# Annex J

*Survey on Public Participation*

Contents

# J Survey on Public Participation

## J.1 General Situation

The citizen's participation in the solid waste management is considered weak. The habit of improperly disposing the waste in containers and in the streets is seen in many places in the city. The citizen's participation tends to be related to the quality of the service provided. In general, the majority of citizens understand that the municipality should deal with the problems, and therefore the citizens' attitude regarding the payment service is negative.

There is no participation of the community on the waste management decisions. At present, the decisions have been executed only by the political actors and they decide the human, economic and technological resources. The practitioners who have SWM knowledge and know the real situation cannot achieve their objectives because of no available access to decision making levels.

Generally, a community belongs to the services entities through barrios' organizations, NGO, and through the Public Attendance Department of ADN. When the collection service is not given appropriately, they request through phone calls or written communications to the entities in charge. In addition, they often directly contact with the representatives of the technical and political sectors. The contacts are informal and does not exist formal mechanisms that facilitate the community participation.

The ADN directorate which is responsible for the collection and final disposal of the waste is not directly related and neither act in a coordination with the institutions related to the environment problems.

In the ND, they have experience of coordination between community groups, environmentalist NGOs' and the cooperation of the EU for some marginal barrios.

## J.2 Customer Service (complaints and answers)

The customer service department of the Billing and Collection Directorate of ADN is in charge to receive the calls and assist the clients that pays the cleansing service. The payers that emit complaints to this department are assisted during 9 days. Once the call is received they send it to the corresponding office. If the problem is related with the collection service, is transmitted to the Cleansing Management Directorate. After three days they call the client, if the problem hasn't been solved the complaint is send again to the office through a letter. At the six days the procedure is repeated and at the ninth days they call the client again. If the problem has not been solved, they close it like a non solved case.

A coordinator is in charge of the customer service department, works inside the Billing and Collection Directorate of ADN and has a total of 15 persons distributed in the following way:

| ADN Office | Number |
|---|---|
| Customer Service | 6 |
| Collection Management | 4 |
| Collection and Digitations | 5 |
| Total | 15 |

| Agencies or Stations | Number |
|---|---|
| Feria Agency | 2 |
| Independencia Agency | 1 |
| Naco Agency | 1 |
| Conde Agency | 1 |
| Padre Castellanos Agency | 1 |
| Euclides Morillo Agency | 1 |
| Total | 7 |

The customer service Schedule is from Monday thru Friday from 8.00 a.m. to 6:00 p.m. and Saturdays from 8:00a.m. to 12:00 noon.

The average number of calls per agency and the most frequently areas of calls (complaints, reclamations or applications) are the following:

| Agencies | Number of calls and visits per day | Most frequently areas of calls |
|---|---|---|
| Feria Agency | 240 | Bella Vista |
| Independencia Agency | 55 | San Jerónimo |
| Naco Agency | 200 | Urbanización Tropical |
| Conde Agency | 50 | Cacique I |
| Padre Castellanos Agency | 35 | Urbanización Renacimiento |
| Euclides Morillo Agency | 60 | Mirador Sur<br>Arroyo Hondo |
| Total | 640 | |

The types of calls received daily by the customer service office and the Collection management are resumed in the following concepts:

| Complaints | Reclamations | Applications |
|---|---|---|
| They don't receive the bill<br>Deficiency in the collection<br>Requesting Money<br>Recurrent in complaints for deficiency in the service | Double billing<br>Payment not credit<br>Type of use, activities or units | Change the address<br>Change the name<br>Change the use type, activities or units<br>Fee reevaluation<br>Single billing<br>Billing duplicate<br>Payment agreement<br>Billing unification |

The reclamations, complaints or applications assisted by phone or personal are entered in the reclamation module system and automatically a reclamation number is assigned which is informed to the client to pursuit the case. An approximately date is assign to these reclamations for its solution. Customer Service send these reclamations to the corresponding departments for their prompt solution, and once the reclamation is closed a communication is emitted to the clients informing if it was or not reasonable and the measures taken to determine its resolution.

According the information of the Customer Service Department, the most frequently calls are the complaints on the collection waste deficiency. Several persons send complaints that the waste has not been collected. They don't want to pay the fee.

Actually, the ADN through the Customer Service Department only assist the population sector that pays the solid waste collection fee. The population that does not pay or does not have the collection service is not assisted by this department.

# Annex K

*Survey on Information Management*

Contents



Tables



Figures

# K Survey on Information Management

## K.1 Objectives

Appropriate information management is crucial to establish and maintain a sound SWM. Information of technique, finance, labors, customers and others tells the actual situation of the SWM and possible risks in the future, although individual information does not tell a lot because one person cannot extract many implications, even if he has a lot of information on his hands. To exchange information among persons/organizations concerned is indispensable to maintain the SWM on the right track.

This survey has the following objectives taking into account the importance of the information management mentioned above:

- To evaluate the actual information management
- To clarify issues to be challenged to establish and maintain a sound SWM

## K.2 Methods

This survey was carried out by means of interviewing persons/organizations concerned, and checking the existing data. In addition, the survey focused exchanging information among the persons/organizations concerned. Data that was investigated are as follows:

- Technical data (collection quantity, disposal quantity, hours of vehicle operation, number of trips, number of employees, etc.)
- Financial data (personnel cost, fuel cost, cost of private collection companies, other expenditures, collection of user charges, other incomes, etc.)
- Labor data (hours worked, strikes, injuries, diseases, etc.)
- Customer data (households, business firms, payment status, etc.)
- Whereabouts and possibilities to use other types of data, for example, social data such as population census, maps and topographic data

## K.3 Results

Operations of waste collection and final disposal are basically carried out by private companies. Although the company operating the landfill informed everyday to the municipality the amount of final disposal waste at Duquesa landfill, private collection companies do not provide most of the data on collection works. In fact, this survey was able to obtain the data of the final disposal waste amount that contained not only ADN but also other municipalities. However, data on collection works conducted by the private companies were limited.

It was found that the financial data was not well managed, thereby making it difficult to calculate the costs of the SWM in respect to the work items such as collection, transport, street sweeping, final disposal and administration. However, the collection cost can be estimated, as most of the collection works delivered by private companies at a metered rate, US$ per ton of waste. Also, final disposal fee has been established in the same way.

Still lacks to see if the private companies have established management of labor data. Such information has not been provided. The Environmental Management and Urban Cleansing Directorate (EMUCD) does not manage the labor data. However, there is a work injuries insurance system in the municipality. It suggests that someone manages data of injuries.

Triple A, which is a fee collection company, began its operation since May 31, 2004. This company has well established and has been updating a customer database. Also, it receives claims from citizens about the collection service and conveys them to the municipality. During this survey, interviews on some personnel of the company were carried out and the database was investigated.

The Urban Planning Department of the municipality has a digital map of the city. Also, Triple A has another digital map. None of them was used in the SWM.

## K.4 Findings

### K.4.1 Evaluation of the current Information Management

#### a. General View of the Current Information Management

In general, the information is recorded, used and exchanged inappropriately. The final disposal amount technical data is limited. The current financial data management does not give accurate information of the costs of the SWM regarding each technical sub-system such as collection, transport, street sweeping, final disposal, maintenance and administration. Also the labor data management is not well established. Only the customers' data has been well developed and updated.

