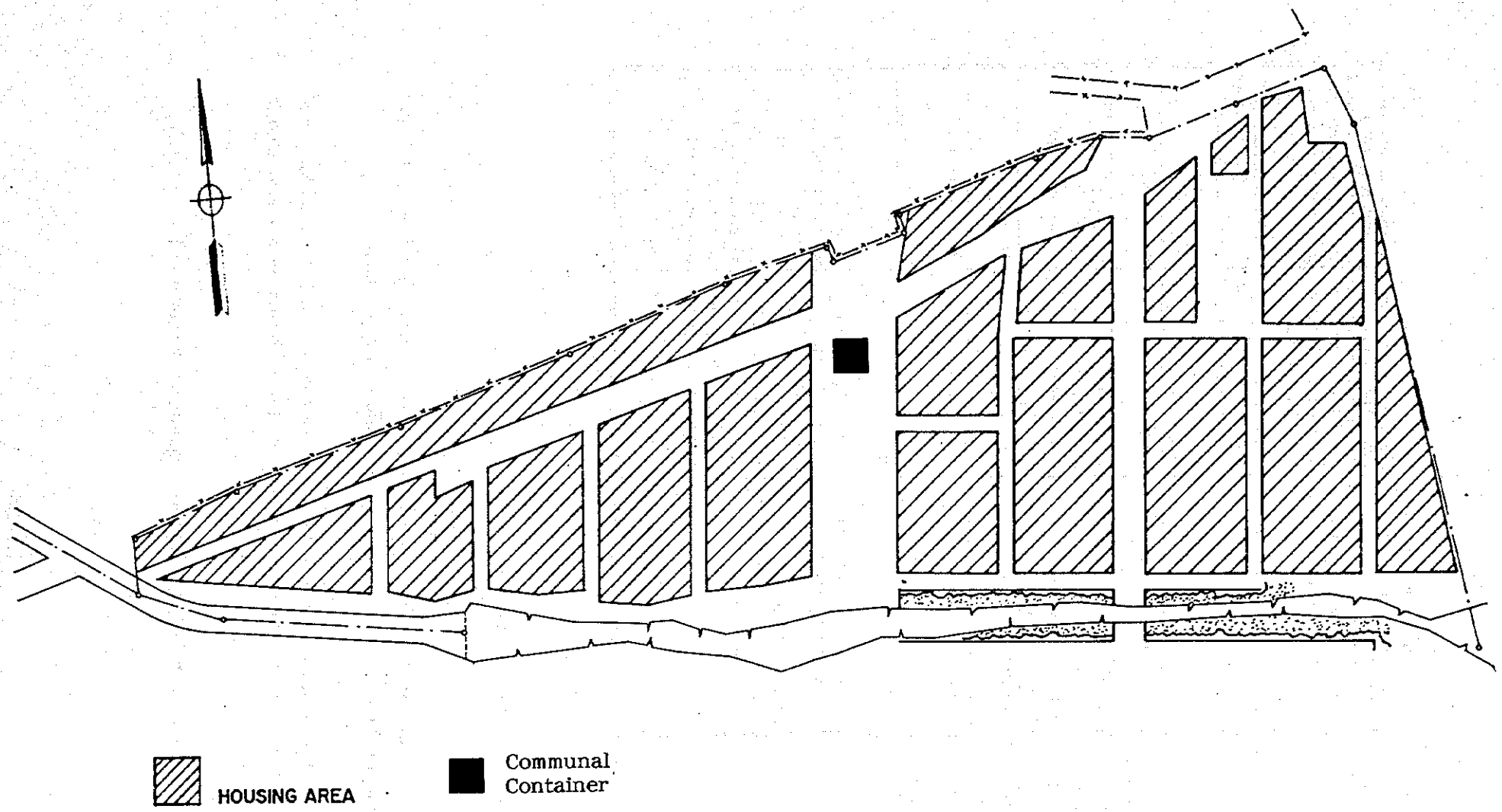


THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure L.1.5c

The Location of Communal Container Set up in Carlos Marx



THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

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Figure L.1.5d

Location of Commual Container Set up in Waspan Norte

Table L.1.5c Detailed Design

Name of Area		Cesar Sandino(D-5)	Carlos Marx(D-6)	Waspan Norte(D-6)
Discharge and Storage		Residents discharge their waste directly in the collection vehicle	Residents discharge their waste in front of premises using plastic bags or sacks	Residents discharge their waste in front of premises using plastic bags or sacks
Primary Collection		-	Primary collection is done before collection vehicle comes. Sun., Wed.	Primary collection is done before collection vehicle comes. Mon., Thu.
Collection Work by the Municipality	Collection Frequency	thrice a week	twice a week	twice a week
	Collection Days in a week	Tuesday, Thursday, Saturday, first collection day - 13 December (Tue)	Monday, Thursday, first collection day - 15 December (Thu)	Tuesday, Friday, first collection day - 13 December (Tue)
	Collection Time	7:00 am	7:00 am	7:00 am
	Collection Point and Route	refer to Figure L.1.5a	refer to Figure L.1.5b	refer to Figure L.1.5c
Collection Fee		C$ 3 2/3 of total fee amount will be paid to the Municipality. Remaining 1/3 of total fee amount will be used for cleansing activities in the community.	C$ 3 1/3 of total fee amount will be paid to the Municipality. Remaining 2/3 of total fee amount will be used for cleansing and improvement activities in the community.	C$ 3 1/3 of total fee amount will be paid to the Municipality. Remaining 2/3 of total fee amount will be used for primary collector compensation and cleansing improvement activities in the community.

afb. Construction of container bed

In view of the Municipality's aim to extend its collection services, four 15m³ communal containers were repaired for the collection experiment.

In order to prevent damages, container beds were constructed in Carlos Marx and Waspan Norte. At the same time, sloping platforms with steps were constructed to facilitate discharge.

Structure of container bed for collection experiment is shown in Figure L.1.5e.

afc. Detailed Plan for the Improvement of the Sanitary Condition in Area B

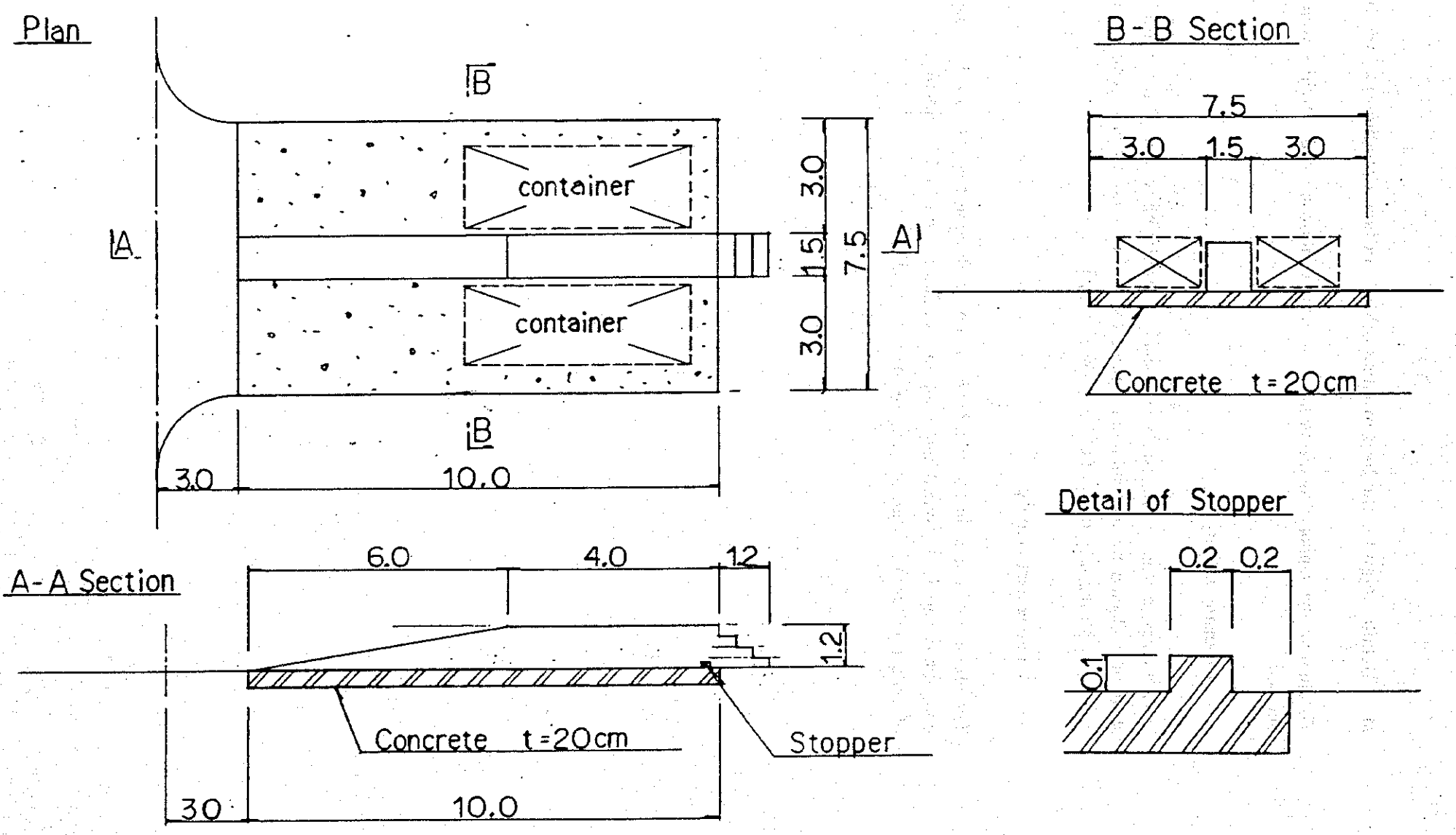
To improve the sanitary condition in the area, the following two activities were planned:

- Cleansing activity

Vacant areas, canals and roadsides are usually littered with wastes. These wastes shall be collected by the community prior to the implementation of collection services with the help of the PCO and District Offices.

- Improvement activity

The absence of drains in the area leaves drainage flowing freely on roads. The community should do something about this condition prior to the implementation of collection services with the help of the municipality.



THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

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Figure L.1.5e Container's Bed for Collection Experiment

b. Implementation

The collection experiment was implemented in three areas from December 10, 1994 to January 11, 1995. In order to examine the feasibility of the proposed plan, the following were carried out in the experiment:

- time and motion study (collection time, distance for collection, and amount of waste to be collected)
- public opinion survey
- examination of operation and management system of the Public Cleansing Office
- examination of coordination and assistance system of District Offices
- examination of public education system organized by the Department of Environmental Education
- examination of promotion and fee collection system in the community
- examination of working efficiency of primary collectors

ba. Time and Motion Survey for Collection Experiment

The objectives of the survey are:

- To examine the proposed collection system in the Basic Plan;
- To compare the efficiency of the present collection system and collection experiment.

bab. Contents of the Survey

The vehicles assigned in the experiment areas were traced in the survey.

The details of the survey are described in Annex E, E.5.

bac. Method of the Survey

The details of the survey are mentioned in Annex E, E.5.

bad. Results

i. The results of the collection experiment were included in the existing collection routes.

- Ceser Sandino was included in route 9; and
- Carlos Marx and Waspan Norte were included in the route for markets.

Collection work in Cesar Sandino was set after regular collection work commenced. At first, collection in Cesar Sandino was carried out an hour ahead or later than originally planned due to traffic and vehicle conditions, but finally it was carried out before the beginning of the regular collection route instead of later, as was originally planned.

ii. The waste collection service was done based on the basic plan. The collection from houses and the haulage to communal containers by the primary collector was done twice a week. The haulage from the containers to the disposal site was carried out by the Municipality the day after primary collection.

During the time and motion survey, however, it was observed that the communal container was not full, because of the following:

- unfamiliarly of primary collector; and
- ineffective coordination between primary and municipal collection

iii. Bell collection in Cesar Sandino took 54 minutes. A total of 223 families participated in the collection experiment spending an average collection time per family of about 15 seconds. The efficiency of the collection work was a result of the cooperation of the residents.

bb. Public Opinion Survey for Collection Experiment

bba. Objectives of the Survey

The main objectives of the POS (Public Opinion Survey) are described as follows:

- to confirm the changes in the awareness of the community before and during the collection experiment.
- to check the suitability of the collection system proposed in the collection experiment.

bbb. Survey Period

POS was conducted in December 21 and 22, 1994 to compare the degree of awareness of the community before and during the collection experiment.

bbc. Survey Areas and Number of Samples

The households covered by the POS were selected from the collection experiment areas. A total of 30 households, 10 from each of the three chosen collection areas, were selected.

bbd. Method of Survey

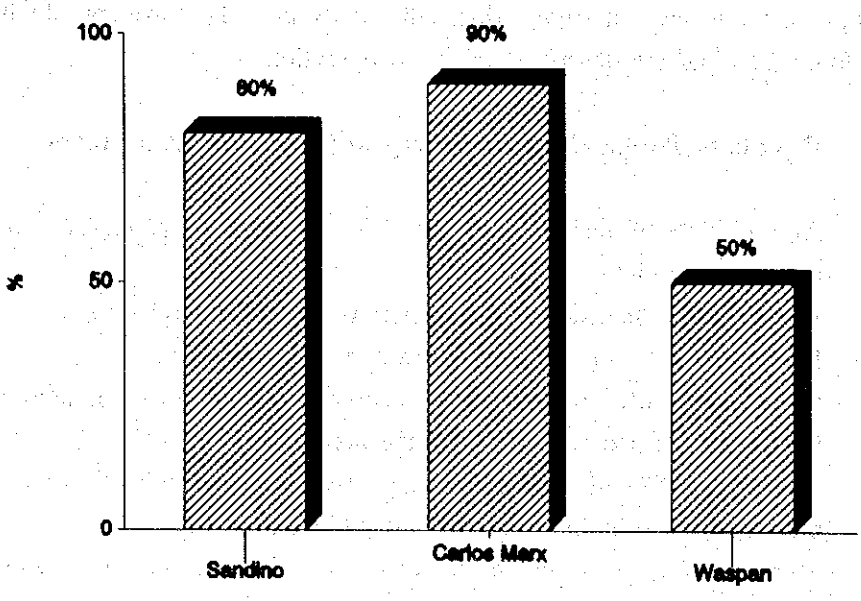
Every resident was interviewed in the POS and the answers obtained were computerized and are described in the next section.

bbe. Results of Public Opinion Survey in Collection Experiment

- About 75% of residents in the 3 experiment areas receive solid waste collection services.
- Around 90% of residents store their waste before collection.
- More than 70% of residents know the collection day.
- More than 70% of residents receive cooperation of neighbors and/or community is necessary to keep the area clean.
- More than 85% of residents are satisfied with the collection work performance of the primary collector and the Municipality.
- More than 80% of residents think that the collection service provided in their area is suitable.
- More than 90% of residents think that the sanitary condition of their areas have changed after the collection experiment began.
- Residents answered that they would like to use the funds collected from the residents to:
  - improve the drains
  - improve the roads
  - construct community facilities such as street lighting, etc.
- 100% of the residents want to continue receiving collection services.

1. **Percentage of residents receiving solid waste collection services**

Sandino	Carlos Marx	Waspan
80%	90%	50%



2. **Reasons why residents are not receiving solid waste collection services** (question for residents not receiving collection services)

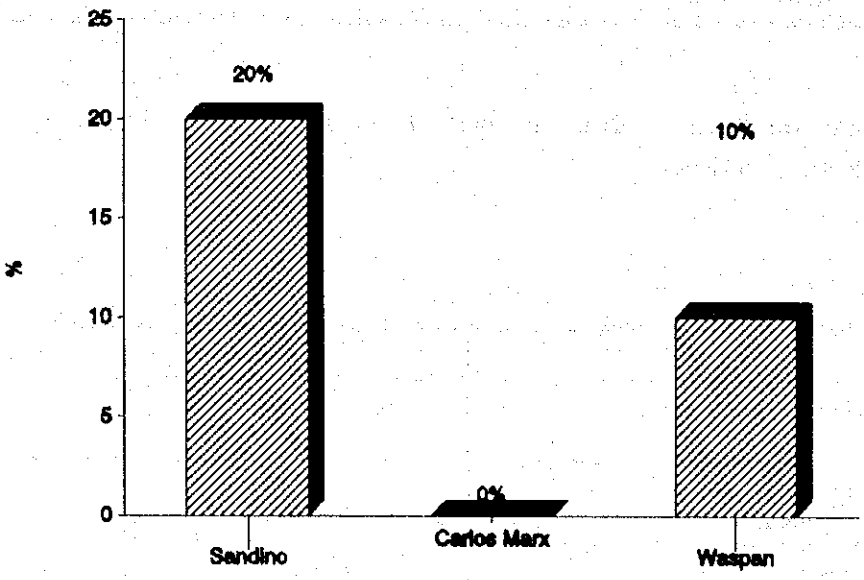
	Sandino	Carlos Marx	Waspan
1)Nobody comes to contract waste collection services	10%	0	50%
2) expensive waste collection fee	0	0	0
3)Partial waste collection fee system	0	0	0
4)No trust in the Municipality	0	0	0
5)No trust in the community	0	0	0
6)unaware of collection services in the area	0	10%	0
7)Others (Please specify)	10%	0	0

3. **Waste discharge / disposal method** (questions for residents not receiving collection services)

	Sandino	Carlos Marx	Waspan
1) Regular collection service	10%	0	20%
2) Irregular collection service, road sides or channels etc.	0	0	10%
3) Combustion / disposal	10%	10%	20%
4) Others	0	0	0

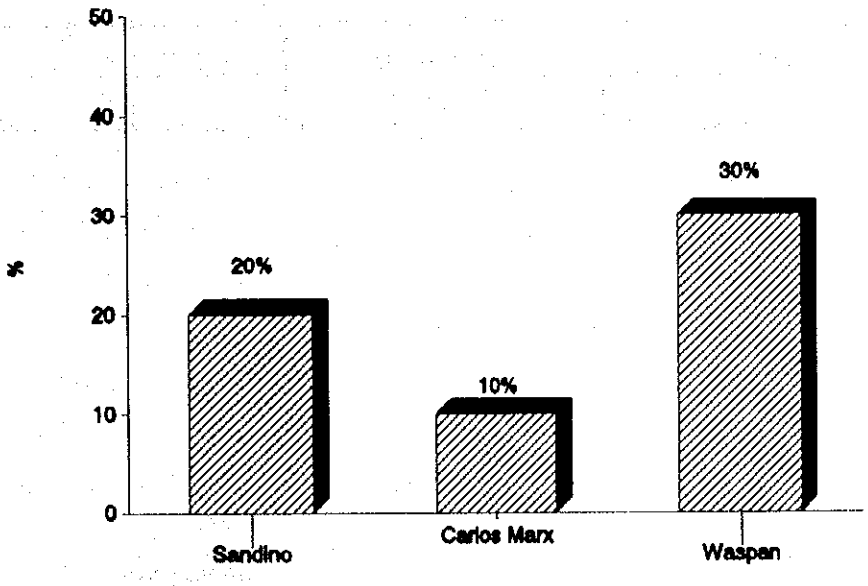
4. **Percentage of residents thinking the area is clean and in good sanitary condition** (questions for residents not receiving collection services)

Sandino	Carlos Marx	Waspan
20%	0%	10%



5. **Percentage of residents thinking that the area condition has become sanitary after the onset of collection experiment** (questions for residents not receiving collection services)