The general sketch of the SWM regarding the collection and final disposal is shown in the following figure:

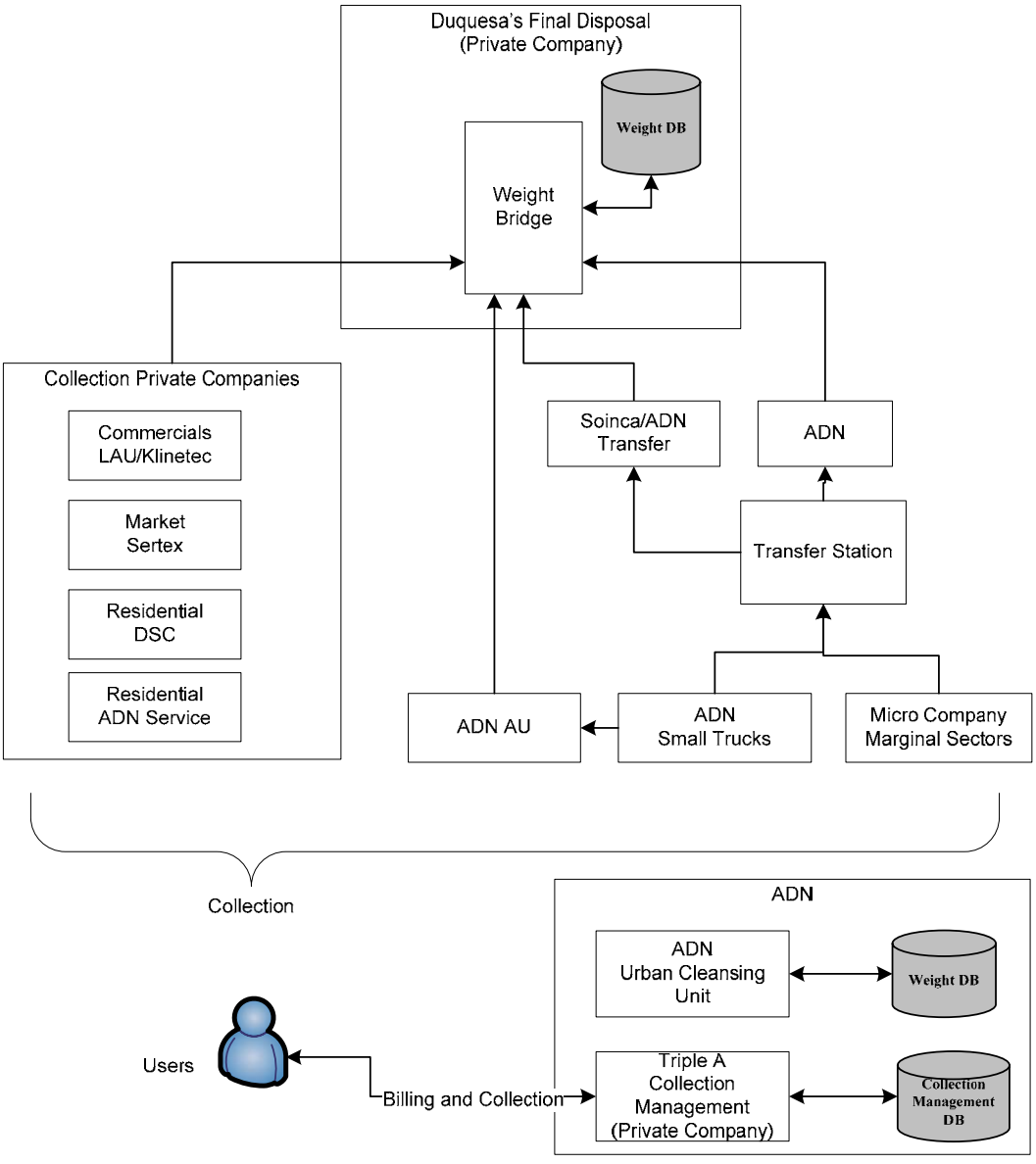



Figure K-1: General View of the Current Information Management

## b. Duquesa's final disposal site (Private Company)

### b.1 Outline

The Duquesa's final disposal site is operated by a private company, which has a weighbridge installed in the entrance connected to a computer were the computer system register all the vehicles and the corresponding weight of the waste that enters in the site. The following figure shows the general picture of the system.

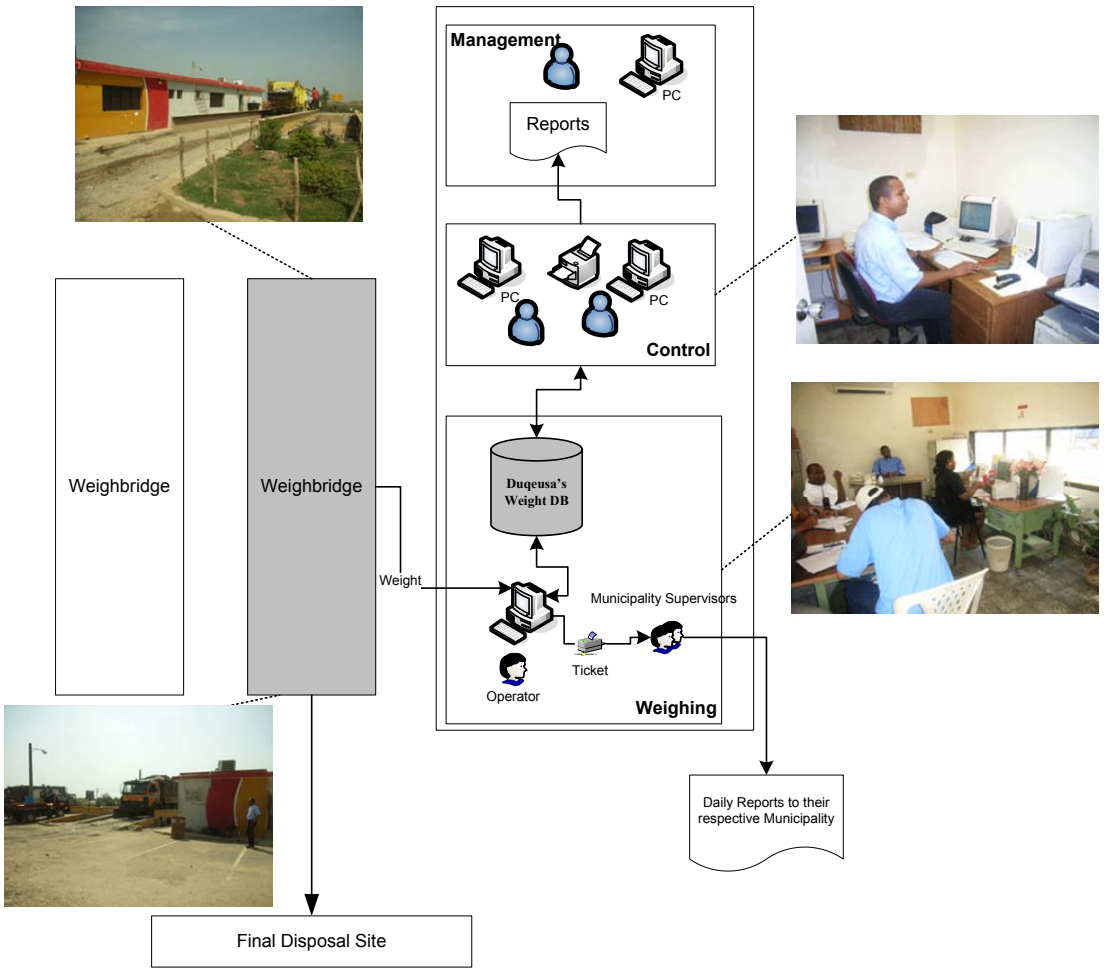



Figure K-2: Duquesa's Information Management

The vehicles are weight just in the entrance only when they enter the disposal site, because the tare weight or the truck weight is registered in the DB. If the truck is new, and it's not registered in the DB, it is weighed twice, in the entrance and in the exit, and the tare weight of the vehicle is registered.

All the trucks that entered are weight on the weighbridge, the gross weight is read automatically by the computer, the vehicle code is entered and the tare weight registered is subtracted and then the net weight is registered.