Sandino	Carlos Marx	Waspan
20%	10%	30%

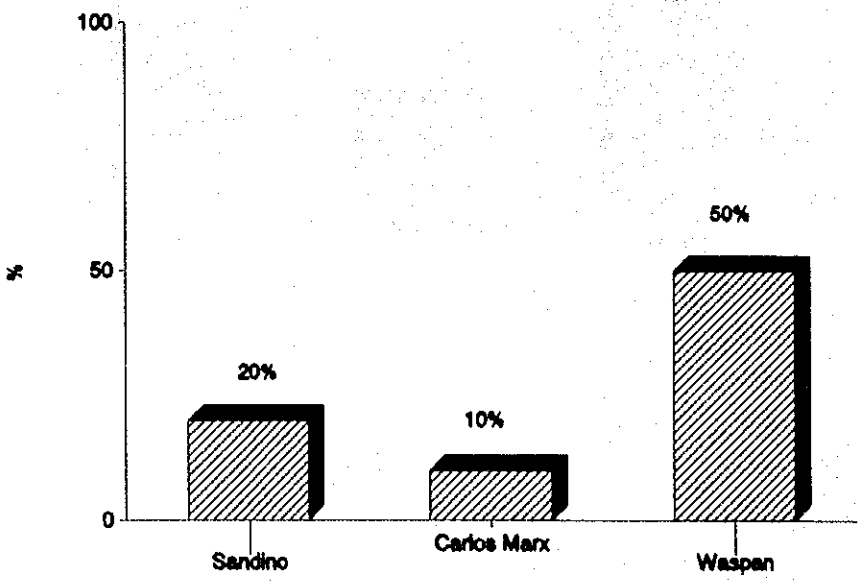


6. **The use of the fee for improvement works** (questions for residents not receiving collection services)

	Sandino	Carlos Marx	Waspan
1) to improve the roads	0%	0%	0%
2) to improve the drains	0%	0%	20%
3) to construct community facilities, such as street lamps, etc.	0%	0%	20%
4) to clean up the area	0%	10	20%
5) others (please specify)	20%	0%	0%

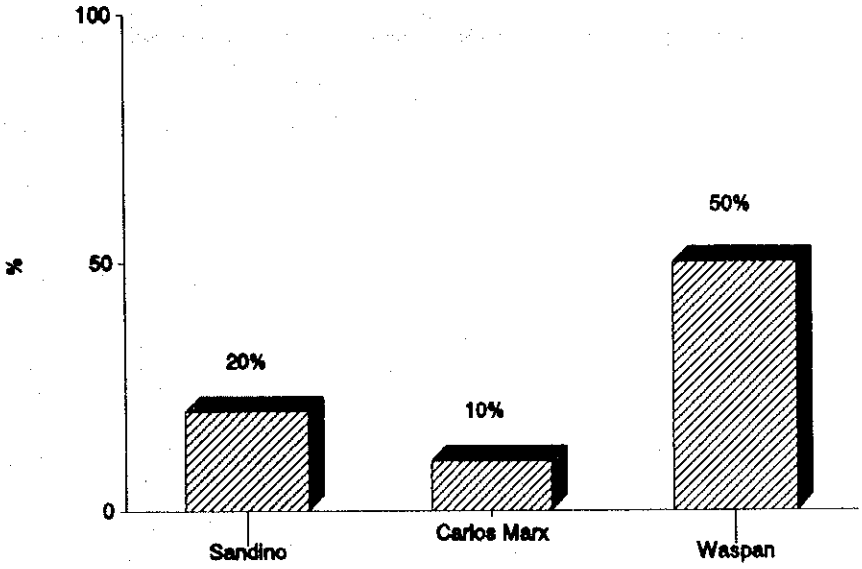
7. **Percentage of residents thinking that public cooperation is necessary to keep the area clean** (questions for residents not receiving collection services)

Sandino	Carlos Marx	Waspan
20%	10%	50%



8. **Percentage of residents who want to receive collection services** (questions for residents not receiving collection services)

Sandino	Carlos Marx	Waspan
20%	10%	50%

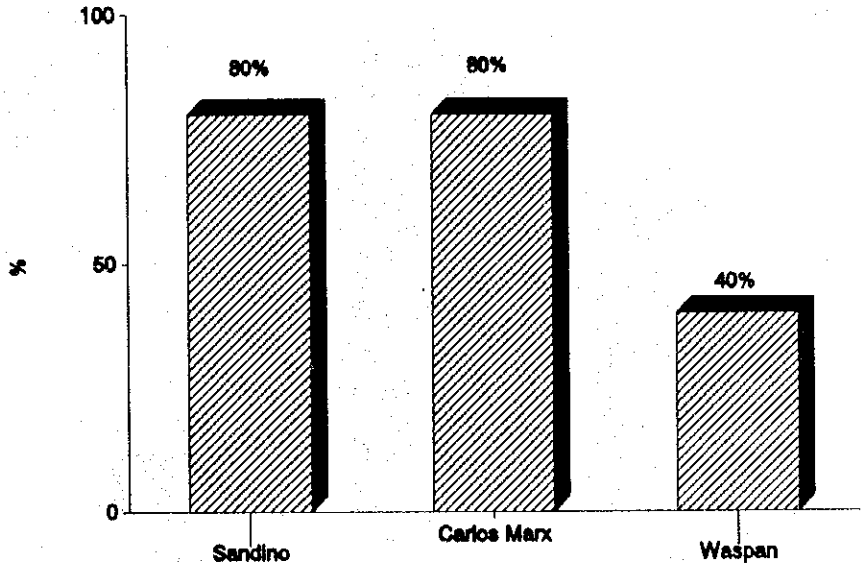


9. **Reasons why residents receive solid waste collection services** (questions for residents who receive collection services)

	Sandino	Carlos Marx	Waspan
1) to keep area clean	40%	40%	40%
2) to make the area sanitary	50%	40%	10%
3) to prevent the generation of flies and bad smell	20%	20%	0%
4) to prevent illness	40%	30%	0%
5) others (please specify)	0%	0%	0%

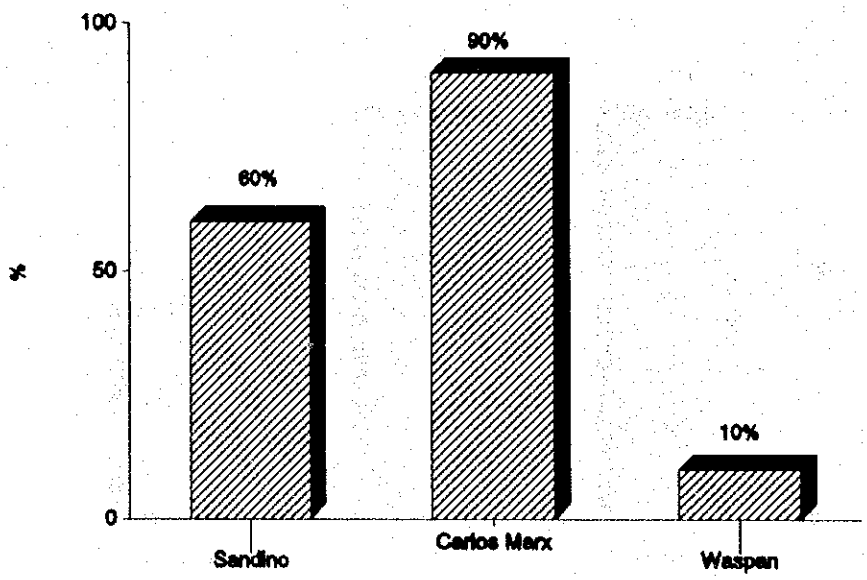
10. **Percentage of residents storing their waste before collection** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	80%	40%



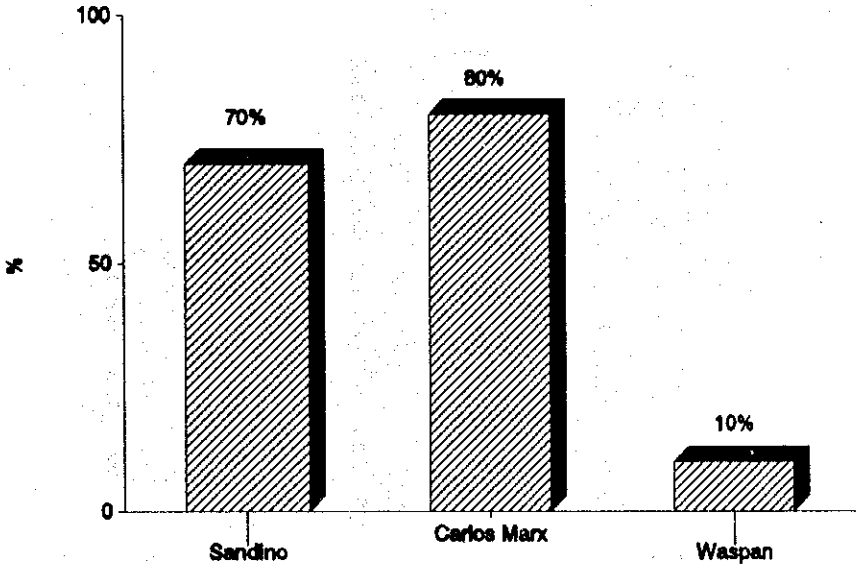
11. **Percentage of residents aware of weekly collection days** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
60%	90%	10%



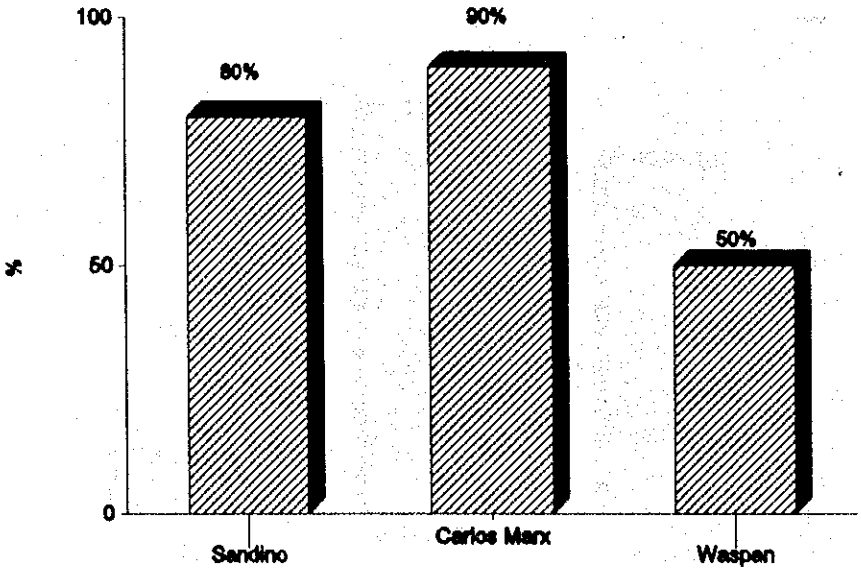
12. **Percentage of residents who receive collection services at a fixed time** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
70%	80%	10%



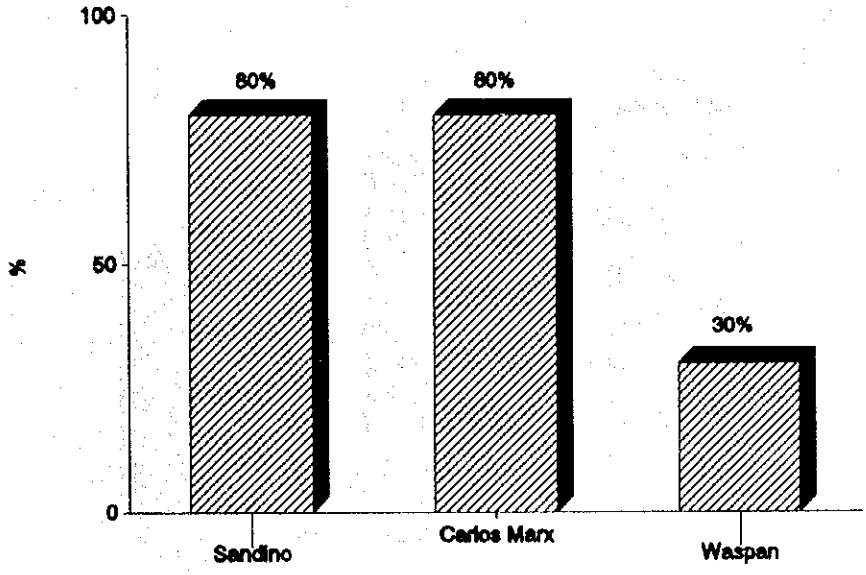
13. **Percentage of residents thinking that public cooperation is necessary to keep the area clean** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	90%	50%



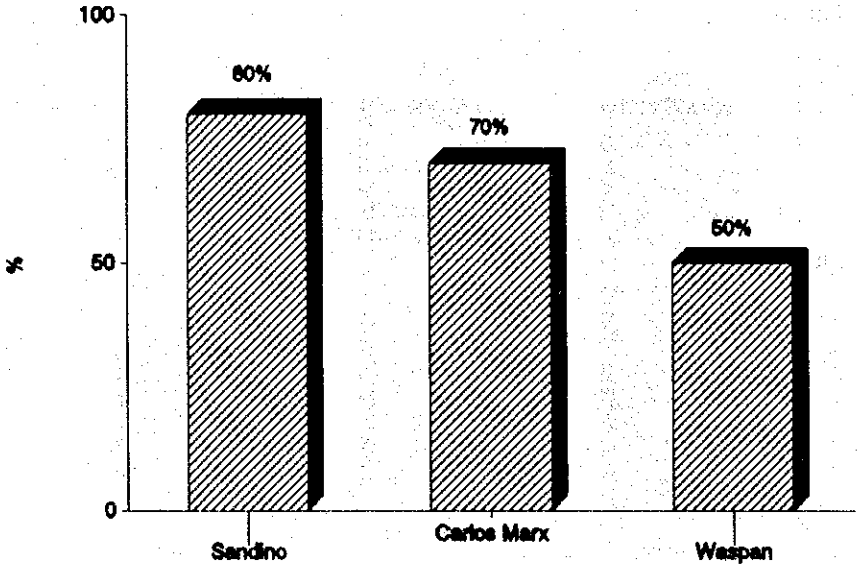
14. **Percentage of residents satisfied with the collection services of the primary collector** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	80%	30%



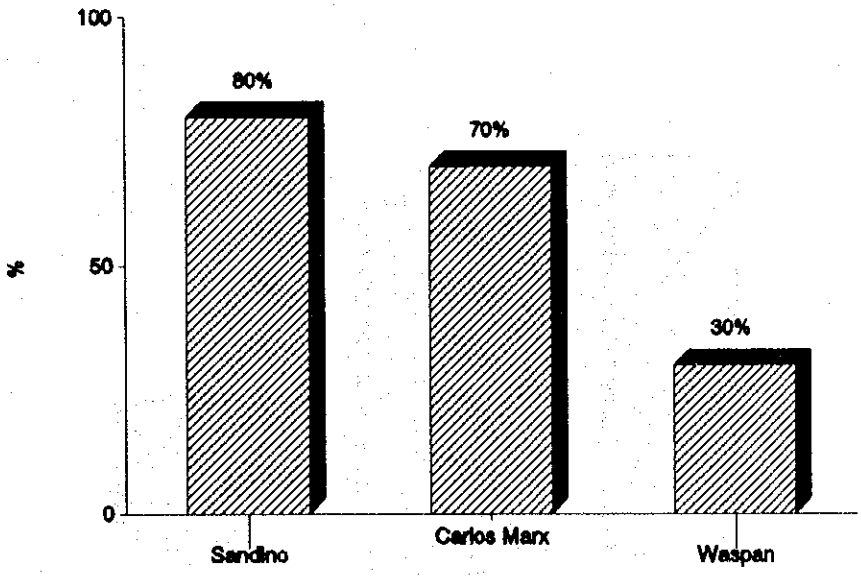
15. **Percentage of residents satisfied with the collection services of the Municipality**
(questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	70%	50%



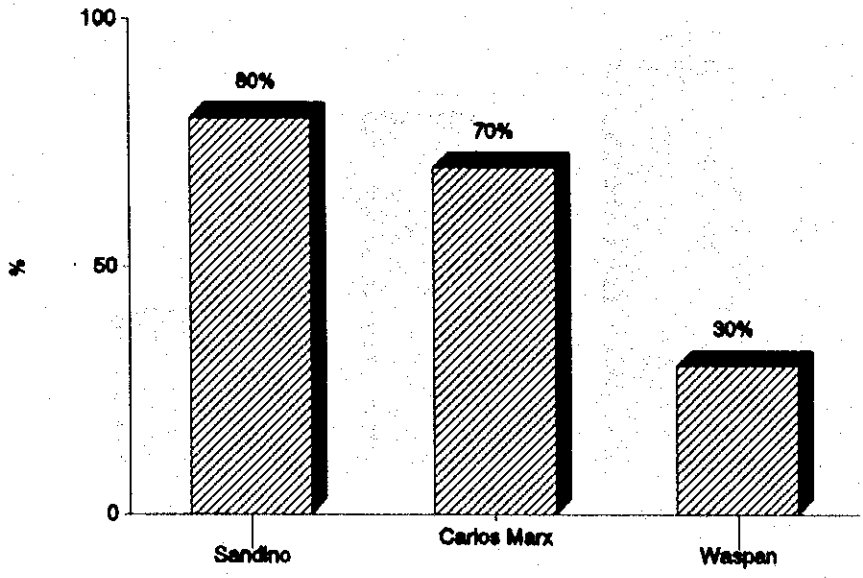
16. **Percentage of residents thinking the collection system provided in their area is suitable** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	70%	30%



17. **Percentage of residents thinking that the area condition has become sanitary after the onset of the collection experiment** (questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	70%	50%

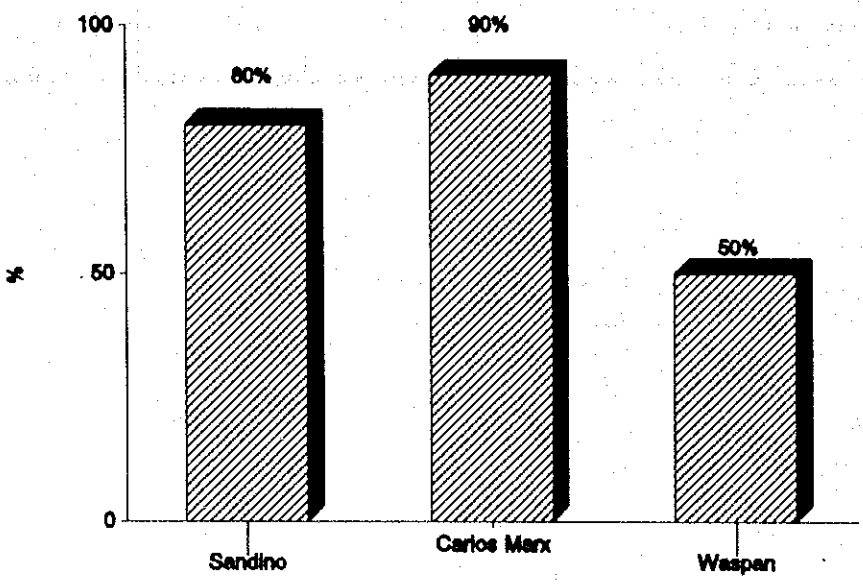


18. **The use of fees for improvement works** (questions for residents who receive collection services)

	Sandino	Carlos Marx	Waspan
1) to improve roads	40%	10%	20%
2) to improve drains	50%	50%	10%
3) to construct community facilities, such as street lamp, etc.	10%	20%	30%
4) to clean up the area	10%	10%	10%
5) others (please specify)	10%	40%	0%

19. **Percentage of residents who want to receive collection services continuously**
(questions for residents who receive collection services)

Sandino	Carlos Marx	Waspan
80%	90%	50%



bc. The routes of the collection services in the experiment are as follows:

i Cesar Sandino was included in the existing collection service route 9

ii Carlos Marx and Waspan Norte were included in the existing collection service route for markets.