For each registration the system immediately emits a ticket with 2 copies, where one is given to the supervisor in charge of the municipality of where the waste comes and the other copy stays in the landfill administration.

The whole registration system is controlled by the supervisors of each municipality of where the waste comes, and at the end of the day each supervisor takes a list of all the vehicles that entered with their respective weighing.

The private company that operates the landfill from its control department accedes to all the data registered in the weighbridge and processes the data and generate reports to the management, where the reports are analyzed. In general, the whole system is working very well.

### b.2 Weighbridge Registrations

The weighing register system is developed with Microsoft Access and mainly registers the following data for each vehicle that enters to the site:

Table K-1: Data registered at Duquesa

| Brigade ID | Sequential Entrance Number |
|---|---|
| Cart ID | Vehicles code |
| Gross | Gross weight of the weighing |
| Date | Entrance Date |
| Hour | Entrance Hour |
| Load Type | The type of the load |
| Proportion | Waste percentage proportion |
| Ticket No | Ticket Number |
| Observations | Observations |
| Weigher | System operator Code |
| Status | Register Status |
| Net | Net weight of the load |
| Company ID | Code of the transport company |
| Name | Company Name |
| Municipality | Municipality of which the waste comes |

### b.3 Registered datas from 09/01/2004 to 08/31/2005

Actually in the Duquesa's final disposal site the waste that entered comes from the following municipalities: National District, Santo Domingo East, Santo Domingo North, and Santo Domingo West. How it shows the following table and figure, the amount of waste registered in Duquesa has a notable increasing (34% between September 2004 and August 2005) from February 2005 until now. Also they showed the increasing amount of Santo Domingo East (67% in the same period).

Table K-2: Amount of Waste registered at Duquesa (September 2004 – August 2005)

Unit: ton

| Year | Month | ND | SD East | SD North | SD West | Total |
|---|---|---|---|---|---|---|
| 2004 | 9 | 36,552.5 | 13,396.9 | 7,129.5 | 10,501.5 | 67,580.4 |
| | 10 | 36,150.3 | 13,775.2 | 7,337.4 | 10,473.7 | 67,736.6 |
| | 11 | 36,399.7 | 15,509.3 | 7,074.3 | 10,596.6 | 69,579.8 |
| | 12 | 37,569.2 | 14,267.7 | 6,633.2 | 10,515.4 | 68,985.6 |
| 2005 | 1 | 35,915.8 | 13,818.6 | 7,503.2 | 10,328.7 | 67,566.2 |
| | 2 | 34,161.0 | 15,527.0 | 6,298.1 | 9,395.5 | 65,381.7 |
| | 3 | 38,713.7 | 17,228.0 | 6,484.7 | 10,813.9 | 73,240.4 |
| | 4 | 40,860.7 | 16,618.1 | 6,988.3 | 13,830.5 | 78,297.7 |
| | 5 | 41,871.3 | 19,553.4 | 6,566.7 | 16,341.7 | 84,333.2 |
| | 6 | 44,568.2 | 19,017.8 | 8,332.8 | 14,440.5 | 86,359.3 |
| | 7 | 47,140.7 | 21,097.1 | 8,900.3 | 13,578.0 | 90,716.2 |
| | 8 | 49,127.8 | 22,427.3 | 8,821.0 | 12,867.5 | 93,243.5 |
| Total | | 479,030.9 | 202,236.4 | 88,069.5 | 143,683.5 | 913,020.6 |

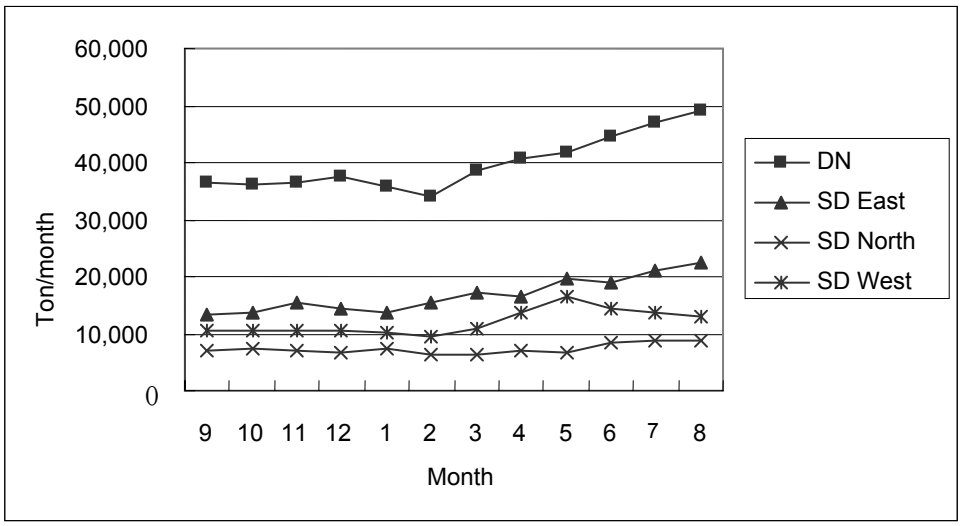



Figure K-3: Amount of Waste registered at Duquesa (September 2004 – August 2005)

**c. Collection Private Companies**

Each private company uses their own information management methods, using both calculation schedules and small DB.

ADN does not have any control or access to the information of the collection private companies.

ADN can know the waste amount disposed by each collector by using information recorded at the Duquesa, however there is no data of the collection routes and collection hours of each collector.

**d. ADN – EMUCD (Programming and Control Management)**

Inside this unit, a DB system has been developed, where the Duquesa's weight data is introduced and daily or monthly informs can be generated of the collection waste by collector.

Duquesa gives daily informs in paper to all the vehicles that had entered to the Programming and Control Management in the final disposal site, and then an operator introduce the data in a manually to the DB system what implies a great lost of time.

The S/T jointly with the C/P studies the possibility to receive the data in a digital form Duquesa. The C/P got the approval to receive the Duquesa's weighing data in a digital form and the S/T developed a data import module for the current DB system. This way the weighting data are imported in kind of minutes to the system.

**e. Customer Management – AAA Dominican (Private Company)**

**e.1 General Sketch**

The collection management is carried out by a private company, AAA Dominican, through the commercial management system "America Software", developed in Oracle. The following figure shows the general sketch of the collection management:

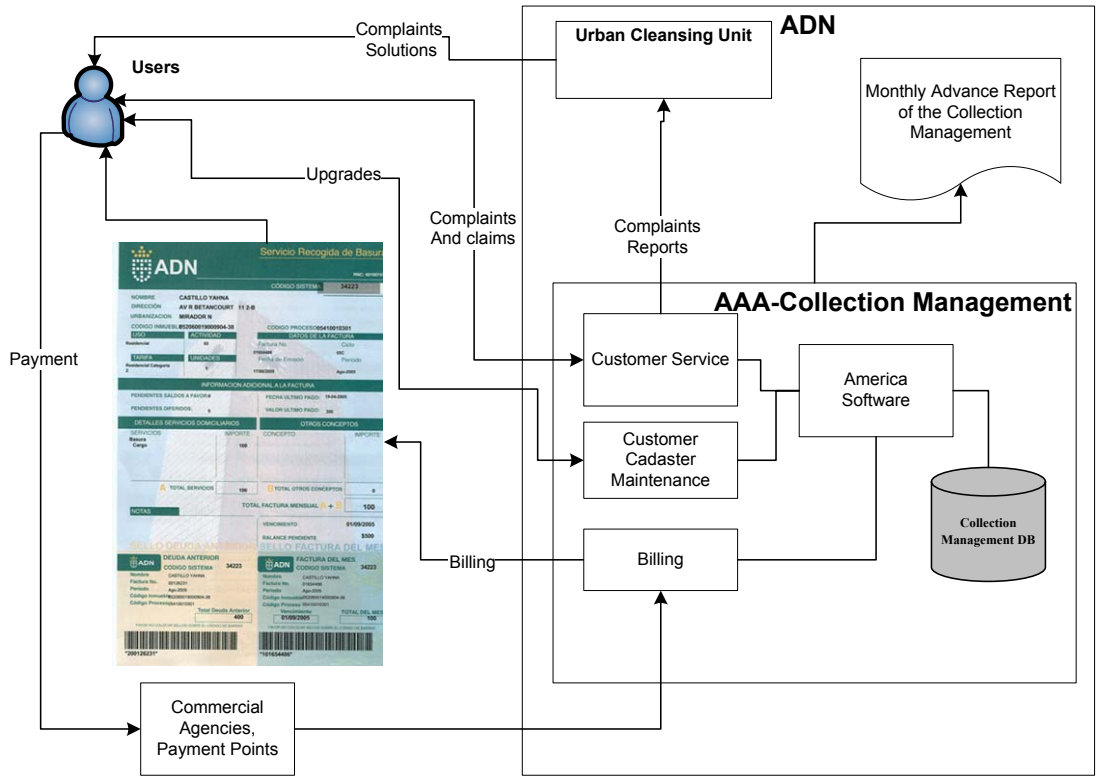



Figure K-4: General Sketch of the Fee Collection Management

### e.2 Billing

Monthly invoices are generated according to the users' category. The household rate system is simple, but for the business entities such as commercials, industries and offices it's very complicated. From June 2004 to August 2005, 691 types of rates were used, like you can see in the following table. A revision on the rate fixation of no households must be done.

Table K-3: Types of Rates Numbers

| Use | Types of rates numbers |
|---|---|
| Commercial | 585 |
| Industrial | 51 |
| Official | 49 |
| Residential | 6 |
| Total | 691 |

### e.3 Payments

The customers have a big number of payment stations located in the whole National District for more comfort. In summary, actually there are eight (8) Official Agencies, four (4) Stations in the Banks, thirty nine (39) Stations in pharmacies, three (3) ADN Agencies and eight (8) Stations located in several private points.

### e.4 Customer Service

Inside the ADN there is a Customer Service Department, where all the complaints and claims calls are received. The collection service complaints are sent to the Urban Cleansing Unit, which is responsible for taking remedial actions.

The claims are received only by the users that have their payment on day. This situation

makes impossible to know the claims total because the percentage of the users that have their payment on day is low.

### e.5 Customer Data Base Maintenance

Mixed and Industrials Commercials users have been upgraded in 8 of the 12 sectors in which the city is divided, since the upgrading plan was design for this users like a priority; starting from the 2006 a campaign to upgrade the household users will be developed.

Actually there is a digitized map, where the billing sectors-routes are divided and it is working in the use of the GIS.

### e.6 Monthly Advances Report

Monthly the AAA emits a report of the advances reached so you can appreciate the collection management performing. The content of the report is as follow:

- Monthly Collection
- Number of clients assisted
- Claims, complaints and applications interposed by the users in the commercial area
- Applications and complaints interposed by the users in the technical area.
- Monthly billing
- Total of users billed and bills distributed
- Inspections and upgrades made by the cadastre area for the urban cleansing and tributary customers.
- Information about the movements carried out on the cleansing and taxpayers database.
- Advances on the taxpayer management

The AAA Company carries out the fee collection management with a billing commercial system very efficient and has a user DB constantly upgraded. The commercial management is very good, but pitifully the payment culture of waste collection does not help with an effective collection.

### f. Transfer Station

Daily, more than 400 tons of waste is transferred in the transfer station. A data base (DB) has been developed since November 2005, as a result of the installation of a scale to weight each truck that enters.

### g. Household Survey Census 2002

The 2002 Census provides valuable information for investigating the SWM current situation. The following table says that the 90% of the citizens were covered with the collection service and 10% was not covered. There were many homes without the service in the Districts 2 and 3.

Table K-4: Number of homes covered with the collection service, Census 2002

| Number of Homes | | | | | | |
|---|---|---|---|---|---|---|
| District | Municipality | Private Companies | Dump Site | Throw to the field | Others | Total |
| 1 | 85,666 | 2,521 | 1,059 | 138 | 484 | 89,868 |
| 2 | 48,508 | 2,039 | 5,790 | 481 | 4,862 | 61,680 |
| 3 | 80,876 | 3,884 | 4,418 | 577 | 7,281 | 97,036 |
| Total | 215,050 | 8,444 | 11,267 | 1,196 | 12,627 | 248,584 |
| Porcentage (%) | | | | | | |
| District | Municipality | Private Companies | Dump Site | Throw to the field | Others | Total |
| 1 | 34.5% | 1.0% | 0.4% | 0.1% | 0.2% | 36.2% |
| 2 | 19.5% | 0.8% | 2.3% | 0.2% | 2.0% | 24.8% |
| 3 | 32.5% | 1.6% | 1.8% | 0.2% | 2.9% | 39.0% |
| Total | 86.5% | 3.4% | 4.5% | 0.5% | 5.1% | 100.0% |

Source: Census 2002

### K.4.2 Issues to be challenged

The following are issues to be challenged in order to establish and maintain a sound SWM.

- Establish a manner to receive the data of the final disposal waste amount at Duquesa in digital format in order to facilitate its utilization
- Develop a manner to keep and exchange the collection data in order to share such data among persons/organizations concerned
- Strengthen the customers data base prepared by Triple A so that the data can be used to analyze and improve the collection works
- Establish a manner to keep and exchange data at the transfer station so that the data can be used to analyze and improve the collection and transport system
- Unify and/or associate each data so that the totally SWM can be harmonized

# Annex L

*Hazardous Waste Survey*

Contents

# L Hazardous Waste Survey

## L.1 Current Situation

The Chapter V of the Environmental General Law is related to the elements, substances and hazardous products management. It is this way how is establish that the Dominican State Hill adopt the regulator norms to identify, minimize and rationalize the elements usage, combinations and chemical substances, synthetic and biological, that can put in danger the life or the health of who manage it, as well as the accidents occurrence related with it manipulation.

On the other hand, SEMARN will regulate the management of substances, wastes and hazardous waste, based in the principle that *who establishes the risk must be responsible for the cost of the whole process from its disposition or definitive disposal in the site authorized by SEMARN.*

SEMARN already have enacted the norms for the Environmental Management for the radioactive waste and for the Integrated Infectious Waste Management.

Taking in consideration of the enforcement of the CAFTA-DR for January 1st 2006, it is indispensable that the State makes an important effort to complete the regulatory framework that establishes the hazardous waste management, because the waste generation will increase with the economic growth.

Up to now any state policy regarding the hazardous waste management has not been generated.

The industries that manage the hazardous substances are not subject to the control of their procedures, pouring and discharges; over this aspect the State should be alert on the application of the chapter 17 of the CAFTA-DR, that refers to the environmental normative, and when dealing with the protection levels establish that:

*… each Part will **guarantee** that its laws and policies provide or stimulate high levels of environment protection and they should make effort to improve those laws and policies.*

*The parts recognize that is inappropriate to promote the commerce or the investment through the debilitation or reduction of the protections contemplated in its internal environmental legislation.*

*Everything make foresee that the environmental laws will be effectively applied for that the economic activities be free of the sanction for the treaty violations. Continues the articles related with the environment guarantees and the procedures accorded for its application.*

*Each Part will **guarantee** that the judicial, quasi judicial or administrative procedures, according to its legislation, they are available, to sanction or repair the infringements of its environmental legislation…*

*Each Part will establish sanctions and effective and appropriate reparations for the infractions of its environmental legislation…*

*Each Part will **guarantee** that the persons interested can request to the competent authorities of the Part that investigate supposed infractions of its environmental legislation...*

*Any person of the Part would be able to remit communications that assert that a Part is not performing in the effective application (enforcement) of its environmental legislation.*

In the SEMARN registrations, only one company in the private sector is registered:

Dominican Incinerator Alliance, which offers services of transport and oil incineration, solvents and waste that comes from ships (MARPOL). This company dispose of the waste from their incineration process at Duquesa.