Collection work in Cesar Sandino was fixed after ordinary collection work began. The collection time in Cesar Sandino was made an hour ahead or later than the fixed collection time due to traffic and vehicle condition, and instead of being the second, it was settled as the first collection route during the implementation period.

bd. Examination of Coordination and Assistance System through District Offices

District Offices extended the following services during the experiment:

i Social workers or persons in charge of municipal services assisted in the community works needed for the experiment, such as hiring primary collectors, contracting residents for the services and fee collection.

ii District Office 6 lent the use of their hand carts for primary collection to the communities of Carlos Marx and Waspan Norte.

iii District Offices assisted the cleansing and road improvement activities of the communities at the beginning and during the experiment.

iv District Office 5 held meetings in Cesar Sandino to encourage resident participation in the experiment. Authorities of the Department of Environmental Education also carried out campaigns on sanitation.

be. Examination of Public Education System by the Department of Environmental Education

The Department of Environmental Education implemented the following during the experiment:

i Carried out campaigns on sanitation in Cesar Sandino.
ii Carried out campaigns on sanitation using the audio visual tools prepared by the Study Team in the following days:

5 January 1995: Cesar Sandino
6 January 1995: Carlos Marx
9 January 1995: Waspan Norte

bf. Examination of Promotion and Fee Collection System in the Community

The following works were implemented by the organization exclusively established for the experiment:

i Contracting a primary collector according to the conditions prepared by the Study Team.

ii Contracting residents for collection services according to the terms prepared by the Study Team.

Table L.1.5e shows the number and percentage of households contracted before and during the experiment, including the increase in the percentage of contracted households.

Table L.1.5e Number and Percentage of Households contracted by the community for the experiment

	Cesar Sandino	Carlos Marx	Waspan Norte	Total
(1)Total number of households	300	197	163	660
(2)Number of households contracted before the experiment	63	72	82	217
(3)Number of households contracted during the experiment	223	180	90	493
(4)Percentage of households contracted before the experiment (%) (2)/(1)	21%	36.5%	50.3%	32.9%
(5)Percentage of households contracted during the experiment (%) (3)/(1)	74.3%	91.4%	55.2%	74.7%
(6)Increase in percentage (%) (5)-(4)	53.3%	54.9%	4.9%	41.8%

iii Household Fee Collection was carried out as follows:

- fee collection from January 2 – 5, 1995
- 5 January 1995 was the Primary collector's payday
- 5 January 1995 was the day for payment of waste collection fees

The amount of fee collected from the residents in the experiment is shown in Table L.1.5f.

Table L.1.5f Amount of Collected Fee

	Cesar Sandino	Carlos Marx	Waspan Norte	Total
Total Amount of Fee (C$)	669	540	270	1,479
Salary for Primary Collector (C$)	0	180	90	270
Waste Collection Fee (C$)	446	180	90	716
Money for Area Improvement (C$)	223	180	90	493

iv. The organization established exclusively for the experiment acts as the mediator between the residents and the municipality, relaying every request made by the former to the latter and passing information from the latter to the former.

Sample of Contract Document for Primary Collector

Contrato de Prestación de Servicios

Nosotros, _____ miembros del comité formado para la ejecución del Proyecto Piloto de Recolección en el barrio Carlos Marx y el Sr._____ _____, residente del barrio, hemos acordado celebrar un contrato de recolección primaria de los desechos domiciliarios de nuestras casa bajo las siguientes condiciones:

1. El Sr._____ se compromete a recoger los desechos de _____ __ casas.

2. Los desechos serán recogidos del frente de las casas y llevados al contenedor que la Alcaldía de Managua ha instalado en la colonia.

3. Los desechos deben ser recogidos los días Domingo y Miércoles de cada semana a las 8:00 am y deberán estar vaciados en el contenedor cominitario donde serán recogidos por la Alcaldía de Managua los días Lunes y Jueves a las 7:00 am.

4. El Sr. _____ debe ejecutar su trabajo atendiendo todas las casas de la colonia, sin derramar los desechos en las calles y en las orillas del contenedor.

5. El pago por el servicio de recolección primaria será de C$ 1.00 por casa atendida al mes.

6. El Sr. _____ efectuará su trabajo los días Domingo y Miércoles de cada semana de 8:00 am a 12:00 pm.

Ambos comparecientes dicen estar de acuerdo con los puntos anteriores en fé de lo cual firman el presente compromiso.

Managua,_____ de Diciembre de 1994

_____ _____

Sample of Contract Document for Residents

Compromiso de Pago

Por este medio los abajo firmantes residentes del barrio Augusto Cesar Sandino se comprometen a pagar la cantidad de C$ 3.00 al mes por cada casa para cubrir los costos del servicio de recolección que prestará la Alcaldía de Managua durante el mes de _____, bajo las siguientes condiciones:

- Frecuencia de recolección: Tres veces por semana

- Días de recolección en la semana: Martes, Jueves y Sabado 11:00 am

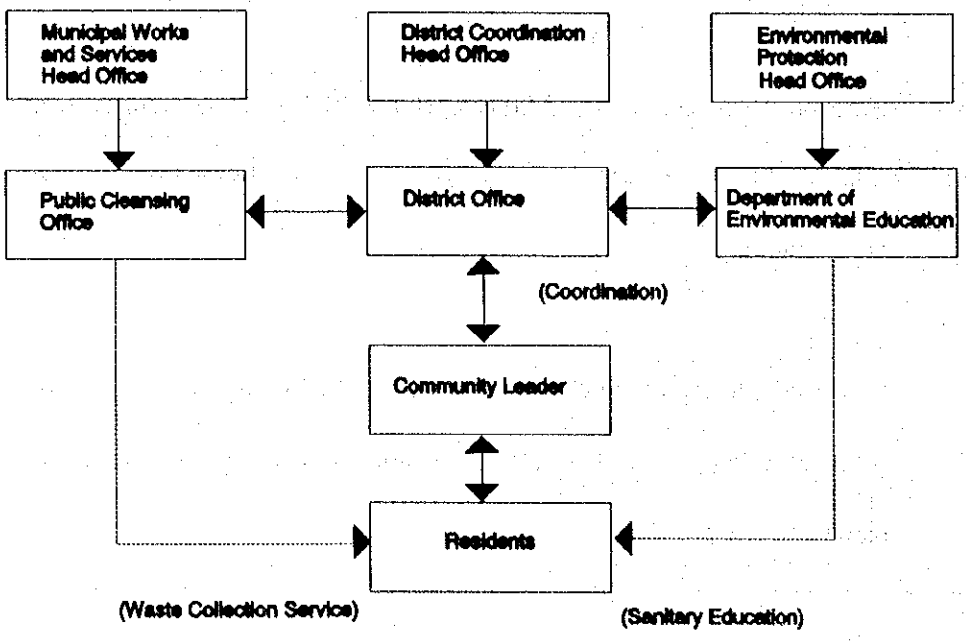
- Tasa por recolección : C$ 3.00/casa (C$ 2.00 para el servicio de recolección a la Alcaldía y C$ 1.00 para cubrir gastos de la actividad de limpieza en la comunidad)

- Los residentes se comprometen a pagar puntualmente la tasa, promover la limpieza y buenos hábitos en la población y colaborar para la buena ejecución del proyecto.

L.1.6 Findings

i The container and bell collection system requires public cooperation a lot more than the other collection systems. A 27% increase was observed in the number of contracted households as the number of households that participated in the experiment totaled 493. Moreover, 80% of the households receiving collection services find the collection system suitable. These figures indicate the residents' approval of the experimental collection systems, and consequently prove the feasibility of extending collection services to these areas through these collection systems.

ii The organization structure below was established to provide assistance to the experiment and proved to be very important in the extension of collection services.



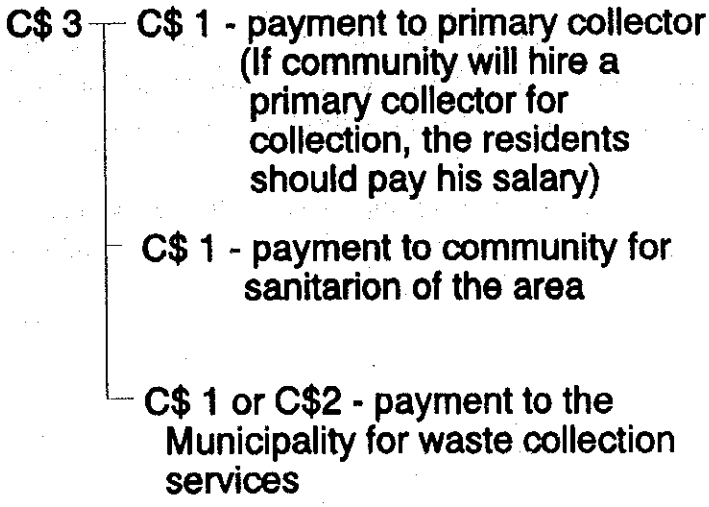
iii To effectively carry out the experiment, an organization responsible for promoting sanitation should be established. The responsibilities of the organization are as follows:

- contracting primary collectors
- contracting residents for collection services
- fee collection and management
- act as a mediator between the residents and the Municipality to establish coordination in sanitation activities

The establishment of an organization in the community is proven to be necessary not only for the extension of collection services but for the sanitation of the squat areas as well.

iv The primary collection system incorporated in the container collection system was proven to be effective in the squat areas and should be implemented therefore for the extension of services to other areas.

v The waste fee collection system in squat areas was established as follows:



A community organization made up of three members was organized to manage the fees collected. The communities hand the collected fees over to the Municipality. The Study Team recommended the separate management of the fees from the general finances of the Municipality. It further recommended that the fees should be managed by the Public Cleansing Office.

vi With the assistance of the district offices and the Public Cleansing Office, the community carried out cleansing and improvement activities. The district offices and Public Cleansing Offices also assisted these activities during the experiment.

However, some roads and drains were not improved or repaired due to geological influences and lack of equipment.

These activities were proven to be necessary to sanitize the squat areas.

vii In order to prevent damages, container beds were constructed in the experimental areas provided with the container collection system. At the same time, sloping platforms with steps were constructed on the beds to facilitate discharge.

The construction of the platform to facilitate discharge was proven to be effective especially for children and primary collectors.

viii The community of Hialeah requested to be included in the experiment after the selection of experimental areas was finalized. The household percentage eager to participate in the experiment exceeded 90%.

The Study Team recommended the inclusion of Hialeah in the experiment to the Municipality for collection area extension and in accordance with the basic plan proposed in the collection experiment.

Thereafter the Municipality started the preparations necessary for the implementation of collection services in the area from 5 January 1995.

L.2 Sanitary Landfill Experiment

L.2.1 Background

The disposal site in Acahualinca has been operating for almost 20 years since it opened in 1975 and the disposal site area has increased to about 40 ha. Based on the information given by the Public Cleansing Office, almost half of the landfill works is completed and will be continued until the entire landfill area is even. The remaining landfill site is shown in Figure L.2.1a. The remaining capacity of the present Acahualinca disposal site is estimated to be approximately 1,220,000 m^3, a capacity capable of accommodating the volume of wastes to be disposed in the following 5 years.

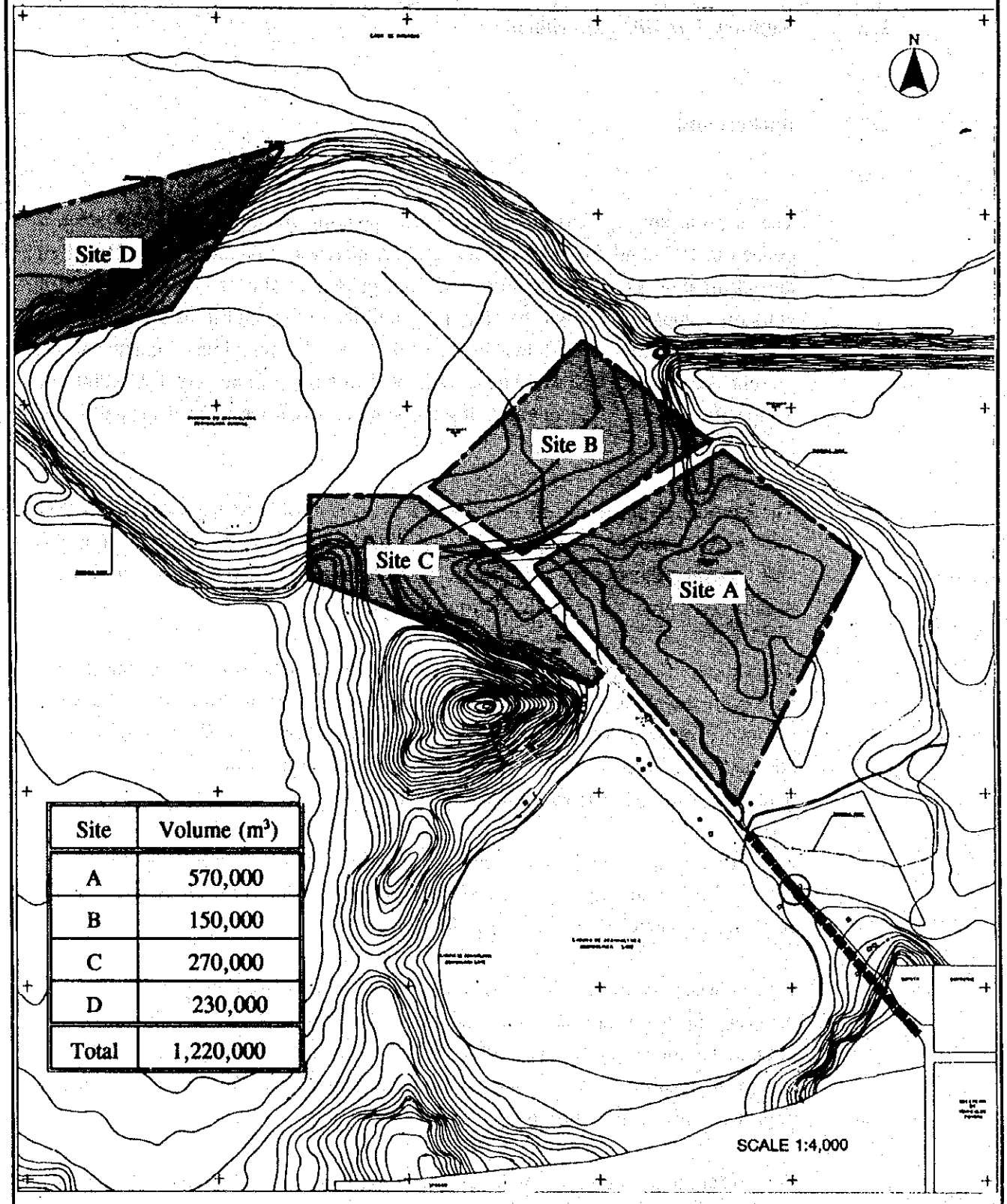
The present disposal site in Acahualinca is in a terrible state. More than 200 scavengers, including animals and birds looking for food waste, can be seen in the site. Wastes dumped in the site are also scattered and those lighter in weight usually get blown away to the surrounding area.

The shoreline of Managua lake formerly divides the lake from the disposal site. However, the annual decrease in lake water level has created a distance between the two. The view of the shoreline is not very pretty to the sight as it is now adorned with heaps of waste. This condition is feared to deteriorate lake water quality if water level rises up to its former height.

Furthermore, the natural combustion of disposed wastes due to putrefaction can be observed in a wide area. The smoke densely covers the disposal site and can be seen from every elevated ground in Managua city.

Given these conditions, the Study Team proposed the relocation of the present disposal site to an area 2 km to the west. The Study Team also proposed the implementation of sanitary landfill in the master plan for the proposed new landfill site in Acahualinca to keep the environment sanitary and prevent any adverse impact to the surrounding area.

The experiment, therefore, will also be carried out to determine whether the implementation of a sanitary landfill is feasible or not, and also for the formulation of the Master Plan.



Site	Volume (m^3)
A	570,000
B	150,000
C	270,000
D	230,000
Total	1,220,000

The Study on The Improvement of The Solid Waste Management System for The City of Managua	Figure L.2.1a Remaining Landfill Area in the Present Acahualinca Disposal Site
Japan International Cooperation Agency	

L.2.2 Objectives of the Sanitary Landfill Experiment

The sanitary landfill experiment aims to inform the people, residents in the area and neighboring areas of the importance of sanitary landfill practices. The objectives of the sanitary landfill experiment are described below:

(1) to sanitize the area condition of the present Acahualinca disposal site in accordance with the immediate improvement plan.

(2) to verify the workability of sanitary landfill works proposed in the Master Plan

L.2.3 Contents of Sanitary Landfill Experiment

The Study Team and ALMA agreed to carry out the following items in collaboration with each other, based on the above objectives.

(1) Immediate improvement measures
- improvement of approach road
- covering of wastes
- construction of dike

(2) Verification of the workability of sanitary landfill works
- covering of wastes
- construction of dike
- installation of gas removal facilities

a. Improvement of approach road

The approach road, which is impassable in the rainy season because it subsides and gets really muddy, impedes the operation of the landfill works. Because of the unpaved condition of the approach road, haulage is not effectively carried out and vehicles consume a lot of fuel. Consequently, the approach road will be improved to smoothly implement landfill works.

b. Covering of wastes

Scattering of wastes, generation of bad odor, propagation of insects and fire are usual occurrences in the present Acahualinca disposal site due to the uncovered state of the wastes. To create a sanitary condition, wastes in the present dumping site will be covered daily and for the last time after landfill works are completed.

c. Construction of dike

Some of the wastes in the present disposal site overflow into the neighboring area due to the absence of a definite boundary, thereby corrupting the surrounding environment. A dike will be constructed therefore to act as a clear boundary between the surrounding area and the disposal site. To maintain a clean and good environment, the heaps of waste surrounding the dike will be leveled and covered with soil.

In addition to the above, the present dumping site should be enclosed by the dike to prevent uncontrolled tipping and spreading of the wastes. The dike construction schedule should be adjusted to the daily waste covering operation.

d. Installation of gas removal facilities

The condition of the part of the disposal site where landfill works are completed is anaerobic. The anaerobic decomposition of organic waste materials produces 40 – 60% methane, 60 – 40% carbon dioxide and various other gases. The emission of these gases usually result in explosion which interrupts the spreading or compaction work. Deoxygenation, on the other hand, injures vegetation in the recently recultivated surface of landfill and the surrounding area. Since these gases could impede the future use of the area as a disposal site, the installation of gas removal facilities will be taken into account.