Regarding the organizational structure of the entity, newly in the 2001 it's created in SEMARN the Environmental Emergency Department that was in charge to assist the accidents or commit errors in the hazardous substance management.

In 2003 the Chemical Substance and Hazardous Waste Management Department is organized which is in charge of the activities related with the normative, control and monitoring preparation, and assist the entity high direction in the hazardous waste management. This department has only assigned three professionals to assist these responsibilities (one agricultural engineer, one chemical engineer and one professional in chemistry).

In this department the applications of the agreements subscribed by the state are pursuit: Basilea Agreement, Rótterdam Agreement and Estocolmo Agreement. Likewise the norms project for the PCB's management has been concluded.

Also knows about the project of the installation of manufactures in the Free Zones through the documents contain in the applications of the Environmental Impact Studies and analyze the Management Plans proposed, however, does not have the resources to check its performance.

The following figure shows the summary of the Manufacturer Industrial Directory that corresponds to the National District. The information corresponds to the year 2004 and was made by the Central Bank of the Dominican Republic. The companies are classified by activities according to the Uniform International Industrial Classification CIIU, third revision.

The 50% of the work force is employed by companies dedicated to the elaboration of nutritious and drinking product. The bigger manufacturers of the National District are Colgate/Palmolive (Unilever), Cesar Iglesias and Metaldom; the products manufacture by these industries does not generate important quantities of hazardous waste.

**NATIONAL DISTRICT**

| ACTIVITIES | NUMBER OF COMPANIES | NUMBER OF EMPLOYEES |
|---|---|---|
| Elaboration of Nutritional Products and Drinks | 110 | 24,726 |
| Textile Products Manufacture | 53 | 1,440 |
| Articles manufacture to dress, marinate and colored of leathers | 83 | 2,219 |
| Tanning and marinate of Leather, Suitcases Manufacture, Handbags, Saddlery and Harnesses articles and Footwear | 20 | 712 |
| Wood production and manufacture of Woods and Cork, Except Furniture, Manufacture of Straw and Braider materials | 40 | 421 |
| Paper Manufacture and Paper Products | 12 | 1,239 |
| Edition and Impression Activities and Recording Productions | 153 | 4,570 |
| Substance and Chemical Products Manufacture | 71 | 6,499 |
| Rubber and Plastic Products Manufacture | 19 | 1,926 |
| Manufacture of other Mineral Products non Metallic | 24 | 1,922 |
| Non common Metal Manufacture | 7 | 398 |
| Manufacture of Products elaborated with Metal, Except Machineries and Equipments | 45 | 1,175 |
| Machineries and Equipments Manufacture | 5 | 26 |
| Machineries and Electrical Appliances Manufacture | 5 | 427 |
| Manufacture of Medical, Optician and Precision Instruments, and Clocks manufacture | 16 | 71 |
| Manufactures of Automotive Vehicles, Tows and semi-tows | 5 | 150 |
| Furniture Manufacture; Manufacturing Industries N.C.P. | 63 | 797 |
| **TOTAL NATIONAL DISTRICT** | **731** | **48,718** |

# Annex M

*Construction Waste Survey*

Contents

# M Construction Waste Survey

## M.1 Current Situation

During the last decade the construction sector made a significant growth and it is known that has been a great solid waste generator.

However, there are not specific registers of the construction waste generation in the Dominican Republic. The international estimated of the waste generated in the construction sector varies between the 130 and 300 kg/habitant/year and in Brazil the national media is of 510 kg/habitant/year.

In the Bello Horizonte city, the construction waste generation represented in 1999 the 48.67% of the total weight of all the municipal waste collected by the Municipality whereas the housing waste weight and commerce was of 31.16%.

Regarding the management the construction waste it is considered as special waste, this is, that it not forms part of the municipal waste category. However, ADN has been responsible of the management of these wastes.

In the framework that regulates this management goes back to the Police law of the year 1911, where is prohibited the placement of the construction materials in the streets that obstruct the public road; this prohibition is reiterated in the laws Nos. 675 of 1944, 241 of 1967, 83-89, 120-99, and several municipal resolutions. Very in spite of this valid normative of the construction waste they are still been managed in an inadequate way and without any control.

As a beginning of the management regulation it is suggested that after giving the construction/demolition permission the proprietary should contract an especial service from ADN; with it can be assure that the waste generated by this activity will be managed adequately.

# Annex N

*Investigation of Duquesa's Landfill*

Contents



Figures

# N Investigation of Duquesa's landfill

## N.1 Description

Duquesa's landfill is located in the Municipality of Santo Domingo North approximately about 15 km. to the northwest of the ND, actually it assist the Municipalities of Santo Domingo North, Santo Domingo West, Santo Domingo East and National District. Duquesa's landfill allowed closing the final disposal site of the Guaricano.


Figure N-1: Duquesa's landfill location

It covers a surface of 127.81 ha. from which approximately the 60% has been used in waste disposal.

In answer to the request presented by the Government of the Dominican Republic, the Japanese Government made in 1993 the "Basic Design Study for the Cleaning and Waste Collection Project for Santo Domingo city", through which the final disposal problem was approached, recommending the construction of Duquesa's landfill. Later in 1996 and through a donation made by the Japanese Government of 4.2 MUS$, the habilitation of the landfill was initiated, including others like the construction of a maintenance workshop, weighing machine, entry control office and weighing registration, administrative offices and preparation of the first deposit sector that contemplated a leached collection system storing and recirculation gap, additionally equipments were acquired to begin the operation in 1997.

## N.2 Participation of the Private Sector

In 1998 the operation passes to the private company DOAMSA. Due to the new territorial administration division, since 2002 Duquesa's landfill passed to be under the jurisdiction of Santo Domingo North Municipality, who in May 7$^{th}$ 2004 signed a concession contract with Duquesa's Consortium, enterprise constitute by a local company and a Brazilian company, transferring the administration, operation, maintenance of the biogas controls, of the leakages, of the equipments, the property of the physical plant. Through the same contract the Municipality of Santo Domingo North authorize the concessionaire to use the gas for the same period of its extinction, forcing the concessionaire to pay 5% of the net benefits that they obtain. The contract starts since June 1$^{st}$ of the same year and has a duration of 20 years.

In November 23rd of 2004 and due to that the ND does not count with a final disposal site inside its territory, an Inter-institutional Collaboration Agreement for the Sustainable Management of Duequesa's landfill was signed, through which the Municipalities of Santo Domingo and the ND recognized the operation and administration of Duquesa's landfill, by the Consortium with the same name, and decide to conform an Inter-institutional Technical Unit, which responsibility will be supervised and advised Duquesa's landfill management, and others:

- Determination of the costs structure of the landfill operation.
- Recruiting of an environmental audit. By the Duquesa's Consortium, to verify the environmental impact levels of the actual operation and the gap of the environmental norms valid in the Dominican Republic, to determine the minimum investment level that makes feasible the landfill operation in both economic and environmental terms.
- The later formulation of a management plan and an environmental adaptation of the administrative, technical and physical operations of the final disposal for its implementation in order to mitigate the environmental impacts.
- In the other hand SEOPC and SEMARENA has the responsibility to advise and supervise in the areas of their respective competences the operations and complete execution of Duquesa's landfill.