The abovementioned items to be carried out in the sanitary landfill experiment are summarized in Figure L.2.3a. These items will be carried out by the JICA Study Team and the Public Cleansing Office, as shown in the following table. Furthermore, the role assignments were decided taking the following into account:

- the limited period allotted to the experiment
- the use of Public Cleansing Office equipment and the preferred execution of the works by PCO
- the implementation of the remaining works by the JICA Study Team

Table L.2.3a Role Assignment for the Sanitary Landfill Experiment

Items for the Experiment	JICA	ALMA
1. Improvement of approach road	Plan, Construction Supervision	Supervision
2. Covering of wastes	Plan, Supervision	Construction, Supervision
1|3. Construction of dike	Plan, Supervision	Construction, Supervision
4. Installation of gas removal facilities	Plan, Construction, Supervision	Construction Supervision

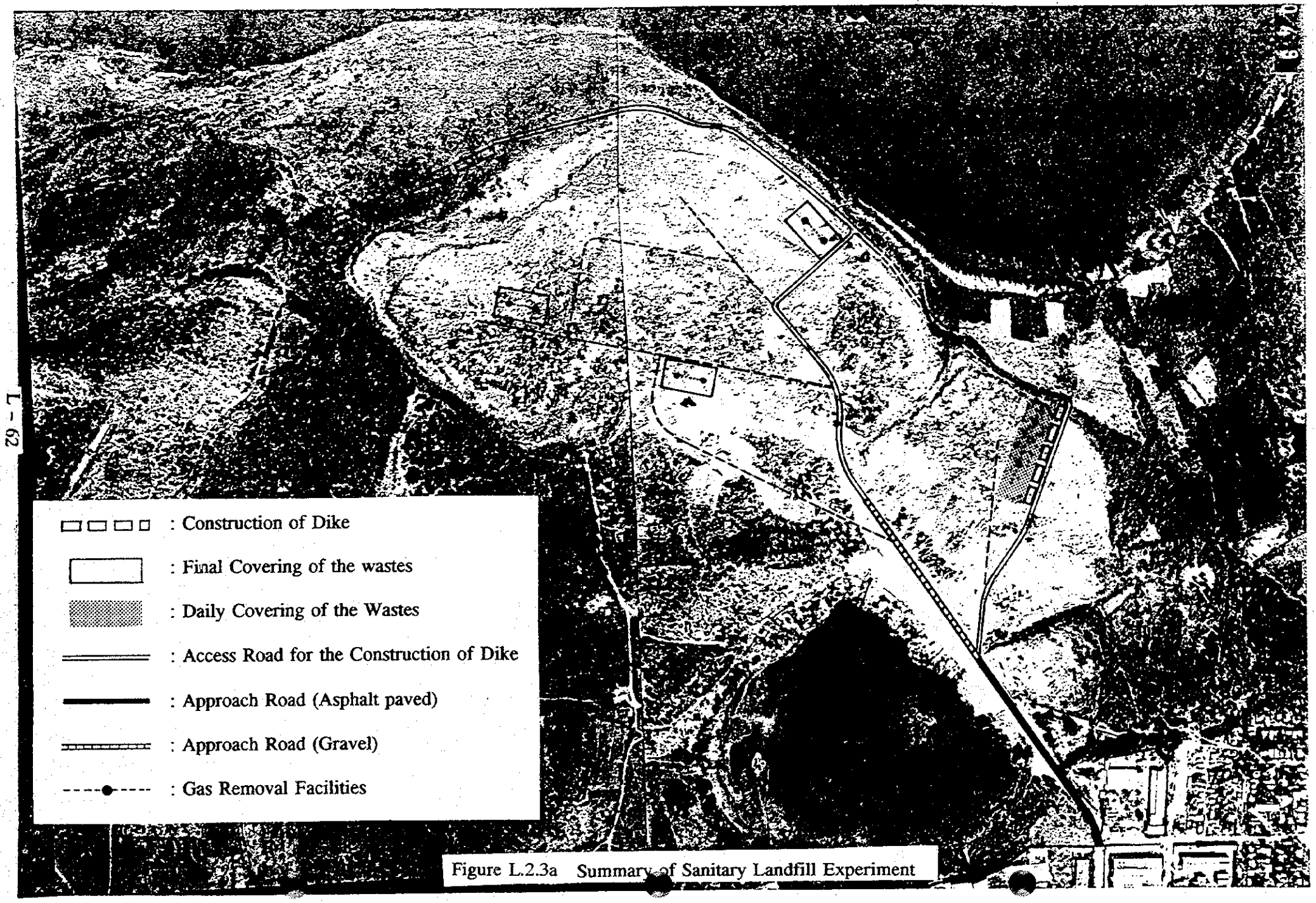


Figure L.2.3a Summary of Sanitary Landfill Experiment

L.2.4 Execution Method

a. Improvement of approach road

A section of the present approach road, with a length of 250m starting from the avenue to the end of the truck scale constructed in the previous phase, is paved in asphalt and its vertical alignment was partially changed. The following section, with a length of 300m in the direction of the landfill site, is paved in gravel. The level of the approach road was also raised to about 1.0m. The present gate should be replaced with a new one. The location of the road, vertical alignment plan, typical cross section and gate facilities are shown in Figure L.2.4a, L.2.4b, L.2.4c and L.2.4d. The JICA Study Team consigned the works to a local construction firm.

b. Covering of wastes

Waste covering is carried out by the Public Cleansing Office under the supervision of the JICA Study Team and the counterpart in areas where landfill work is completed or in progress. The Cleansing Office executed the final covering of the wastes at the area where landfill was completed in collaboration with the Municipal Maintenance Office who supplied the equipment needed. The Public Cleansing Office should supervise the daily covering of wastes since its further continuance is most desirable even after the experiment.

ba. Final covering of wastes

Almost half of the landfill works in the present Acahualinca disposal site is completed. The volume of waste disposed in this area is about 15m thick from the ground. Final covering is not carried out.

The final covering of wastes is carried out at the three areas selected for the installation of gas removal facilities. The areas covered measured 2,800m^2(40m x 70m), and the thickness of the layer was 50cm considering future vegetation. Details of the final covering are shown in Figure L.2.4e.

bc. Daily covering of wastes

There are 4 sites available for landfill in the present Acahualinca disposal site. The current dumping area used for landfill (December 1994) is located near the entrance of the disposal site and measures approximately 60,000m^2 with an estimated

capacity of 570,000m³. The Municipal Cleansing Office carries out daily waste covering activities at the northern part of this area.

At the beginning of the experiment, daily covering activities were planned to be carried out on the day wastes are disposed of. However, the presence of numerous scavengers near the heavy equipment used in the dumping area led to alterations for safety reasons. The methods involved in the waste covering operation, e.g., heaping, compacting and covering, are carried out 2 days after the wastes are dumped, giving scavengers sufficient time to go ahead with their business. See Figure L.2.4f for further details on this arrangement.

According to the analysis of wastes carried out at the truck scale, soil makes up 15% of the incoming waste volume. Because the Municipal Cleansing Office does not have enough equipment to haul soil from the borrow pits within the Acahualinca disposal site, and since this activity would require additional capital, the use of soil in incoming waste is recommended for covering activities in view of the economic condition of the Study Area and for the possible continuance of the activity which is essential in the sanitation of the disposal site.

c. Construction of dike

The construction of dikes was proposed to build a boundary between the disposal site and Managua lake and an enclosure of the current dumping site where the daily covering works will be carried out. The Public Cleansing Office constructed these dikes under the supervision of the JICA Study team and counterparts, using wastes to build the dike body to curtail construction cost.

Since access to the dike is necessary, the Public Cleansing Office and Municipal Maintenance Work Office is currently constructing an access road using the flat band on the slope of the heap of wastes. The access road is 8m wide to accommodate two way traffic and will be as extensive as possible for maintenance purposes.

The details of the dike and access road construction work are shown in Figure L.2.4g.

d. Installation of gas removal facilities

Gas removal facilities are installed in the areas where landfill works have been completed or ongoing. The JICA Study Team was in charge of the installation the

former, while the Municipal Cleansing Office was responsible for the installation in the latter. The JICA Study Team consigned the installation works to a local construction firm.

da. Gas removal facilities in the area where landfill work is completed

The selection of the three areas to be installed with gas removal facilities was made depending on the period of years the landfill works have been carried out. Landfill works in the first selected area was carried out about 10 - 20 years ago, the 2nd area about 5 - 15 years ago, and the 3rd area about 5 years ago. As previously mentioned, these areas are covered with soil as thick as 50cm and are each equipped with 2 gas removal facilities (refer to Figure L.2.4h).

db. Gas removal facilities in areas where landfill works are ongoing

The gas removal facilities are installed in areas where the daily covering experiment is carried out by the Public Cleansing Office under the supervision of the JICA Study Team. See Figure L.2.4i for details.

L.2.5 Findings

Sanitary landfill experiment was commenced form early December 1994. The experiment period was so short that the expected results of the experiment could not be fully obtained. However, the findings recognized through the experiment are as follows:

- Total 550m length of approach road consists of 250m of asphalt paved road and 300m was improved. Some pavement work was carried out at night time so as not to disturb landfill operation. The improvement of approach road was very effective for the smooth access of collection vehicles to dumping site. Also, the landfill operation will be possible even during heavy rains. Therefore the purpose of this experiment was completely attained.

- A road was constructed inside the site by the construction department of ALMA for the construction of dike located at north west end of disposal side. This road will be used for maintenance purposes after the completion of landfill. This road was connected to the approach road above-mentioned. The landfill operation can be done in the whole area.

- Final waste covering activities was done by the construction department of

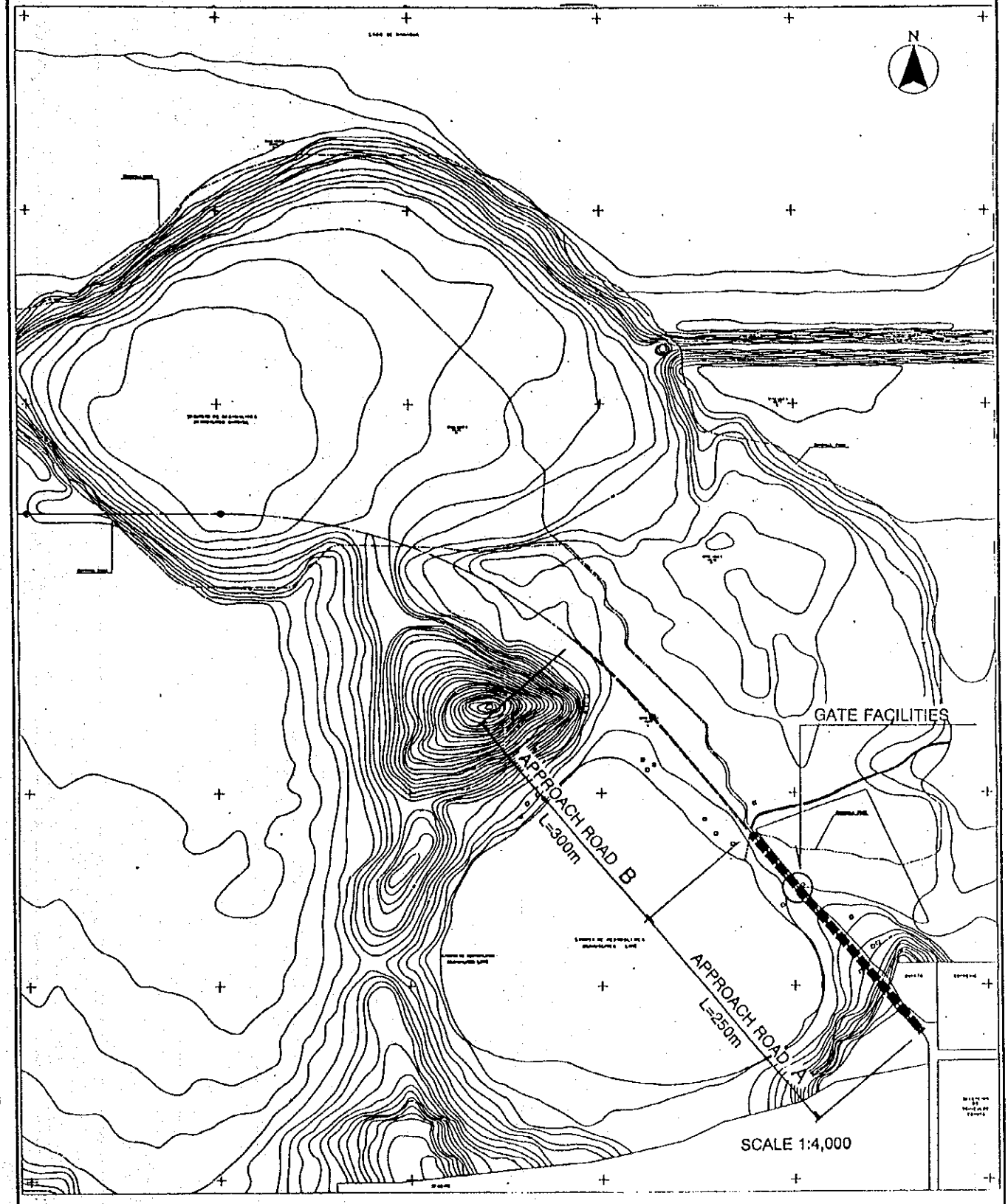
ALMA in the area where landfill is completed, because the Public Cleansing Office does not have enough equipment for earth works. Heavy equipment shall be prepared by PCO for the final covering of waste. This activity will be considered as a regular activity in the site. However, final waste covering activities did not prevent the scattering of waste, generation of bad odor and the flocking of birds in the area for long.

- Daily waste covering was executed by PCO. The soil brought from the city was heaped beside the normal waste, and was used as a covering material after waste compaction. The presence of many scavengers prowling around the landfill compactor hampered compaction work. However, the dumping is acknowledged to be more sanitary after commencement of the daily waste covering, activities – which needed no additional budget.

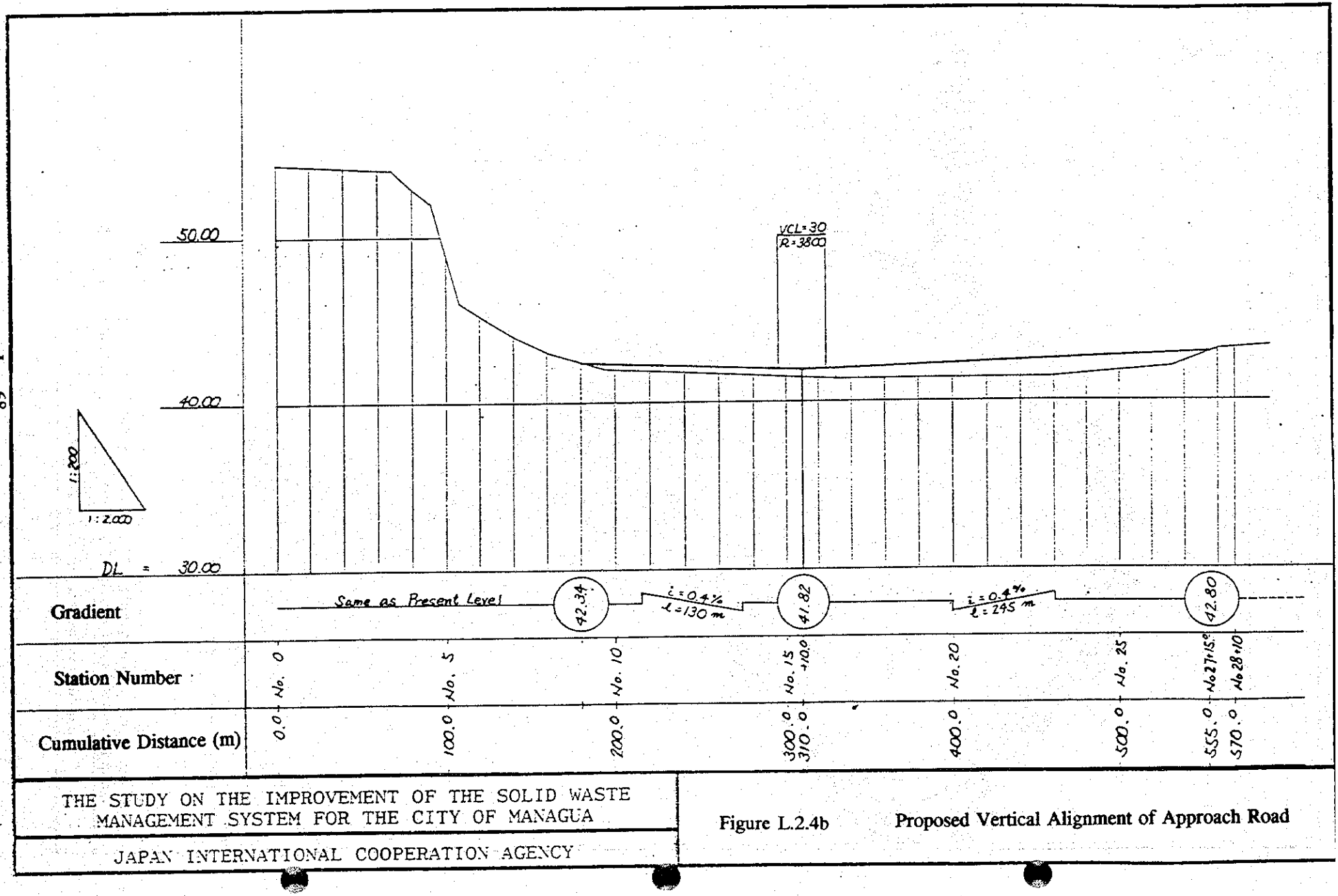
- Gas removal facilities were installed by the Study Team at the area where the final covering was done. Methane gas was measured by using the potable sensor during and after the facilities were installed. The Study Team confirmed the presence of methane gas was not able to measure the volume produced. However, a detailed observation of methane gas production shall be done to protect the people engaged in landfill operations from explosion and fire accidents. In addition, ALMA also independently installed one at the current dumping site. The material for gas removal facilities was made from construction waste.

- The enclosing dike was made from waste matter, and made the boundary clear and controlled waste scattering to surrounding areas. PCO recognized the above mentioned effects of the dike and started to extend the enclosing dike further.

The sanitary landfill experiment was concluded to be almost successful as it has proven that the Municipality of Managua is capable of sustaining sanitary landfill level 3 operations, except for the leachate circulation system.



The Study on The Improvement of The Solid Waste Management System for The City of Managua	Figure L.2.4a Location of Approach Road
Japan International Cooperation Agency	



THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

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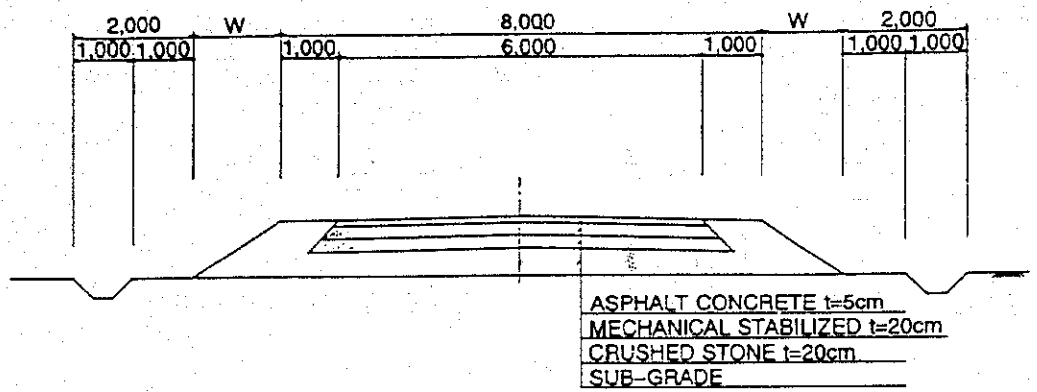
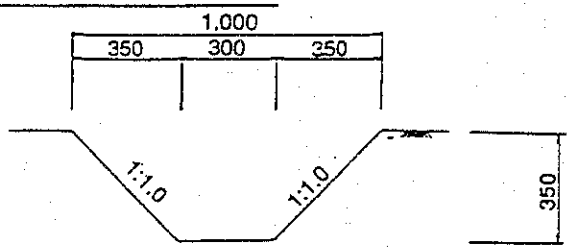
Figure L.2.4b Proposed Vertical Alignment of Approach Road

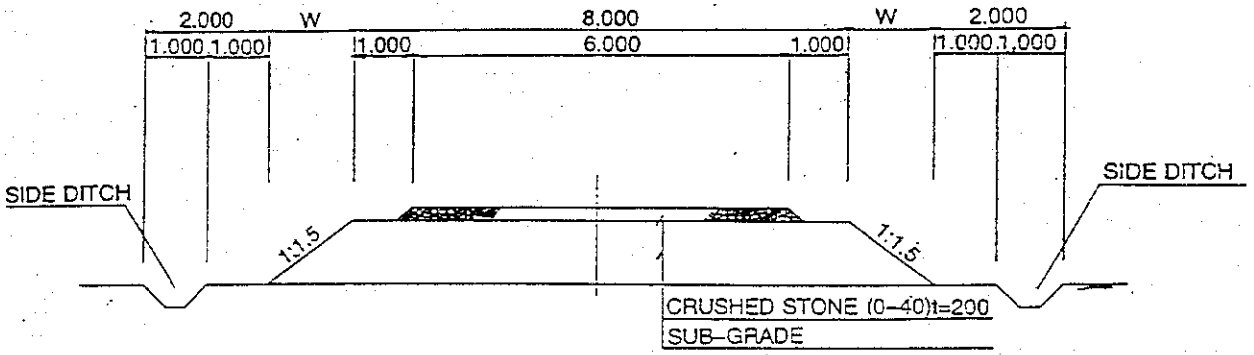
TYPICAL CROSS SECTION OF APPROACH ROAD A