While the cost structure and the profitability for the Consortium are determined, the results of the Environmental Audit are obtained and the intervention budget is formulated, the amount to be cancelled by each municipality that uses Duquesa's landfill is fixed.

In the other hand, in the contract is established as a responsibility of the Concessionaire the establishment of an operation plan for Duquesa's landfill, recovery and rehabilitation of the actual dump areas, rehabilitation of the internal access roads and the construction of a new maneuver front, establish a program to recover the existing equipments, and the establishment of a recovery system and biogas control.

## N.3 Operation

When Duquesa's Consortium Company took the operation management it carries out several field studies in order to define the future features of the project. Within these studies is the construction of three exploratory drilling, with the purpose of knowing the features of the land, which are mainly conformed by a clay stratum with of thickness from 5 to 6 m, gritty loamy between 6 to 10m. The aquifer level was detected at the 11m. Additionally, presents a work program, dividing the area in three sectors, the first one correspond to the area with old wastes that have a height around the 10m denominated as a covered and closed area, the second sector corresponds to the transition area, which includes a surface of approximately 65,000 m², which allows the operation for an approximately period of 10 months, and that is where they are working since may of the present year, in a part of this area their was a waste cape between 1,5 and 3 m of thickness, the project considers the disposition of waste conforming cells of 7 m of height which later covered the floor, approximately 60 cm of fine soil material and 40 cm of coarse material. The last sector corresponds to the future area of waste disposal, which at the same time is divided in two, Area for the Implantation of the new Waste Treatment Center (WTC), and Areas for future expansions. In this sector the operation will be carried out based on the construction of a landfill by the terrace level method, being considered 4 levels of 5 m each one with a terrace of 7 m of wide among them. Starting from the antecedents of the year 2004 of waste incomes and the design proposed for the future waste disposition a useful life around 20 years has been calculated, however, the great increase of waste entered (approximately 30% from January to October 2005), makes necessary to revise these calculations.

For the operation they count with the following machinery:

- 1 Caterpillar Tractor D-6,
- 6 Caterpillar Tractor D-8
- 1 Caterpillar Tractor D-7
- 2 Komatsu Tractor D155
- 1 Komatsu Excavator PC200
- 2 Caterpillar Excavator
- 1 Frontal Charger

Additionally they rent 1 frontal charger, 1 retro-excavator, 1 moto-bulldozer, 1 roller.

It has a total of 75 persons distributed according to the following details:

- 5 In charge of weighing
- 5 In charge of the administrative cleaning sector
- 3 In charge of the warehouse
- 5 Drivers
- 10 Operators
- 5 Mechanics
- 5 Workers
- 10 In charge of the area (workshop, general area, dump, etc.)
- 6 Administrative personnel

The rest of the personnel are dedicated to the administrative and control works.

The landfill operations actually are carry out in the transition area, counting with two dumping areas, one for the compactor trucks and the other for the transference trucks, the wastes are compacted with two or three bulldozer. The works are very difficult because in the sector there are around 300 persons of different ages and genders dedicated to recover materials from the waste mainly plastic and glass. Such persons (scavengers) does not allowed that the machinery operates while they have not moved away the recycle materials and even more, what is recovered they accumulated in nearby areas where the coverage already has been carried out, contaminating the whole sector and damaging the coverage.

The old landfill sector is covered by a ground cape, in some areas the covering has been damage due to the glide of the waters rain. In such sector some biogas drainage has been constructed.

In the transition area approximately 60% of the surface is covered.

There is no conduction system neither a leachate caption, reason why the waste drains freely and emerge the area contaminating the perimeter zone and reaching the Isabela River.

Also an important quantity of fauna conformed mainly by cows, dogs and birds is appreciated in the area.

## N.4 Conclusions

Duquesa's landfill has enough space to operate for a period of at least 10 years, supposing that the projected work programmed by the concessionaire is fulfill, that is to say, a landfill with terrace levels with a total height of 20m, what gives a capacity of 13,929,133 m³, and that the initial entrance of waste for the new area is of 92,000 tons/month with an annually growth rate of 5%.

Duquesa's landfill is contaminating the ground and the existing water courses in the sector, like the case of the Isabela River. At the moment such situation can not be controlled and reverted, since the concessionaire company does not count with the necessaries incomes to apply the contingency and reparation measures. It is urgent to construct the works that at least

allowed keeping the leachate inside the landfill area. Although it is certain that the surveys have showed that the grounds located under the waste deposit are mainly impermeable clays and the water bearing at a depth of 11m respect to the lowest point of the landfill, during the whole operation of the landfill, quality monitoring of the subterranean water that allows to conclude that they have not been contaminated by the liquids has not been carried out. After the works of the new dump area start, it is recommendable to make monitoring of the subterranean water to verify what was mentioned before, and see the necessity to include a passive impermeability (installation of geomembrane liner) that prevents the exit of leachate by the landfill base. Parallel the new deposit area must obligatory have a reception and liquid conduction system out the landfill.

The Project of the new area considers the construction of a liquid reception system to be later conducted to an accumulation and recirculation lagoon. Taking into account the intensity and quantity of the precipitations produced in the area, and that are bigger to those presented in the National District, results evident that the solution planted is not enough, and is expected that under adverse climatic conditions, an increase of the liquids in such lagoon will be produced, been able to overpass their capacity and originating the draining of the leachate outside the landfill. It is recommendable to consider a leachate treatment system that at least allowed reduce the organic charge. Due to the coverage quality (highly permeable) the generation of an important volume of liquids is expected, what makes impossible the recirculation of these from the lagoon toward the waste mass.

What was mentioned previously is still more unquestionable taking into account that the waste deposited in the landfill has a high content of humidity (over the 50%) and if to that the water that infiltrates due to the high permeability of the covering is added, the volumes of liquids that will generate will overpass the 50% of the volume of waste deposit and therefore is not a technical and economically way to manage it through the deposits or accumulation lagoons, even more when is not possible to recycle.

The project considers a short term to implement a system to manage and take advantage of the biogas, choosing the carbon bonds (MDL project), this project will allowed to extract the biogas reducing the fire risks, however, it can not be carried out until a highly impermeable cover that prevent the entrance of air to the landfill and also the settle of explosive mixed is installed.

The actual fee of the landfill (approximately 2.25 US$/Tons), only allows to cover the minimum costs of the personnel and of the machinery, reason why is not possible to operate the place as a sanitary landfill and not even make investments to reduce the environmental impacts. If is considered a sanitary landfill executing the environmental normative and including the treatment of the leachates, the fee should be in the range of 10 to 13 US$.

The viability of Duquesa's landfill operation do not depends exclusively on counting with enough space for the waste disposition and of improving the environmental conditions of the place, but also with the construction of the Isabela airport and the utilization of the nearby areas per house, that put in great danger the operation of the site. In the first case because the international normative regarding the minimum distance that should exist between both facilities is not fulfill, however, is important to leave in clear, that the construction of the airport is after the operations of the landfill begun and therefore in the moment to decide the construction of the airport it should be considered this aspect. The same occurs in the household aspect, those that have been constructed after the settle of Duquesa, is of great importance, that in a short term the competent authorities define the use of the ground in the areas around the landfill, preventing the advance of the population toward this area.

The situation describe above indicates that until now their is no security regarding Duquesa's operation, for which it is necessary, that the competent authorities defined the future of the final disposal site, in order to give security to the continuity of its operation or closure, and

based on this establish a work and investment program of the landfill or the necessity to start the works to count with a new final disposal site, that is considered that it will demand at least a term of 4 years.