DETAIL OF SIDE DITCH



TYPICAL CROSS SECTION OF APPROACH ROAD B



THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

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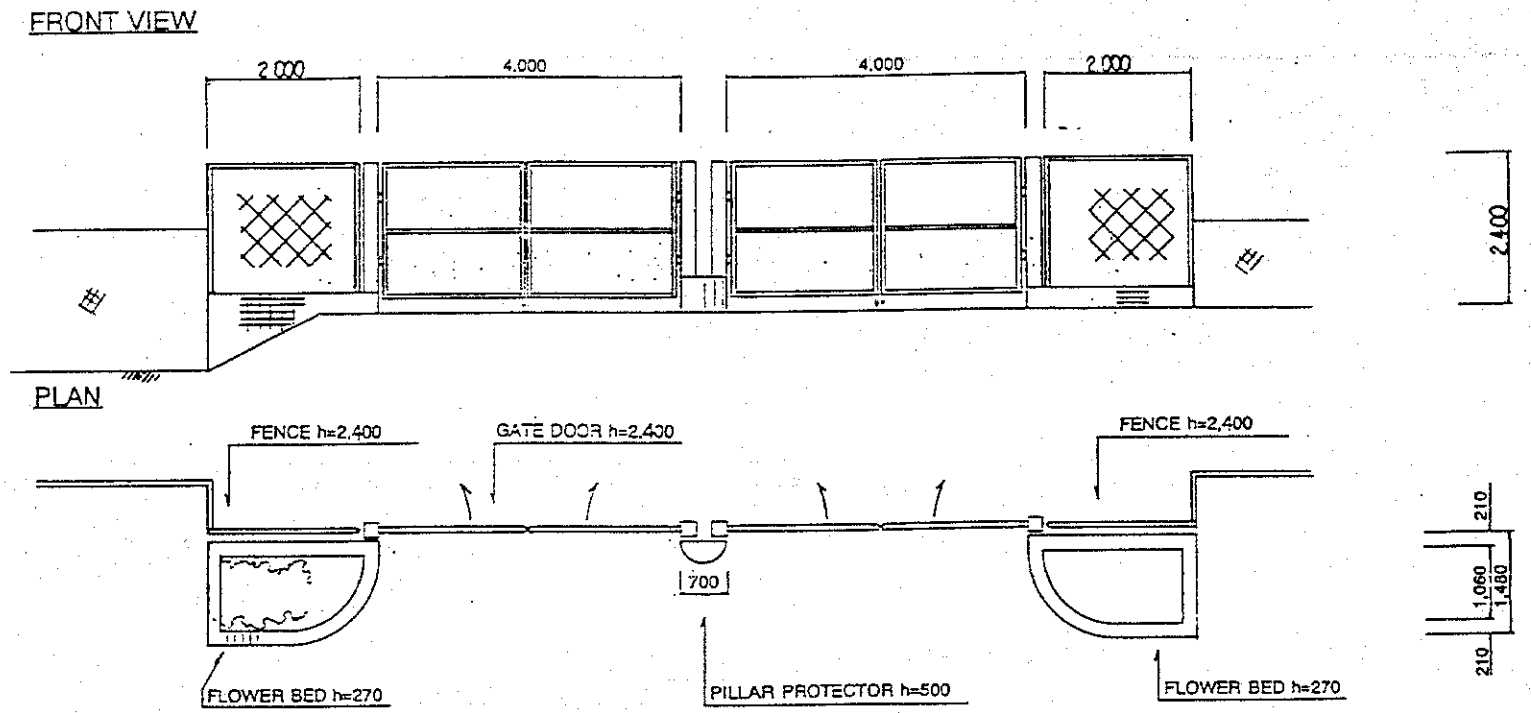
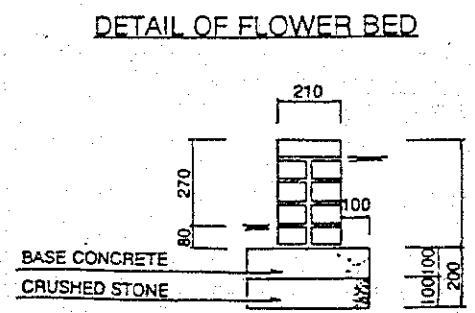
Figure L.2.4c Typical Cross Section of Approach Road

DETAILED PLAN OF GATE FACILITIES





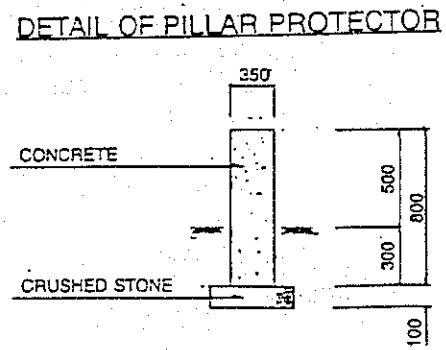


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Figure L.2.4d Gate Facilities

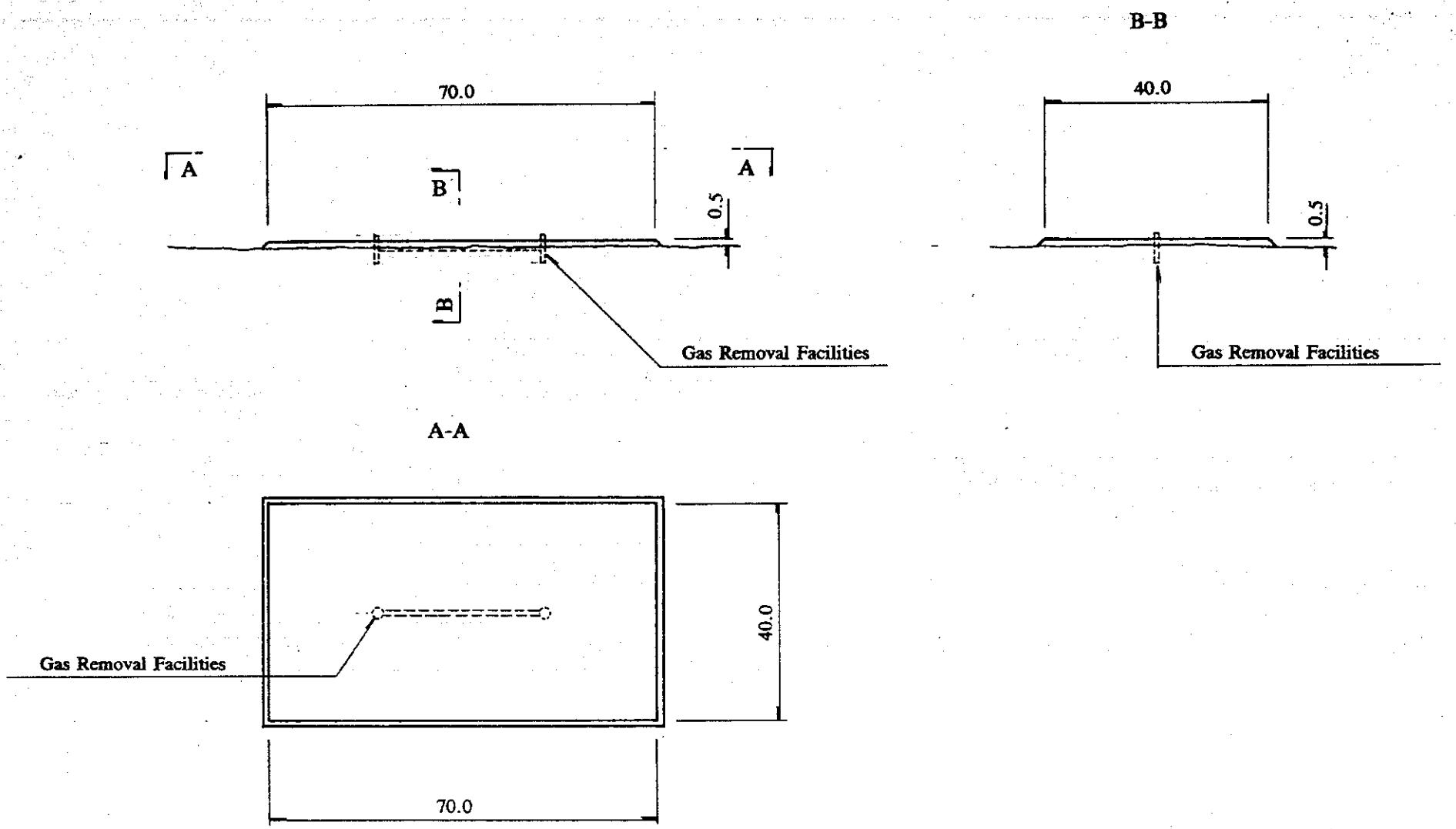

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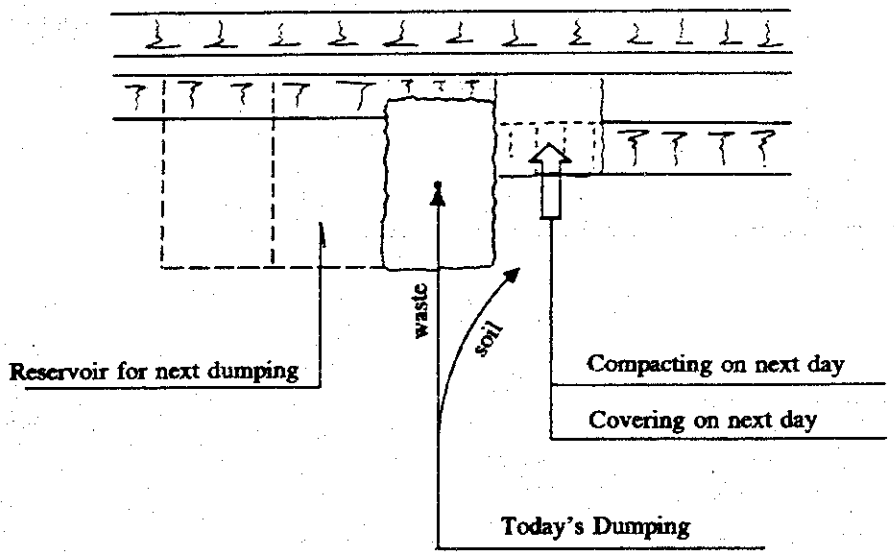
Figure L.2.4e Detail of Final Covering of the Wastes



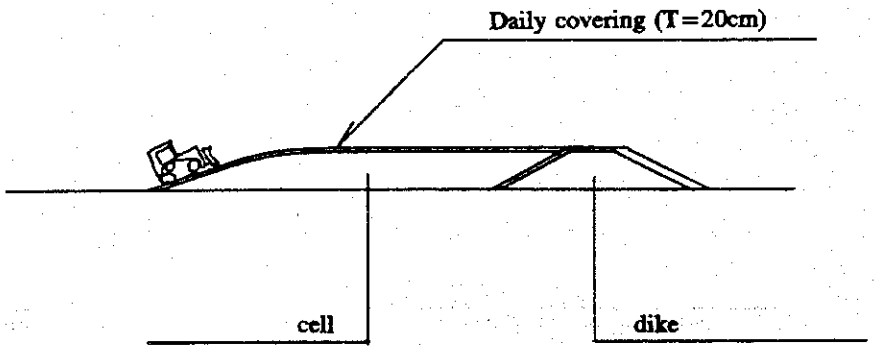
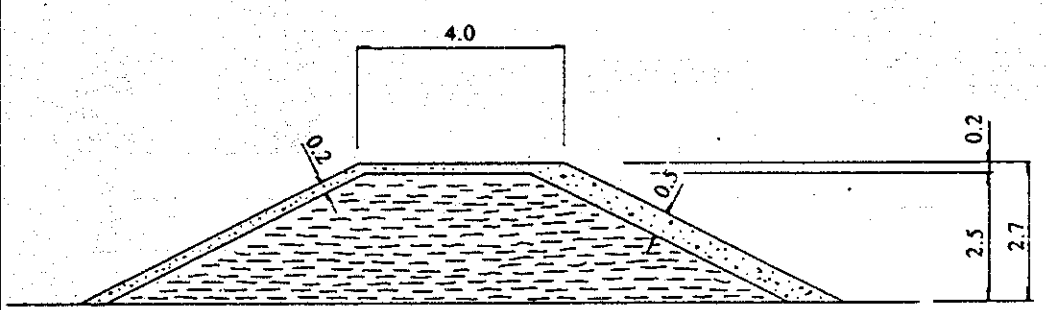


Figure L.2.4f Operation of Daily Covering of the Wastes

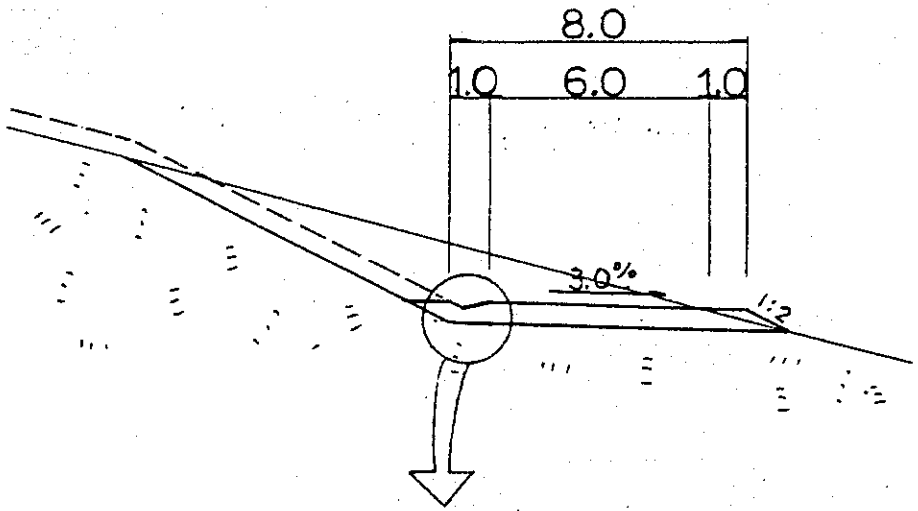
CROSS SECTION OF DIKE



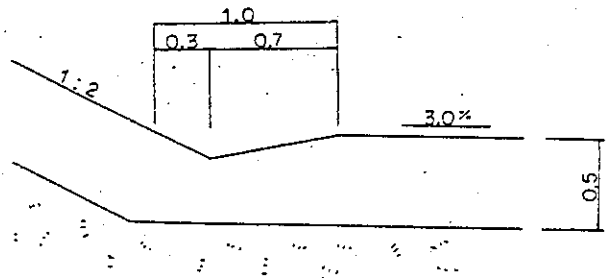
Inside of Disposal Site

Outside of Disposal Site

TYPICAL CROSS SECTION OF ACCESS ROAD FOR DIKE CONSTRUCTION



Side-Drain



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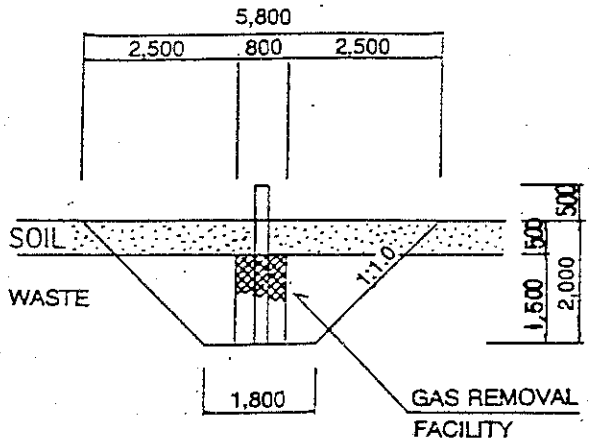
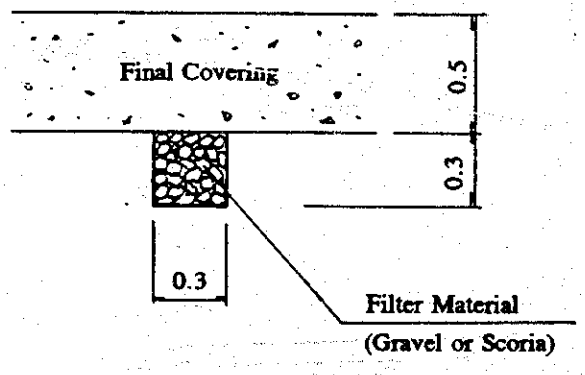
JAPAN INTERNATIONAL COOPERATION AGENCY

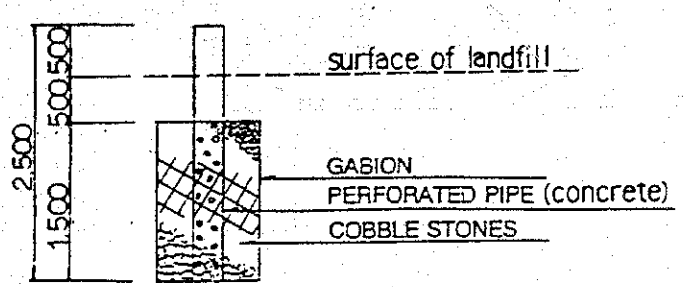
Figure L.2.4g Detail of Dike and Access Road for Dike Construction

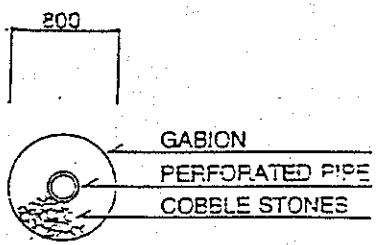
Vertical Gas Removal Facilities



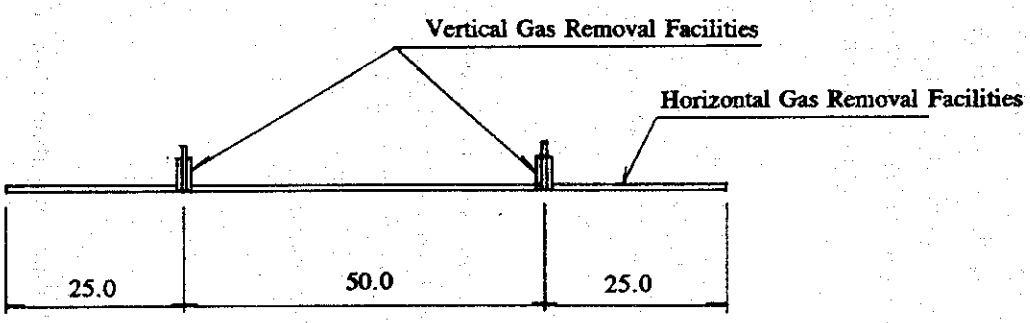
Horizontal Gas Removal Facilities



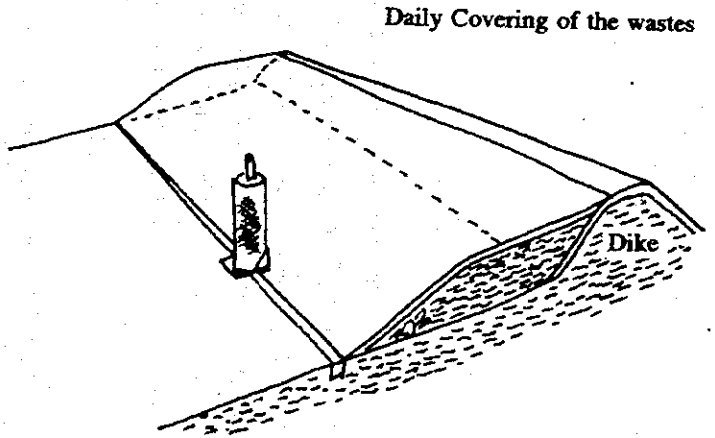




THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA	Figure L.2.4h Detail of Gas Removal Facilities (1)
JAPAN INTERNATIONAL COOPERATION AGENCY	

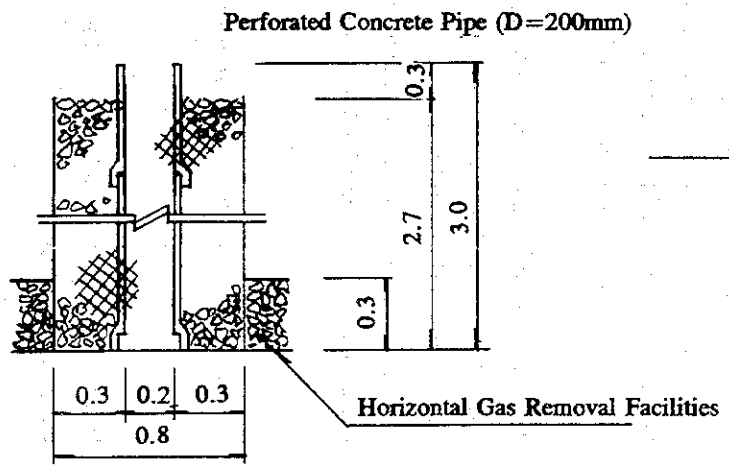


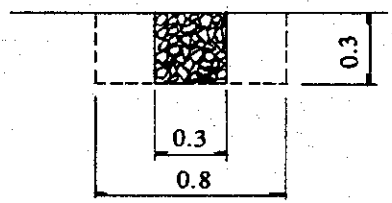
Illustrated Installation



Vertical Gas Removal Facilities

Horizontal Gas Removal Facilities





THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA

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Figure L.2.4i Detail of Gas Removal Facilities (2)

L.3 Public Education Campaign

L.3.1 Background

Generally, Public Sanitary Education consists of planned attempts to improve individual, group and communal behavior through lectures, events and advertising. However, in Nicaragua, as in most underdeveloped countries, public sanitary education has always been a response to urgent issues affecting the population rather than a long term goal. Governmental organizations lack resources, justifying the use of funds only when the issue in question has immediate and serious physical and political consequences.

Therefore, in Nicaragua, public sanitary education campaigns have been historically directed primarily towards the achievement of short term goals, placing special emphasis on matters affecting large segments of the population. This practice has created a habit among the Nicaraguan institutions responsible for the formulation of public education policies and among the population responding to them. The planning and implementation of public sanitary education programs are only carried out according to the degree of urgency and seriousness of the matters dealt with in the campaigns.

However, most educational techniques widely utilized in other countries to transmit campaign messages to the public are ineffective in Nicaragua. The low literacy rates, the economic crisis and the history of conflicts and natural disasters that have befallen Nicaragua have particularly rendered such techniques that are appealing to the society or environmental responsibility useless.

Therefore, public education campaigns must put emphasis on fear. They must instill fear in the minds of the population regarding consequences for the disregard of campaigns and not following its measures. On the other hand, the campaign must contain a positive message, because a campaign based solely on fear can create panic and disturb the MSWM services in a country like Nicaragua.

L.3.2 Objectives of the Public Education Campaign

With this background in mind, the objectives of the Public Education Campaign were set as follows:

- Explain the magnitude and urgency of the solid waste issue in the City of Managua.

- Stress the benefits of an adequate solid waste management and harm of an improper one on public health, welfare and the environment as related to the daily life of the general population.

- Point out that only through the active participation of the whole population can the problems related with solid waste in the community be solved.

- Underline the costs involved in solid waste management as a public service, and the effects of the populations improper waste management habits on SWM, i.e. illegal dumping increases the costs and reduces efficiency and so forth. Also, explain the problems faced by the Municipality in extending services to non collection areas.

- Promote adequate disposal habits and public participation in matters related to solid waste management, in particular on cleansing, storage and disposal manners as well as maintenance and use of facilities and equipment.

L.3.3 Methods of Public Education Campaign

Generally public education methods are divided into campaigns targeting the general or large segments of the population and those trying to reach limited and confined target groups. The first method utilizes mainly the mass media or indiscriminate general campaigns, while the second concentrates on reaching specific groups through costume designed campaigns, events and lectures.

The mass media can be used through paid advertising and through press releases and other forms of free coverage in television, radio, newspapers and magazines. In the long run this method is very effective because it reaches vast amounts of people at the same time, but because the message has to be very vague and general due to the diversity of the audience, its effectiveness is very difficult to evaluate in the short run. Also, this method is the most expensive and complicated, as large amounts of money and long periods of time are required to implement a campaign.

The techniques to reach limited target groups are endless and are generally divided between those targeting area groups, i.e. community centers, neighborhood associations, sports clubs and so forth, and those targeting social groups determined by such things as age, gender and religion, i.e. schools, women associations, churches, etc.

In targeting area groups, the goal is to focus the issue on its effects on the residents, thus appealing to the sense of community and brotherhood, creating a sense of awareness in which the residents of a certain area influence and control each other to change and/or modify inadequate habits. The problem with this method is finding a proper way to transmit the idea, because the educational level and the attention span of the average Nicaraguan citizen is very limited.

Social groups have the obvious advantage of having very narrow and precise target audiences. Schools particularly present an effective audience because children are very impressionable, curious and idealistic, so that it is very easy to transmit the message. However, by the same principle, it is also very easy for them to forget the issue at stake. Therefore, the biggest challenge regarding public education at schools is to design the campaign in such a way that they remember the main points of the campaign.

For the public sanitary education campaign, it would be best to utilize as many techniques as possible to evaluate their effectiveness. However, we must keep in mind that since in this particular case the campaign is a pilot project, the education methods must be selected based on their effectiveness in reaching determined target groups rather than in changing general customs and behaviors, so that its effects can be properly evaluated in the Study.

Therefore, the techniques selected for the Public Sanitary Education Experiment concentrate on meetings with the communities and lecturing at schools.

L.3.4 Public Education Campaign Tools

After determining the public education techniques, proper campaign tools must be prepared to increase their effectiveness. Besides the obvious background study and preparation of the lecturers, educational videos and booklets were prepared. The contents of this two educational tools are summarized below.

a. Educational Video

In a country with scarce economic, cultural and technical resources such as Nicaragua, any message transmitted in a high-tech medium, such as a video, is bound to gain automatic attention and credibility from the public. Moreover, a video can show very descriptive images of the present reality of the audience, so that they understand that it relates directly to them and not to some worldwide

fashion trend.

However, since the target audience for the video are socially diverse groups such as communities and schools, it is impossible to produce custom made videos for each target group. Therefore, the video must be aimed in a way that it can be effective with as wide a range of the population as possible without loosing its usefulness with specific target groups. The goal is to be as specific as possible without excluding a particular segment of the population.

The conclusion by the Study Team was to make a video targeted to the younger audience. The rationale being that youth is more susceptible and impressible, and at the same time they can have a strong influence on the older population. Moreover, within the youth, older teenagers were selected as the main target because children look up to them and adults don't find the message patronizing or condescending.

Regarding the contents and structure of the video, it had to be short, simple, concise and direct, so that the audience's mind doesn't have time to wonder off. The video's scenario is summarized below:

- The main characters are a boy and a girl in their late teens, very cheerful and enthusiastic and very "cool", using slang terminology and listening to modern music.

- The scenario follows the following format:

  . present MSWM situation in Managua in all its crudity(catch the audiences attention)
  . effects that this situation can have on each one of the members of the population in terms of health and the environment, such as pollution from burning dumps and leachate, and the vector threat from flies, rats and mosquitos transporting diseases as carrying agents (underline the importance of the issue through fear of the consequences)
  . proper cleaning, storage and disposal of solid waste (there are ways to avoid suffering the consequences of inadequate SWM manners)
  . benefits to the public as individuals as well as a community following this steps (positive final message conditioned to taking the preceding measures)

- The images concentrate on popular spots of Managua so that the whole audience relates to it.

- The issues are transmitted as warnings rather than as condescending messages.

The video is identified by the slogan "¿Que Pasa con la Basura?"(What is going on with waste?) and lasts for approximately 7 minutes.

b. Educational Booklet

The educational booklet must be designed to fit several purposes. It should complement the video so that they can be used jointly and it must be more general than the video so that its use is not confined to school education or community lectures. With this in mind, the booklet was designed as follows:

- Small, short and simple to avoid initial rejection by the public.
- Colorful and made with quality materials to encourage the people to keep it and study it.
- Layout with little text and many pictures and illustrations to avoid boredom.
- Impersonal text, with a general vocabulary not restricted to any particular age, gender, income, social, religious or interest group.
- Plot supportive of the video, i.e. present situation – harmful consequences – adequate measures to avoid such consequences – benefits of taking the measures.

The booklet is also identified by the slogan "¿Que Pasa con la Basura?"(What is going on with waste?) to create a homogeneous and global campaign by defining a unified message and it has twelve full colored and high quality pages.

L.3.5 Implementation of the Public Sanitary Education

As mentioned before, the methods selected by the Study Team for public sanitary education were through meetings with the community and school lectures.

a. Meetings with the Community

Public Sanitary Education through community meetings was carried out by the Study Team as part of the Collection Experiment and separately as a public education campaign in itself. Although both works are deeply interrelated, we must make a differentiation because of the slightly different campaign goals. The differences, goals, campaigns, etc. are summarized as follows:

aa. Meetings with the community for the Collection Experiment

In the Collection Experiment the purpose of the education program is not only to increase public awareness on SWM related issues, but also to promote the Collection Experiment itself and gain support and participation from the Community involved. Using the same rationale utilized for the general public education campaign, the main concern is to motivate a certain target community which currently doesn't receive collection services from the Municipality, to take initiatives to start a collection system.

This meetings were carried out at all candidate communities for the collection experiment. During this meetings, the following issues were discussed:

- benefits to health and the environment of the collection experiment
- relationship between diseases and solid waste
- common diseases in that community at present
- benefits of a regular waste collection
- labor problems associated with solid waste related diseases
- disease prevention
- the solid waste generated by each individual should be his responsibility, while the environment should be everybody's
- need for changes in bad habits and attitudes
- need for cooperation by the community
- how to cooperate with the collection experiment

From all the candidate communities, three were selected to carry out the collection experiment, at which time further meetings were held to discuss in further detail the said experiment. To insure the effectiveness of the collection experiment and consequently public sanitary education, the district officers, community leaders and residents of the selected areas agreed to:

- attend and help prepare meetings among all parties involved
- announce the meetings to the residents and other relevant persons asking them to attend

- attend and cooperate in all cleansing activities
- explain to all the residents the benefits of the collection experiment and the subsequent advantages of a proper SWM
- organization of a task force to manage the collection experiment
- promote the implementation of the measures applied to the collection experiment well beyond the finalization of the experiment

During the meetings, the Study Team observed that the main concerns of the residents were diseases related with SWM, specially the "dengue" which at the time was affecting large parts of the population. However, when the issue turned towards the environment and long term goals, people automatically became uninterested and absent minded.

ab. Meetings with the Community for Public Sanitary Education

Apart from the collection experiment, several meetings were held with the selected members of the three communities. The communities were chosen because of their low income levels and poor educational condition. The Study Team wanted to test the educational tools under the extremist conditions, to evaluate their potential and usefulness.

A television and video set were carried to the three communities. A lecture was performed by a member of the counterpart and a member of the Study Team, the video was shown and the booklets were distributed. In all cases it was observed that, although most people didn't understand everything, they were very interested, asking many questions and listening with attention. The residents, as in other areas and in previous meetings, were mainly concerned with SWM related diseases, and what measures they could take to avoid them.

b. Public Sanitary Education at Schools

As mentioned before, public sanitary education directed toward target groups placed emphasis on children in scholastic age. However, regretfully schools in Nicaragua have a summer holiday from the end of November until the beginning of February, so that the Study Team could not implement the campaign in schools.

Nevertheless, the younger members, particularly children, of the audience in community meetings were observed to be the most receptive of the video, booklet and issues discussed. The positive response from the youth during these meetings allow us to affirm, with a certain degree of certainty, that the public sanitary education designed by the Study Team would be very effective in educating school children.

L.3.6 Findings

Residents, as previously expected, are concerned with current SWM related issues such as diseases, aesthetics of their community and the consequences of an inadequate management system on their children and relatives. They are not concerned with long term effects and consequences and preservation of the environment as long as it doesn't affect them physically.

District offices have good organizational structures which can be very helpful in public education campaigns and other matters in need of communal participation. Also, the social promotion departments of the districts are very useful in obtaining public participation in such activities as the collection experiment, system modification and evaluations.

Surprisingly enough, residents presented a strong willingness to cooperate and participate in projects as long as their areas benefit from it, specially those projects related with sanitation or disease control. They also have some experience in the development and organization of communal projects. However, it must be noted that the Nicaraguan citizen, by nature, agrees to cooperate and participate in principle, but in fact is a lot less willing than he originally expressed.

The Environmental Bureau has a well organized Environmental Education Department managing and coordinating public education campaigns. This department has extensive experience regarding public education and has a history of strong cooperation with the district offices and the residents. The Environmental Education Department implements public education in three stages: publicity through the mass media and other channels; public awareness through lectures and person to person contacts; and practice through implementation events in which segments of the population such as communities and schools are asked to carry out measures stated in the campaigns in an experimental capacity, allowing the public to see for themselves the reality of the issues discussed in the public awareness campaigns.

Furthermore, the Municipality of Managua has approved a project by which the Environmental Bureau will increase its financial and physical resources. This project includes the construction of an environmental library and a video projection room which the Municipality plans to use in the future for environmental public education campaigns and programs. Also, the Environmental Bureau will use the educational tools prepared by the Study Team to maintain public education regarding SWM beyond the study period.

L.3.7 Recommendations

The Environmental Education Department should carry out all public education programs in the future for the Municipality. However, since Environmental Education is a broad subject, it should implement the campaigns not only as general environmental education effort, but also as specific goals to educate determined target groups specially in SWM related issues. For this purpose the Public Cleansing Office should have a Social Awareness, Social Promotion or Public Education section to cooperate with the Environmental Education Department in the coordination of all activities related with communal participation with the solid waste system in Managua.

Moreover, this new section as well as the Public Cleansing Office itself, should maintain the current relationship with the district offices, based on cooperation and assistance in achieving goals. Without the active participation of the citizens or an organism to coordinate and promote participation, it will be very difficult if not impossible to achieve any improvement.

The Municipality of Managua should establish a budget for the Environmental Education Department solely for the promotion and implementation of public sanitation programs and activities to achieve long term educational goals, besides the present assignment of budget according to the urgency of the issues. The budget should be sufficient to implement public sanitary education permanently. Also, the Public Cleansing Office should have its own budget for its own public education section, so that it can cooperate and participate in all public education activities regarding SWM and other public cleansing programs.

The Nicaraguan Health Ministry or MINSA is responsible for the welfare of all citizens, the Municipality should therefore coordinate its efforts with them to increase efficiency and reduce costs. Furthermore, MINSA has a Health Education Department and social workers which can be very helpful to the Municipality in implementing public education and citizen participation programs.

The Press Office of the Municipality of Managua should play an important role in the public sanitary education efforts. The Cleansing Department and specially the Environmental Education Department should inform the Press Office periodically about the environmental and health situation in Managua and their campaigns, events and other efforts to educate the public. At the same time the Press Office should constantly issue press releases to publications and television and radio stations. The population should become accustomed to seeing environmental issues in the media, keeping them informed on all efforts carried out by the Municipality

as well as all issues in need of attention in the community regarding the environment.

The Environmental Education Department should use the educational tools prepared by the Study Team to carry out public education. Specifically, this department should establish a program using those tools, and invite schools to attend environmental education sessions at the future environmental library and video projection room.

ANNEX M

IMMEDIATE IMPROVEMENT NEEDS AND PLAN

CONTENTS

LIST OF TABLES

ANNEX M IMMEDIATE IMPROVEMENT NEEDS AND PLAN

M.1 Immediate Improvement Needs

M.1.1 Criteria for Identification of Immediate Improvement Needs

The implementation of an immediate improvement plan is very important in view of the fact that the Basic Plan targets can be pursued only through step-wise improvement.

Immediate improvement needs were identified based on the following criteria:

i Possibility of immediate improvement

ii Efficient but inexpensive use of existing resources

iii Achievement of tangible improvement effects in a short time

iv Possibility of becoming a model for future improvement

M.1.2 Immediate Improvement Needs in the Study Area

According to the above mentioned criteria, the following MSWM immediate improvement needs in the Study Area were identified:

i Improvement of collection work efficiency

The collection service of the Public Cleansing Office covers 86 collection routes.

The data obtained for 4 months through the use of the truck scale states a large difference in the maximum and minimum waste amount hauled by collection vehicles. Using the output of the operation program, therefore, it is possible to examine the efficiency of each route.

ii Establishment of the collection system in a squat area

Collection services will be extended to squat areas since collection area A is almost entirely covered by the services at present. Although the container or bell collection system is proposed to be most suitable to the squat area, it is still important to conduct a study proving the collection system's workability

in the area.

iii Establishment of the system for improvement of area condition, i.e., roads and drains in squat area

Generally speaking, the provision of collection services is not a top priority to the residents of the area as there are other more pressing matters to attend to such as legalization of land tenure, improvement of housing facilities, drinking water, electricity, unemployment, etc.

However, it is advisable to combine the collection project with another equally important one, thereby forming an attractive package.

The improvement system was examined in the collection experiment.

iv Improvement of sanitary condition in the present Acahualinca disposal site

Open dumping of wastes has been carried out since 1975 and has been causing sanitary problems such as scattering of wastes, bad odor, propagation of noxious insects and incidental fire. In addition to the above, scavengers scatter wastes transported by vehicles on the approach road which is extended to the outer area of the disposal site, thereby corrupting the environment of the surrounding area as well. Measures should be immediately carried out to cope with this condition.

v Establishment of waste fee collection system in squat areas

The quality and quantity of collection services is directly proportional to the amount of waste fees collected. In view of the present financial situation of the municipality, therefore, a proper waste fee collection system should be established in order to extend services to other areas. Fee collection in area B may be difficult, however, since the majority of the residents are squatters without any fixed income. The possibility of implementing a fee collection system was examined in the collection experiment therefore.

vi Establishment of community organization for the sanitation of the squat area

There are some community organizations responsible for the enforcement of policies in the Study Area. Since the community plays an important role in keeping the environment sanitary, the collection experiment took into account matters involved in the establishment of a community organization.

vii Execution of public education on sanitary issues

Public Sanitary education is essential to improve sanitary condition. Since the sanitary education program in the Study Area is not satisfactory enough, the collection experiment carried out public sanitary education using videos and booklets.

M.1.3 Measures for each Immediate Improvement Need

The measures for each immediate improvement need are shown in Table M.1.3a.

Table M.1.3a Measures for each Immediate Improvement Need

Immediate Improvement Needs		Classification	Improvement Measures
1.	**Improvement of collection work efficiency**	Technical	Data from truck scale
2.	**Establishment of the collection system in a squat area**	Technical	Collection Experiment
3.	**Establishment of the system for the sanitation of the squat area**	Technical	Collection Experiment
4.	**Sanitation of the present Acahualinca disposal site**	Technical	Sanitary Landfill Experiment
5.	**Establishment of waste fee collection system in the squat area**	Institutional	Collection Experiment
6.	**Establishment of community organization for the sanitation of the squat area**	Institutional	Collection Experiment
7.	**Execution of public education on sanitation**	Institutional	Collection Experiment & Public Education Campaign

b. Examination of Improvement Measures

ba. Improvement of Collection Work Efficiency through Data Obtained by Truck Scale

In order to determine the disposal amount at the present Acahualinca disposal site, a load cell type truck scale was installed at the entrance of the site. Collection efficiency was examined by using the output of the operation program.