In case that is decided to continue with Duquesa's operation the following activities are priorities (term of 3 months) to assure an adequate operation:

- The construction of access roads.
- The construction of internal roads to the sites or to the dump areas.
- The construction of two dumps areas, one for rain periods and the other one for normal periods.
- Move away the scavengers.
- Coverage of the transition area and improvement of the final coverage in the old area to allow the future reception of gasses, parallel revegetate the area to avoid damages due to the erosions.
- Leachate management works that prevent that this drain out the landfill area and contaminate the Isabela River.
- Construction of the leachate storage lagoon.
- Implementation of a ground waters monitoring program (including the Isabela river), at least considered two deep wells one up stream and the other down stream, starting with a quarterly pursuit, measuring the parameters that include the water quality norms for human consumption.
- Implementation of a superficial water monitoring program, that include the samples and analysis taken in all the courses of the water located near the landfill.
- Starting from the monitoring results previously indicated, make a plane that limit the area affected by the leachate and developed a mitigation program. Also since this information analyze the necessity to include in the new sector project the installation of geomembranas, assuring that the leakage would not leave the landfill.

# Annex O

*Initial Environmental Examination*

Contents



Tables



Figures

# O Initial Environmental Examination

## O.1 Overall Environmental and Social Conditions

There are some issues to be taken into consideration in the SWM from viewpoints of environmental and social aspects.

### a. Hygiene Condition in the City

Hygiene condition of the city is not necessarily good due to problems of drainage and waste. Especially, low income areas are adversely affected such unsanitary condition. Adverse impacts on health of the citizens shall be evaluated quantitatively and investment shall be conducted on required measures such as rehabilitation/construction/maintenance of drainage and improvement of waste collection service. In addition, improvement of the water supply system is expected.

### b. Solid Waste Management Facilities

Collection vehicles themselves cause environmental impacts such as noise, leakage, bad odor, etc. Incorporation of environmental considerations in an operation standard and education of workers are recommendable.

A transfer station and transfer points are the place where waste is transferred from small trucks to large transportation vehicles. The transfer station has been constructed having cooperation of European Union. Although it causes some adverse environmental impacts on the surrounding community, such condition is expected to be improved through the project of EU. In addition, it is often seen in the city that private collection companies transferred waste from small trucks to compactor trucks. It gives unfavorable impacts on the surrounding. It is recommendable to eliminate activities of transferring waste on the streets.

Although the current landfill, Duquesa, has put efforts on environmental protection measures, it causes environmental impacts such as leakage, landfill gas emission, proliferation of birds, etc. A large number of waste-pickers are taking recyclable materials from the waste. They make themselves to face health risks and hamper the landfill operation work. It should be mentioned that a new airport has been constructed close to the landfill. The distance between them is estimated around two (2) km. This signifies that the distance does not meet with the national law, Norma para la Gestion Ambiental de Residuos Solidos No Peligrosos. This situation causes doubt on continuity of the landfill operation.

In the future, a transfer station may be necessary depending on location of a future disposal site. Such facility causes adverse environmental impacts to a greater or lesser extent. Consultation to the established procedure of EIA in the country will be required.

### c. Consume-driven Culture

The country has rapidly economically been developed since 1990'. Consume-driven culture of the citizens might have grown in the period. Use of throwaway containers and plastic bags are in widespread in the city. Recycling activities are not common. Taking into account the large waste generation per capita, dissemination of waste minimization and encouragement of recycling activities are expected in the near future.

### d. Income disparity

Inequality is relatively high in the Dominican Republic as reflected by a Gini coefficient of 0.49 in 1992. The richest 20 percent of the population received about 57 percent of total income in 1992, while the poorest 20 percent received only 4.4 percent. The share of income received by the extreme rich and extreme poor increased during the 1986-92 period, but the

share of the poor increased by a somewhat higher proportion. Middle-income groups seem to have been the losers. The Gini coefficient deteriorated markedly in 1989 but improved substantially in 1992 (World Bank, "Growth with Equity: An Agenda for Reform).

Required monthly minimum income for living in February 2004 was RD$14,377 (Central Bank). The Public Opinion Survey said that about 60% of citizens' household income does not reach this level.

Anyhow, there exists income disparity among the citizens. This should be taken into account when considering tariff setting, communication with communities, etc.

**e. Waste-pickers**

Waste-pickers are found on the streets and the Duquesa landfill. Most of them are from out of the metropolitan area, including Haiti. There are contributing recycling, however, they often damage the urban environment by scattering waste and hamper the operation work at the Duquesa landfill. In addition, they make themselves face to health risks. Especially, contact with hazardous waste such as toxic and infectious waste is serious.

Neither one municipality nor a private company can solve this problem. Only the society can confront this issue. It is expected competent authorities will work together on this issue.

**f. Marginal Communities**

Poor communities are extended along the Ozama River. The communities do not have basic social infrastructure such as electricity, water supply, sewage and waste service, as the areas are not legally residential area. In addition, the areas are very vulnerable against natural disaster such as hurricane, heavy rain, strong wind and flood.

As the areas do not have the basic social service, hygiene condition is terrible in some parts. Urgent measures from a viewpoint of humanity as well as measures to solve the problem fundamentally based on a long-term perspective are expected.

## O.2 Environmental Quality Criteria

The following are the laws on the environment, waste and local administration in the Dominican Republic.

a) Law 64-00: Establishes laws and regulations of environment administration, and the basis of the environment section.

b) Presidential decree 1194-00: Establishes environmental protection and service of state policy. Stipulates to keep Law 64-00 and a series of regulations that SEMARN establishes.

c) Presidential decree 233-96: Stipulates to preserve nature reserves, national parks, designated natural resource areas and wild life protection areas in accordance with the classification of the International Union for Conservation of Nature and Natural Resources (IUCN).

d) Law 5852-62: Stipulates distribution of public water bodies and their ranges.

e) Law 218-84: Prohibits the introduction to the country in any way human or animal excrements, domiciliary or municipal garbage and their derived, silts or sewed mud, treated or not, as well as toxic waste from industrial processes.

f) Law 83-89: Prohibits the construction waste placement and debris in streets, sidewalks, avenues, highways and green areas, fallow lots, beaches and public gardens inside the

urban and suburban areas of the country.

g) Law 247-98: Ratifies the International Agreement for the Prevention of Discharges of Waste for Ships (MARPOL 73/78)

h) Law 42-01: Comprehensive health law. Stipulates regulations by the Ministry of Health on disposal of medical waste.

i) Environmental standards
   - Environmental standards for air quality and emission gas control
   - Environmental standards for noise
   - Standards for environmental management of radioactive waste
   - Standards for environmental management of non-harmful solid waste
   - Standards for environmental management on marine affairs
   - Environmental standards for water quality and effluent control
   - Regulations for comprehensive management of infectious waste

j) Environmental service
   - Regulations on authorization and registration procedures for an environmental service donor

k) EIA procedures
   - Procedure of the environment permission acquisition for new facilities
   - Procedure of the environment permission acquisition for existing facilities

l) Law on municipal organization and self-governing body – 1952
   - Stipulates, "A municipal office aims at fulfilling financial management to satisfy the citizen's needs, and other roles."

## O.3 Legal Framework of Environmental and Social Conditions

### a. Regulatory and Legal Framework

The legal framework of this procedure is constitute by the Environmental and Natural Resources General Law, No. 64-00, from August 18 2000; and in a particular way in their articles 9, 17, 18, 38 al 48, 107, 109, 150 and 175; and the normative contained in the followings dispositions:

- Permission System and Environmental Licenses Regulation

Procedure for the transaction of the Environment Permission of the existing facilities.

- Procedures for the Environmental Impact Evaluation
- Explanatory nomenclature of the Works, Activities and Projects

### b. Procedures

The figure attached shows the procedure flowchart of the Environmental Impact Evaluation. The flow responds to the non-hazardous solid waste management case.