About 150 vehicle units, a maximum of 30 – 50 vehicles an hour, enter the Acahualinca disposal site daily, including Sundays. The operation program of the truck scale was developed taking this number into account.

After holding a discussion with the concerned authorities of Managua Municipality, incoming wastes were categorized as shown in Table M.2.1a.

Data on file were computerized and analyzed by the Study Team using the EXCEL system, and the following are the output:

i List of registered vehicles by incoming waste classification

ii Daily, weekly and monthly number of incoming vehicles in accordance with:

- classification of incoming wastes,
- categories of generation source,
- responsible organization for collection and haulage,
- type of wastes hauled directly.

iii Daily, weekly and monthly disposal amount according to the above-mentioned categories.

List of registered incoming vehicles, daily incoming waste amount by category and output of operation program are shown in Table M.2.1b, M.2.1c and M.2.1d, respectively.

Table M.2.1a Classification of Incoming Wastes to Acahualinca Disposal Site

Type of Waste	Responsible Organization	Generation Source		Code No.
MSW	Public Cleansing Office	Household	D1	10
			D2	20
			D3	30
			D4	40
			D5	50
			D6	60
			D7	70
		Market, Commercial Area and Institution		80
		Hospital		100
		RIDS		110
	District Coordination Office	Street Sweeping		120
	Beautification Office	Park and Green Area		130
	Direct Haulage by Private Sector	Bulky Waste	Household	140
			Office, Shop, Others	141
		Garden Waste	Household	142
			Office, Shop, Others	143
		Construction Waste	Household	144
			Office, Shop, Others	145
		Other Wastes	Household	146
			Office, Shop, Others	147
ISW	Public Cleansing Office	Factory		200
	Direct Haulage by Private Sector	Type of Waste Hauled	Paper	210
			Construction Waste	211
			Food Waste	212
			Metal	213
			Plastic	214
			Glass and Ceramic	215
			Textile	216
			Leather and Rubber	217
			Others	218
Soil				300
Recyclable				310
Others				320

RIDS: Registered Illegal Dump Site

Table M.2.1b Example of List of Registered Incoming Vehicles

	REGISTERED VEHICLES										
No.	PLATE	TYPE	MADE	MODEL	CAPACITY	TARE	CNT	SUM	AVG	MAX	MIN
277	043146	CAMIONETA	TOYOTA	DHNA (BU30)		2,970	21	18,400	876	1,390	170
278	043268	CAMIONETA	NISSAN	UAL-720M	1.5 TON.	1,300	1	60	60	60	60
279	043347					1,830	4	470	118	200	40
280	043384	CAMION	MITSUBISHI	CANTER	3 TON.	2,440	3	2,990	997	1,160	810
281	043578					1,590	1	540	540	540	540
282	04381					1,130	1	630	630	630	630
283	043866	CAMIONETA	NISSAN	TL-720 TZ.		1,200	2	1,270	635	800	470
284	043739	CAMIONETA	NISSAN	UTL720T3		1,000	1	400	400	400	400
285	04379	CAMION				8,020	13	29,200	2,246	11,900	560
286	04380					8,000	3	7,270	2,423	3,610	760
287	043812	CAMION	MERCEDES BENZ	N/R	8 TON.	5,750	8	8,760	844	1,280	210
288	04406	CAMION	MAZ		8 TON.	8,460	1	550	550	550	550
289	044173	CAMIONETA	KIA	CERES		1,610	1	680	680	680	680
290	04420					7,940	5	6,680	1,336	2,780	560
291	044231	CAMIONETA	TOYOTA	LN40	1.5 TON	1,440	1	1,060	1,060	1,060	1,060
292	044261	CAMION	VOLVO	F613		8,910	8	9,470	1,062	2,270	290
293	044288					3,100	1	90	90	90	90
294	04432					8,070	4	4,200	1,060	1,730	380
295	044416	AUTOMOVIL	DATSUN	1600	-	1,110	1	460	460	460	460
296	04460					7,950	1	450	450	450	450
297	044630	CAMIONETA	TOYOTA	STOUT (2000)	1.5 TON	1,620	1	360	360	360	360
298	044738					1,300	1	500	500	500	500
299	044746	CAMIONETA	KIA	3600	2 TON	1,430	1	380	380	380	380
300	044803	CAMIONETA	DATSUN	1200	1 TON.	1,200	1	340	340	340	340
301	044831	CAMIONETA	NISSAN	NR		1,360	3	2,780	927	1,020	870
302	044877	CAMIONETA	TOYOTA	LAND CRUSSER	1 TON	1,500	2	680	340	410	270
303	044990	CAMIONETA	TOYOTA	HILUX	1.5 TON	1,840	1	160	160	160	160
304	044997	CAMION	MITSUBISHI	T210	4 TON	2,840	1	1,740	1,740	1,740	1,740
305	045131	MICROBUS	MAZDA	N/R		1,060	5	2,620	524	760	190
306	045290	CAMION	IFA	W50		5,110	13	4,300	331	1,190	120
307	045336	CAMIONETA	MITSUBISHI	L200		1,690	2	380	190	190	190
308	04534					1,200	3	3,120	1,040	1,280	840
309	045357	CAMIONETA	DATSUN	BYNISSAN		1,620	1	230	230	230	230
310	045365	CAMIONETA	TOYOTA	LAND CRUISER	1 TON	1,810	7	1,130	161	210	80
311	04547	MICROBUS	UAZ	UAZ		1,760	3	1,020	340	760	130
312	045644	CAMIONETA	CHEVROLET	CUSTON		2,300	1	1,280	1,280	1,280	1,280
313	045880					1,420	1	10	10	10	10
314	04591	CAMIONETA	UAZ.	422013303		1,460	1	870	870	870	870
315	045911	CAMIONETA	TOYOTA	RN		1,630	8	6,470	884	1,210	200
316	046049	AUTOMOVIL	MITSUBISHI	A112		1,120	1	100	100	100	100
317	046386	CAMIONETA	TOYOTA	HILUX	1.5 TON	1,210	1	280	280	280	280
318	046420	CAMIONETA	CHEVROLET	1800	1 TON.	1,400	1	100	100	100	100
319	046661	CAMIONETA	ISUZU	NR		1,780	1	420	420	420	420
320	046699	CAMIOMETA	ISUZU	PUP		1,400	1	200	200	200	200
321	046809					2,180	3	670	223	430	120
322	046765	CAMIONETA	VOLKSWAGEN	1600		1,360	1	540	540	540	540
323	046776	CAMIONETA	VOLWAKGEN	1600		1,420	1	280	280	280	280
324	046849	CAMIONETA	NISSAN	N/R	2 TON	2,010	1	410	410	410	410
325	047109	CAMIONETA	MAZDA	VC121	1 TON.	1,370	1	260	260	260	260
326	047348					940	1	320	320	320	320
327	047848	CAMIONETA	DATSUN	NR.		1,170	1	300	300	300	300
328	048073	CAMIONETA	NISSAN	JUNIOR L140.		1,900	2	3,820	1,910	1,950	1,870
329	048218	CAMIONETA	FORD	RANGER KLT.		1,470	1	440	440	440	440
330	048247					1,200	3	1,570	523	1,020	220
331	048260	CAMIONETA	TOYOTA	1600		1,380	2	1,280	645	660	640
332	048288	FURGONETA	SUBARU	E10		950	1	210	210	210	210
333	048280	CAMIONETA	MITSUBISHI	K34TJUNSL.		1,400	1	400	400	400	400
334	048418	CAMIONETA	TOYOTA	HILUX	1.5 TON.	1,250	3	3,248	1,083	1,390	780
335	048630	CAMIONETA	MAZDA	1200	1.TON	1,000	27	5,880	210	480	80
336	048632					5,140	2	2,970	1,485	2,380	610
337	048634	CAMIONETA	DODGE	N/R		2,200	3	1,610	503	620	380
338	048758	CAMION				8,000	6	16,900	3,380	4,720	1,860
339	048874	CAMIONETA	TOYOTA	HILUX		1,180	1	170	170	170	170
340	049020	CAMIONETA	MAZDA	B 2000	1 TON.	1,100	1	660	660	660	660
341	049148	CAMIONETA	HYUNDAI	N/R		1,800	3	1,430	477	1,230	30
342	049289	CAMIONETA	TOYOTA	HILUX	1.5 TON.	1,200	12	20,200	1,683	2,400	1,170
343	049528					1,730	6	4,820	820	1,070	670
344	049567	CAMIONETA	TOYOTA	HILUX		2,000	2	1,480	740	940	540
345	049588					5,200	1	970	970	970	970
346	049864	CAMIONETA	TOYOTA	LAND CRUISSER		2,000	1	1,300	1,300	1,300	1,300
347	049979	CAMIONETA	TOYOTA	LAND CRUISSER	1 TON	1,950	1	350	350	350	350
348	04C20					11,910	363	#######	10,981	20,270	3,810
349	04C22	CAMION	WESTER STAR	CONVENCIONAL	16 M3	12,700	93	610,100	6,148	12,600	2,300
350	04C23					14,470	93	616,090	6,614	10,410	2,070
351	04C24	CAMION	MACK	R686S	16 M3	13,980	286	#######	8,166	12,020	1,300
352	04C25	CAMION CABEZAL	MACK	R686S	16 M3	14,580	52	342,340	6,583	13,410	340
353	04C27	1				12,300	3	21,900	7,300	9,120	6,680
354	04K100	CAMION RECOLECTOR	NISSAN	CPC14FHL	25M3	9,200	78	494,230	6,503	9,860	2,100
355	04K101	CAMION RECOLECTOR	NISSAN	CPC14FHL	25 M3	9,180	128	828,900	6,476	9,840	1,000
356	04K102	CAMION RECOLECTOR	NISSAN	CPC14FHL	25 M3	9,180	50	336,320	6,726	8,920	2,370
357	04K103	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,770	63	487,180	7,733	12,100	1,340
358	04K104	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,750	68	483,120	7,106	10,870	2,840
359	04K105	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,840	33	242,000	7,333	10,990	2,670
360	04K106	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,790	106	733,980	6,989	10,350	1,440
361	04K107	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,710	98	708,080	7,206	10,290	2,250
362	04K108	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,740	89	667,270	6,374	9,850	840
363	04K109	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,730	111	812,850	7,321	10,360	2,860
364	04K110	CAMION RECOLECTOR	IVECO	135-17A-	22 M3	9,720	89	687,060	6,596	9,790	1,240
365	04K111	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,680	74	523,340	7,072	11,360	1,670
366	04K112	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,720	89	649,368	7,286	10,680	1,230
367	04K113	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,840	135	908,980	6,733	9,920	700
368	04K114	CAMION RECOLECTOR	IVECO	135-17A	22 M3	9,730	93	678,970	7,301	11,540	970

Table M.2.1c Daily Incoming Waste Amount by Category

AMOUNT OF INCOMING WASTE TO ACAHUALINCA LANDFILL SITE - AUGUST 1994

AG094.XLS

COD	MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7	MON 8	TUE 9	WED 10	THU 11	FRI 12	SAT 13	SUN 14	MON 15	TUE 16
10	0.0	24.0	29.7	13.8	11.7	17.5	0.0	24.5	30.3	0.0	14.3	20.6	16.4	0.0	17.3	32.8
20	0.0	25.0	160.9	20.2	83.5	18.8	0.0	126.4	39.3	0.0	15.4	98.9	44.2	0.0	142.2	24.0
30	0.0	5.4	172.8	32.5	60.5	0.0	0.0	158.0	6.3	0.0	17.6	111.1	0.0	0.0	109.3	11.4
40	0.0	98.6	216.3	22.4	65.1	53.7	0.0	192.8	62.9	0.0	40.8	135.1	57.4	0.0	150.1	52.9
50	0.0	152.3	81.4	88.6	27.2	115.3	0.0	98.1	160.2	0.0	92.8	47.2	110.2	0.0	66.8	172.3
60	0.0	172.7	37.1	114.3	16.0	122.6	0.0	20.6	211.5	0.0	117.1	19.9	127.7	0.0	27.2	189.1
90	0.0	82.8	24.4	88.4	37.8	24.2	0.0	25.9	85.8	0.0	47.0	47.8	33.2	0.0	9.4	22.3
100	0.0	21.5	7.3	7.5	6.7	4.8	0.0	7.8	8.6	0.0	9.8	15.5	7.7	0.0	8.1	7.8
110	0.0	228.6	292.7	242.5	290.4	158.4	0.0	225.8	358.4	0.0	337.4	264.4	183.4	0.0	134.0	232.5
120	0.0	8.3	20.8	7.5	22.2	13.2	0.0	21.0	46.2	0.0	22.3	14.1	9.7	0.0	24.1	21.9
130	0.0	2.3	1.3	2.2	1.8	0.0	0.0	3.2	0.2	0.0	1.0	2.9	0.0	0.0	1.2	0.0
140	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
141	0.0	0.6	6.1	3.0	1.5	0.6	0.0	1.1	3.5	0.0	18.0	8.2	1.2	0.0	2.8	5.8
142	0.0	0.0	2.0	1.3	4.7	0.0	0.0	0.0	0.1	0.0	8.0	6.7	2.7	0.0	3.5	2.5
143	0.0	4.8	3.4	8.0	2.9	3.8	0.0	11.5	1.9	0.0	4.8	8.6	2.1	0.0	1.5	2.1
146	0.0	1.3	12.4	25.2	8.2	7.2	0.0	7.8	7.4	0.0	38.2	3.0	21.7	0.0	0.1	0.0
147	0.0	28.3	17.8	38.3	33.3	32.5	0.0	13.9	28.6	0.0	24.8	42.7	10.7	0.0	18.2	29.6
TOT-MSW	0.0	778.9	1,068.2	710.6	718.5	572.5	0.0	874.3	1,018.2	0.0	802.2	866.8	686.1	0.0	784.5	907.7
	MAX:	1,068.2	MIN:	0.0												
200	0.0	14.4	5.1	9.2	7.2	7.7	0.0	8.5	14.9	0.0	5.8	7.9	9.1	0.0	5.4	18.3
210	0.0	2.8	0.0	1.4	1.2	0.0	0.0	0.3	0.2	0.0	0.0	0.5	0.2	0.0	0.5	0.0
211	0.0	4.2	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	34.7
212	0.0	5.6	3.2	6.1	3.8	0.0	0.0	3.1	3.6	0.0	2.9	2.9	5.2	0.0	2.1	0.0
213	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
218	0.0	11.9	0.0	0.7	7.5	3.5	0.0	5.4	1.8	0.0	0.0	4.2	2.4	0.0	1.2	4.3
TOT-ISW	0.0	39.3	10.7	17.4	19.9	11.2	0.0	19.3	21.0	0.0	8.7	17.4	16.9	0.0	21.3	60.0
	MAX:	60.0	MIN:	0.0												
TOTAL	0.0	818.9	1,079.9	728.0	738.4	583.7	0.0	893.7	1,039.2	0.0	810.8	884.2	612.0	0.0	806.3	967.7
	MAX:	1,079.9	MIN:	0.0												

COD	WED 17	THU 18	FRI 19	SAT 20	SUN 21	MON 22	TUE 23	WED 24	THU 25	FRI 26	SAT 27	SUN 28	MON 29	TUE 30	WED 31	TOT/TN	AVG/TN
10	14.1	14.6	12.6	14.9	0.0	17.8	11.9	17.1	30.2	13.7	14.4	0.0	21.8	26.5	12.7	474.2	15.3
20	83.7	12.9	88.4	18.9	0.0	100.5	15.1	100.3	12.8	85.6	17.9	0.0	110.3	28.4	94.2	1,860.3	60.0
30	71.5	17.7	80.3	16.1	0.0	88.6	12.6	104.8	19.9	92.7	0.0	0.0	136.7	9.4	83.5	1,488.5	48.0
40	98.7	32.7	100.3	38.4	0.0	99.5	32.7	130.6	57.8	84.6	48.5	0.0	146.9	62.0	92.8	2,137.2	68.9
50	25.0	98.8	31.8	87.7	0.0	39.8	99.3	43.7	168.6	29.8	82.1	0.0	48.4	148.8	23.3	2,096.5	67.6
60	17.6	116.1	8.0	100.0	0.0	11.3	85.5	21.3	180.3	14.4	96.8	0.0	19.8	192.0	11.3	2,060.6	66.5
90	36.3	8.4	30.6	13.0	0.0	33.8	30.3	51.4	17.8	25.3	18.7	0.0	30.9	40.8	27.6	816.3	26.3
100	12.9	5.8	6.9	3.3	0.0	7.3	4.8	7.8	8.9	5.8	4.3	0.0	10.6	12.9	12.7	218.1	7.0
110	229.7	253.1	246.0	65.2	0.0	151.8	144.4	185.1	164.4	138.2	209.2	0.0	248.9	246.3	270.3	5,522.3	178.1
120	12.9	1.0	11.7	6.4	0.0	18.7	22.9	28.7	18.6	39.9	2.5	0.0	29.3	29.7	12.7	482.5	15.6
130	0.0	0.0	0.0	0.0	0.0	1.3	2.1	4.1	1.1	1.1	0.0	0.0	2.1	0.8	4.2	32.8	1.1
140	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
141	2.4	1.9	0.2	4.0	0.0	2.2	1.4	1.3	0.5	0.4	1.4	0.0	2.7	1.9	2.8	73.3	2.4
142	6.4	6.0	1.0	0.3	0.0	5.5	5.8	21.6	3.6	2.3	0.4	0.0	5.7	2.3	1.2	81.3	2.6
143	4.7	0.8	4.2	38.8	0.0	2.7	4.7	1.3	12.7	1.2	1.5	0.0	4.0	2.8	3.8	138.2	4.4
146	0.0	4.0	0.0	6.4	0.0	8.8	12.9	10.2	5.6	15.9	8.1	0.0	7.5	1.9	0.1	208.4	6.7
147	20.7	14.7	13.4	3.4	0.0	16.8	5.5	48.8	17.3	20.8	7.1	0.0	16.7	6.2	7.6	511.1	16.5
TOT-MSW	838.2	688.3	844.2	436.8	0.0	618.4	501.3	780.1	728.6	590.9	517.8	0.0	846.0	814.1	821.6	17,870.3	576.5
200	6.5	10.5	8.7	10.2	0.0	7.4	9.8	8.5	21.5	4.1	10.6	0.0	6.5	11.8	5.5	230.0	7.4
210	0.0	0.1	2.9	1.1	0.0	0.0	0.0	0.8	0.2	0.2	0.0	0.0	0.3	0.0	0.0	12.2	0.4
211	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7	1.8
212	5.9	3.0	5.3	0.0	0.0	1.8	0.7	2.1	2.7	1.8	6.2	0.0	2.4	4.9	7.1	83.3	2.7
213	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	1.1	0.0	4.1	0.1
214	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.1
216	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.4	0.0
218	4.2	2.9	5.5	5.7	0.0	0.7	1.5	0.0	2.4	0.0	0.0	0.0	0.0	0.0	1.2	70.9	2.3
TOT-ISW	17.7	21.2	21.0	18.4	0.0	9.8	11.9	8.4	27.8	8.6	16.8	0.0	9.3	17.3	13.8	461.3	14.9
TOTAL	853.9	610.6	867.2	456.3	0.0	628.3	513.2	788.6	756.4	599.3	534.6	0.0	854.9	831.3	835.3	18,337.6	591.5

NUMBER OF INCOMING VEHICLES BY CATEGORY TO ACAHUALINCA LANDFILL SITE - AUGUST 1994

COD	MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7	MON 8	TUE 9	WED 10	THU 11	FRI 12	SAT 13	SUN 14	MON 15	TUE 16
10	0	4	5	2	2	3	0	4	4	0	2	3	3	0	3	5
20	0	4	25	3	18	3	0	19	7	0	2	17	7	0	22	4
30	0	1	31	4	15	0	0	25	1	0	3	19	0	0	28	2
40	0	9	32	6	12	10	0	22	8	0	8	23	9	0	22	8
50	0	25	12	17	4	19	0	9	23	0	15	8	19	0	10	27
60	0	32	3	18	2	18	0	3	34	0	20	3	21	0	4	31
90	0	8	4	11	6	3	0	3	7	0	5	8	4	0	1	3
100	0	3	1	2	2	1	0	2	2	0	2	2	2	0	2	2
110	0	50	63	40	46	32	0	47	81	0	64	56	30	0	24	43
120	0	2	6	5	8	4	0	5	10	0	8	8	2	0	7	6
130	0	2	2	3	2	0	0	2	1	0	2	2	0	0	1	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
141	0	2	9	5	3	1	0	3	7	0	7	7	3	0	2	8
142	0	0	6	2	5	0	0	0	2	0	13	10	8	0	9	7
143	0	6	6	7	5	6	0	9	4	0	1	10	5	0	4	5
146	0	3	3	12	3	4	0	3	3	0	12	4	2	0	1	0
147	0	39	36	38	36	41	0	22	34	0	37	41	22	0	24	22
TOT-MSW	0	180	244	175	173	146	0	178	208	0	201	221	143	0	164	173
	MAX:	244	MIN:	0												
200	0	3	1	2	1	2	0	1	3	0	1	2	2	0	1	4
210	0	2	0	2	2	0	0	2	1	0	0	2	1	0	1	0
211	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3	5
212	0	4	6	6	8	0	0	2	3	0	2	1	2	0	1	0
213	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
214	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
216	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
218	0	6	0	2	6	4	0	4	1	0	0	5	2	0	1	4
TOT-ISW	0	18	8	12	18	6	0	9	9	0	3	10	8	0	7	14
	MAX:	18	MIN:	0												
TOTAL	0	208	262	187	189	151	0	187	217	0	204	231	151	0	171	187
	MAX:	262	MIN:	0												

COD	WED 17	THU 18	FRI 19	SAT 20	SUN 21	MON 22	TUE 23	WED 24	THU 25	FRI 26	SAT 27	SUN 28	MON 29	TUE 30	WED 31	TOTAL	AVG
10	2	2	2	3	0	3	2	3	5	2	2	0	4	4	2	76	2
20	15	3	18	4	0	17	2	18	2	18	3	0	17	5	16	263	8
30	18	3	19	2	0	18	2	20	3	19	0	0	24	2	12	248	8
40	18	5	15	7	0	16	4	23	9	15	8	0	22	10	13	332	11
50	4	16	5	15	0	5	13	8	27	5	16	0	8	26	4	338	11
60	3	19	1	16	0	2	14	3	30	2	15	0	2	33	2	332	11
90	4	2	4	2	0	5	4	8	3	3	3	0	2	8	4	114	4
100	3	2	2	1	0	2	1	2	2	2	2	0	2	4	3	61	2
110	38	50	47	15	0	30	25	36	33	27	41	0	48	55	57	1,066	34
120	5	1	5	2	0	7	7	7	7	9	1	0	8	9	6	143	5
130	0	0	0	0	0	1	1	1	1	1	0	0	3	1	2	26	1
140	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
141	4	2	1	8	0	3	5	2	2	3	2	0	2	5	4	100	3
142	15	8	2	2	0	8	10	11	7	6	2	0	6	9	3	166	5
143	11	4	8	11	0	6	7	1	15	3	4	0	9	5	4	159	5
146	0	2	0	3	0	3	6	5	3	10	8	0	5	2	1	102	3
147	19	28	21	13	0	26	14	35	30	34	18	0	24	20	13	686	22
TOT-MSW	154	147	148	104	0	163	117	181	179	167	121	0	198	196	146	4,204	136
200	1	2	1	2	0	1	2	1	5	1	3	0	1	3	1	47	2
210	0	1	2	2	0	0	0	3	1	1	0	0	1	0	0	24	1
211	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
212	1	1	8	0	0	2	2	2	1	1	1	0	3	3	3	62	2
213	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	5	0
214	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	6	0
216	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	4	0
218	5	2	5	3	0	1	1	0	2	0	0	0	0	0	1	66	2
TOT-ISW	7	8	18	10	0	4	6	7	10	4	4	0	6	7	6	214	7
TOTAL	161	166	166	114	0	167	122	188	188	181	126	0	181	203	161	4,418	143

Table M.2.1d(1) Output Operation Program

MONTHLY DISPOSAL AMOUNT (Unit: ton/month)

CODE	AUG	SEP	OCT	NOV	AVG
10	474.2	428.1	541.9	506.8	487.8
20	1,560.3	1,442.3	1,691.3	1,597.1	1,572.7
30	1,486.5	1,350.5	1,612.6	1,661.5	1,527.8
40	2,137.2	1,986.7	2,423.9	2,236.8	2,196.2
50	2,095.5	1,978.8	2,340.7	2,301.2	2,179.1
60	2,060.0	1,943.1	2,256.4	2,220.9	2,120.1
70	0.0	0.0	0.0	0.0	0.0
80	815.3	745.1	919.7	874.5	838.6
100	218.1	175.1	174.8	198.9	191.7
110	5,522.3	8,110.2	8,037.4	7,027.4	7,174.3
120	452.5	481.9	486.2	587.8	502.1
130	32.6	57.6	58.7	25.6	43.6
140	0.7	0.0	0.0	0.0	0.2
141	73.3	40.3	66.5	80.0	65.0
142	91.3	110.9	108.3	89.7	100.1
143	136.2	120.3	90.6	138.8	121.5
144	0.0	0.9	0.7	0.0	.4
145	209.4	218.8	227.5	226.4	220.5
146	0.0	8.9	26.5	26.9	15.6
147	511.1	492.3	582.0	485.2	517.6
TOT-MSW	17,876.3	19,691.7	21,645.6	20,285.5	19,874.8
200	230.0	261.4	300.3	293.7	271.4
210	12.2	6.5	4.0	3.2	6.5
211	56.7	14.4	26.2	61.8	39.8
212	83.3	60.3	53.0	38.7	58.8
213	4.1	5.8	1.0	0.0	2.7
214	2.7	3.4	0.0	0.6	1.7
215	0.0	3.4	13.0	1.8	4.5
216	1.4	1.0	1.6	0.0	1.0
217	0.0	0.0	5.2	4.3	2.4
218	70.9	26.5	31.6	29.9	39.7
TOT-ISW	461.3	382.6	435.8	433.9	428.4
TOTAL	18,337.7	20,074.3	22,081.3	20,719.4	20,303.2

MONTHLY DISPOSAL AMOUNT (Unit: ton/month)

Items	August	September	October	November	Average
Month	18,337.7	20,074.3	22,081.3	20,719.4	20,303.2
Day	591.5	669.1	712.3	690.6	665.9

MONTHLY MSW, ISW AMOUNT (Unit: ton/month)

Items	August	September	October	November	Average
MSW	17,876.3	19,691.7	21,645.6	20,285.5	19,874.8
ISW	461.3	382.6	435.8	433.9	428.4
TOTAL	18,337.7	20,074.3	22,081.3	20,719.4	20,303.2

Table M.2.1d(2) Output of Operation Program

MONTHLY DISPOSAL AMOUNT BY CATEGORY (Unit: ton/month)

Items	August	September	October	November	Average
HOUSEHOLDS	9,813.7	9,129.5	10,866.7	10,524.3	10,083.5
MARKETS/COM	815.3	745.1	919.7	874.5	838.6
HOSPITALS	218.1	175.1	174.8	198.9	191.7
RIDS	5,522.3	8,110.2	8,037.4	7,027.4	7,174.3
STREETS	452.5	481.9	486.2	587.8	502.1
PARKS	32.6	57.6	58.7	25.6	43.6
DIRECT	1,021.8	992.4	1,102.0	1,047.0	1,040.8
TOTAL MSW	17,876.3	19,691.7	21,645.6	20,285.5	19,874.8
FACTORY	230.0	261.4	300.3	293.7	271.4
DIRECT	231.3	121.2	135.5	140.2	157.0
TOTAL ISW	461.3	382.6	435.8	433.9	428.4
TOTAL	18,337.7	20,074.3	22,081.3	20,719.4	20,303.2

MONTHLY DISPOSAL AMOUNT OF EACH DEPARTMENT AND DIRECT HAULAGE AMOUNT (Unit: ton/month)

Items	August	September	October	November	Average
PCO	16,599.5	18,421.2	20,298.9	18,918.8	18,559.6
DCO	452.5	481.9	486.2	587.8	502.1
BO	32.6	57.6	58.7	25.6	43.6
PRIVATE	1,253.1	1,113.6	1,237.5	1,187.2	1,197.8
TOTAL	18,337.7	20,074.3	22,081.3	20,719.4	20,303.2

MONTHLY DISPOSAL AMOUNT OF PRIVATE SECTOR (MSW) (Unit: ton/month)

Items	August	September	October	November	Average
BULKY	73.9	40.3	66.5	80.0	65.2
GARDEN	227.4	231.2	198.9	228.6	221.5
CONSTRU	209.4	219.7	228.1	226.4	220.9
OTHERS	511.1	501.2	608.5	512.1	533.2
TOTAL	1,201.8	992.4	1,102.0	1,047.0	1,040.8

MONTHLY DISPOSAL AMOUNT OF PRIVATE SECTOR (ISW) (Unit: ton/month)

Items	August	September	October	November	Average
PAPER	12.2	6.5	4.0	3.2	6.5
CONSTRU	56.7	14.4	26.2	61.8	39.8
FOOD	83.3	60.3	53.0	38.7	58.8
METAL	4.1	5.8	1.0	0.0	2.7
PLASTIC	2.7	3.4	0.0	0.6	1.7
GLASS	0.0	3.4	13.0	1.8	4.5
TEXTILE	1.4	1.0	1.6	0.0	1.0
LEATHER	0.0	0.0	5.2	4.3	2.4
OTHERS	70.9	26.5	31.6	29.9	39.7
TOTAL	231.3	121.2	135.5	140.2	157.0

bb. Establishment of Collection System in the Squat Area using the Basic Plan Proposed in the Collection Experiment

The following collection systems were applied in the collection experiment according to conditions prevailing in the squat area:

- Container collection system using a primary collector:

  Applied to wide areas without access roads for collection vehicles. This system obliges residents to discharge their waste in front of their premises in order for them to be collected and transported by the primary collector employed by the community to the communal container.

- Bell collection system using a compactor truck:

  Applied to areas with main roads for collection vehicles. Upon the arrival of a collection vehicle at a given collection point, the collector calls out to the residents to discharge their waste.

To prove the suitability of the collection systems the following points were examined:

- storage of waste in houses
- discharge of waste according to collection schedule
- working capability of primary collector
- Municipal collection work according to collection schedule
- efficiency of collection work

The results are detailed in ANNEX L, L.1.5.

More than 70% of the households in the experiment area participated in the collection experiment, especially in Carlos Marx where participation almost reached 100%. The figures are indicative of the residents approval of the collection systems carried out in the experiment.

bc. Establishment of the system for sanitation using the Basic Plan Proposed in the Collection Experiment

The following activities were implemented during the collection experiment to prove the feasibility of the system:

- Cleansing activities.

  Littering is widely observed in vacant areas, channels and roadsides. The community cleaned the area with the help of the PCO and district offices prior to the arrival of cleansing services.

- Improvement activities.

  The absence of a drainage system in the area leaves drain water flowing freely on roads. With the help of the municipality, the community constructed drains and improved road conditions prior to the start of collection services.

The results are detailed in ANNEX L, L.1.5.

Problems on road condition and drainage system still remain, however, due to geological influences and lack of equipment. Nevertheless, these activities were proven to be important to the sanitation of the squat areas.

bd. Sanitation of the Present Acahualinca Disposal Site by the Basic Plan Proposed in the Sanitary Landfill Experiment.

The Study Team and ALMA carried out several sanitary landfill experiments for the sanitation of the present Acahualinca disposal site of which the (a) covering of wastes and (b) construction of dikes were the most effective.

bda. Covering of wastes

The Public Cleansing Office, under the supervision of the JICA Study Team and counterparts, covered the wastes in areas where landfill is completed and in progress. Aside from independently carrying out daily waste covering activities, PCO also carried out final covering in the area where landfill is completed, in collaboration with the Municipal Maintenance Works Office. The details of the waste covering activities are mentioned in ANNEX L.

It should be especially noted that the daily waste covering activities of PCO did not cost PCO additional expenses because the covering material used was soil included in wastes transported to the disposal site.

Sanitary landfill through waste covering activities was proven to bring about the following effects:

- prevent the scattering of lighter wastes
- prevent the generation of bad odor
- prevent the propagation of noxious insects
- prevent fires

bdb. Construction of dike

Dikes were constructed in the present Acahualinca disposal site by ALMA: one to serve as a boundary between the shores of Managua lake and the disposal site and, the other at the site where daily waste covering activities are carried out. In order to curtail construction cost, waste was used to form the body of the dike, while soil was used to cover the surface.

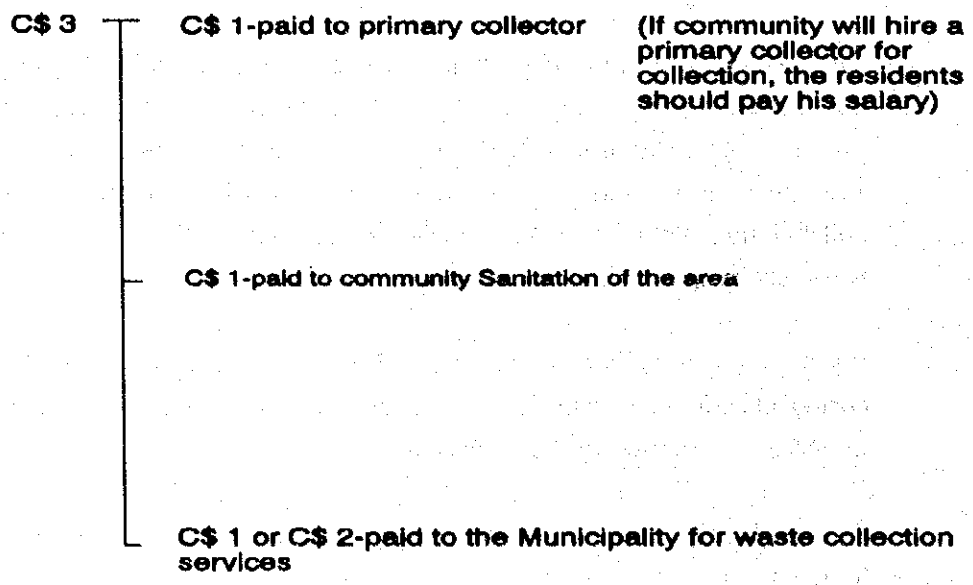
The construction of the dike resulted in the following:

- identification of landfill area
- prevention of scattering of wastes
- prevention of disorderly waste spreading activities

The continuous execution of these measures by PCO is also proven to be possible as the construction cost involved is inexpensive.

be. Establishment of Waste Fee Collection System in the Squat Area using the Basic Plan proposed in the Collection Experiment

The waste fee system shown below was established in the collection experiment:



The results are detailed in ANNEX L.

For an orderly arrangement of the collected fees, the Study Team recommended the formulation of a group of more than three members in the experiment to manage the accounts.

Since the importance of a waste fee collection system for the expansion of collection services has been proven, it will be established according to the manner of collection used in the collection experiment.

bf. Establishment of Community Organization for the Sanitation of the Squat Area using the Basic Plan proposed in the Collection Experiment

The roles of the community organization are as follows:

- contract primary collectors
- contract residents for collection services
- fee collection and management
- establish coordination between the residents and Municipality regarding sanitation activities

The results are detailed in ANNEX L.

The percentage of participating households, amount of fee collected and the degree of coordination observed vary by community during the experiment. The establishment of a community organization was proven to be greatly significant to the extension of collection services and sanitation of the squat area.

bg. Execution of Public Sanitary Education through the Collection Experiment and Public Education Campaign

Public education campaigns were carried out during the pilot projects in the following occasions:

- meetings held with residents during the collection experiment
- educational videos were shown during youth assemblies

The results are detailed in ANNEX L.

Public education programs conducted especially for the youth were proven to be effective in heightening public awareness on sanitary issues.

M.2 Immediate Improvement Plan

Immediate improvement needs and their corresponding measures were identified and studied, respectively, to effectively improve the present situation using existing and available resources and curtail enormous expenses, and to prove the project's potential of becoming a model for future improvement. The results led to the projection of the following immediate improvement plan.

M.2.1 Technical System

a. Improvement of Collection Work Efficiency

The data obtained by truck scale is useful to the management of collection vehicles. PCO should therefore continue the operation program even after the experiment to be able to constantly analyze data and improve collection work efficiency.

b. Establishment of a Collection System in the Squat Area

The container collection system using a primary collector and bell collection system using compactor trucks are the collection systems suitable to squat areas, and through these collection systems, collection areas can be extended.

In order to serve the entire city, the Municipality should follow the methods carried out in the collection experiment.

c. Establishment of the System for the Sanitation of the Squat Area

Aside from waste collection services, the improvement of roads and drains is also important in the sanitation of an area. Therefore, the Municipality should not only establish a waste collection system but a sanitation system as well.

d. Sanitation of the present Acahualinca Disposal Site

Waste covering activities and the construction of dikes are effective countermeasures for the sanitation of the disposal site. The present disposal operation cost will not be affected by the daily waste covering and dike construction activities because these activities do not require any additional investment, as explained in previous sections. Accordingly, the Public Cleansing Office must continue carrying out these measures after the sanitary landfill experiment is completed as they can afford to do so.

Final waste covering operations need twice as much soil used in the daily covering

operations and would therefore cause PCO extra expenses for hiring haulage services as it does not have enough haulage equipment. But since it is very important to the sanitation of the Acahualinca disposal site and the future utilization of the area, PCO is requested to carry out such operations, employing any means possible.

PCO is also requested to devise measures that would regulate scavenger activities in the disposal site, as these usually cause the insanitation of the area.

M.2.2 Institutional System

a. Establishment of Waste Fee Collection System in Squat Areas

The experiment proved that a waste fee collection system is necessary to extend collection services to the entire city area.

The Municipality should therefore establish a waste fee collection system in squat areas according to the basic plan proposed in the collection experiment.

b. Establishment of Community Organizations for the Sanitation of Squat Areas

The experiment proved the importance of the establishment of a community organization for the extension of collection services to the entire city area and the sanitation of squat areas.

The District Offices should assist the communities in the establishment of organizations based on the basic plan proposed in the collection experiment.

c. Execution of Public Education Programs on Sanitary Issues

The execution of public education activities on sanitary issues is proven to be essential to the achievement of the targets of the MSWM Master Plan.

The Municipality should establish public education programs on sanitary issues based on the pilot project conducted by the Study Team.

ANNEX N

GENERAL RECOMMENDATION FOR THE IMPROVEMENT OF ISWM AND MSWM

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LIST OF TABLES

LIST OF FIGURES

ANNEX N GENERAL RECOMMENDATION FOR THE IMPROVEMENT OF ISWM AND MSWM

N.1 Study on the Present Industrial Solid Waste Management (ISWM)

N.1.1 Study Methods

a. Scope of the Study

The study intends to prepare general recommendations for the improvement of ISWM in the Study Area based on a rapid diagnosis study.

b. Study Methods

Due to time limitations the rapid diagnosis study was only carried out for a month. One should bear in mind, therefore, that there are certain limitations to the utilization of the study results in view of the reliability and accuracy of data obtained. In order to make a rapid diagnosis on the present ISWM, the following surveys were conducted:

- data collection from responsible agencies on the present ISWM, i.e. Ministry of Environmental & Natural Resources (MARENA) and Managua Municipality (ALMA).
- questionnaire survey of the producers of ISW.
- field survey such as observation on the incoming ISW at the present landfills and field reconnaissance on illegal dumping sites.

c. Study Flow

The study was executed according to the flow chart shown in Figure N.1.1a.