The categories of the project are as followed:

Category A. With environmental impacts in complex ambit chains, whose effects are from regional until national characters and with a *very high significance*. It requires an exhaustive Environmental Impact Study (EISt) that responds and be focused on the integrated scopes of the Project and that include the

accumulative and synergic impacts, and that designs an Environmental Adaptation and Management Program (EAMP) that show the capacity of the project to prevent, controlled, mitigate and compensate the environmental impacts to be produced. (Ex. Disposition of the non-hazardous solid waste) (Previous Analysis Form SGA-EIA-FOR-001).

Category B. With significant environmental impacts but limited to the area ambit of the project and its direct influence area. Those are project with a *high significance* and that will be evaluated through an Environmental Impact Declaration (EID). They could require Complementary Environmental Studies (CES) focused in critical topics. Both the EISt and the CES will be Developer according with the Reference Terms (RT) issued by SEMARN (Ex. Disposition of the non-hazardous solid waste) (Form for the Environmental Impact Declaration SGA-EIA-FOR-002).

Category C. This category is defined for the project with moderate, foreseeable and manageable potential impacts and a *moderate to low significance*. The environmental evaluation will be carried out over the base of its EID and the EAMP. (Ex. Collection of the Non Hazardous Urban Waste) (Form for the Environmental Impact Declaration SGA-EIA-FOR-002).

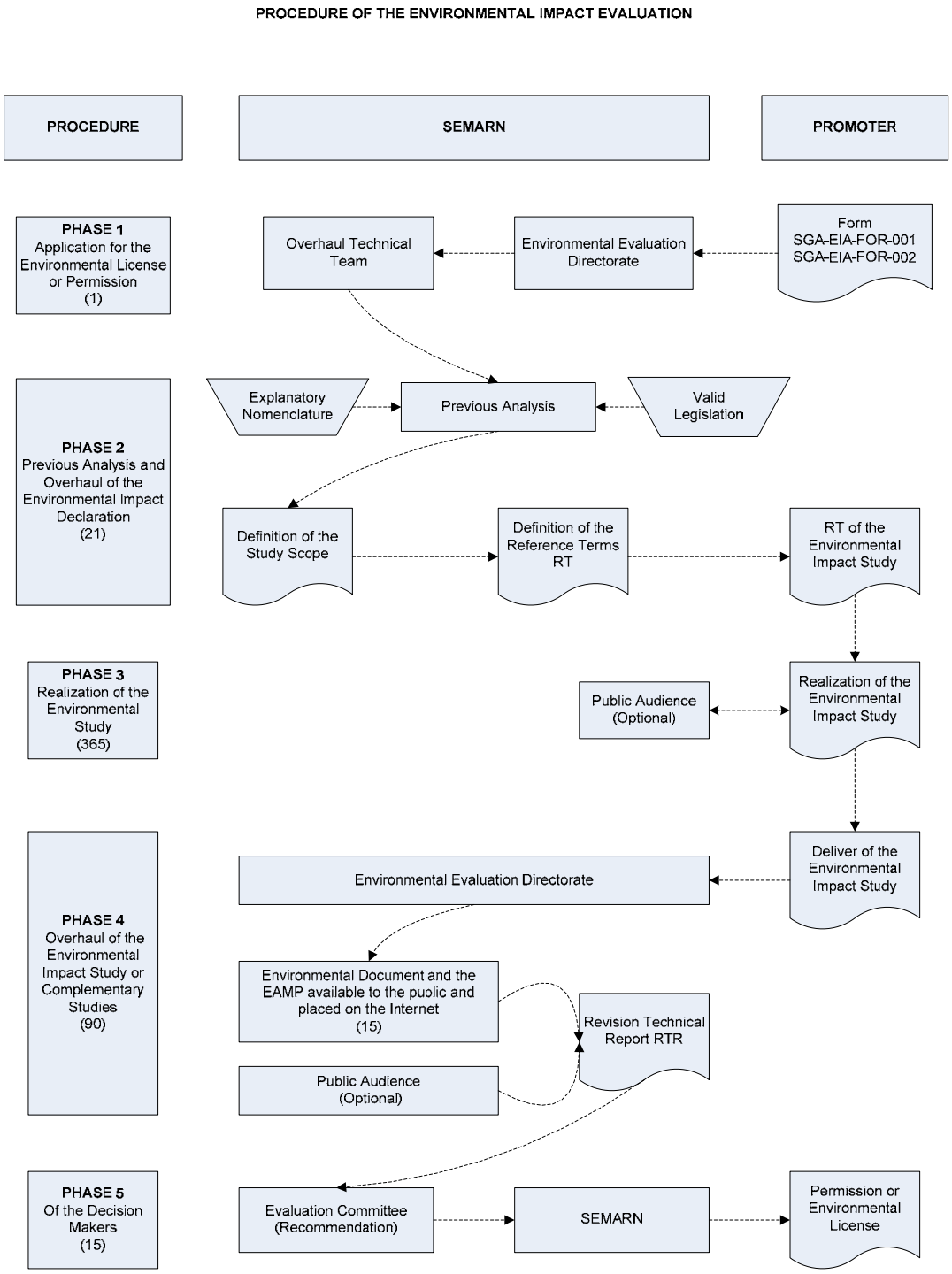



Figure O-1: Procedure of Environmental Impact Evaluation

The following procedure is to obtain a License or Environmental Permission;

PHASE 1: *Application for the License or Environmental Permission.*
The Promoter fills and presents the corresponding Application to SEMARN.

PHASE 2: *Previous Analysis and Revision of the Environmental Impact Declaration*

The Previous Analysis is carried out according to the project categories established in the Explanatory Nomenclature. This phase will have a length of time of 21 calendar days and the activities are responsibility of the Environmental Evaluation Directorate. The project is evaluated considering the valid legislation and the basic activities and can be categorically rejected if these activities violate the legislation. The Scope of the Study and the RT of the EISt are established in case that requires it. The RTs' are given to the Promoter so he can contract an Environmental Service Lender (Consultant) who will conduct the Study.

PHASE 3: *Realization of the Environmental Study*
The Promoter will present to the Environmental Evaluation Directorate (EED) in a term not bigger than fifteen (15) days a communication accepting the RTs' given. The Promoter will have a year to formulate the EISt and then he will give it to the EED for its revision and approval. In case that conflicting aspects are presented the Promoter will directly organize a public audience and will place the results in the EISt.

PHASE 4: *Revision of the Environmental Impact Study or Complementary Studies*
The Environmental Evaluation Directorate (EED) will coordinate the technical revision that will have a maximum length of 90 days. The EED will publish a note in a national newspaper indicating that the Environmental Document and its EAMP will be available and requiring commentaries. The documents will be also available through the Internet in a term not bigger than 45 days after receiving the EISt of the Promoter and for a term of 15 days from its publication. Public audiences can be carried out in case that they are required. As result of the revision a Revision Technical Report (RTR) will be elaborated.

PHASE 5: *Of the Decision Makers*
The Revision Technical Report will be send to the Evaluation Committee who will have 15 days to solve if the permission or the environmental license required will be approved and under which conditions. In case that the permission is refused the process can begin again if is demonstrated that substantial changes have been carried out. Any project can be submitted to the procedure more than two times.

**c. Organization**

SEMARN will carry out inspections and periodical audits to the execution of what is stipulated in the EAMP. The breach of the procedures, rules and dispositions contain in the laws and in the valid environmental norms, will be sanctioned according to what is established in the Law 64-00 and its Rules.

In the following flowchart of the Environmental Management Sub-Secretariat appears the Environmental Evaluation Directorate that counts with the administrative units of the Strategic Evaluations, New Projects and Existing Facilities. This Directorate leans on other units of the Sub-Secretariat and of SEMARN to fulfill with their functions of evaluating the documentation that is presented in the solicitation of Permissions and Environmental Licenses.

STRUCTURAL AND FUNCTIONAL FLOWCHART

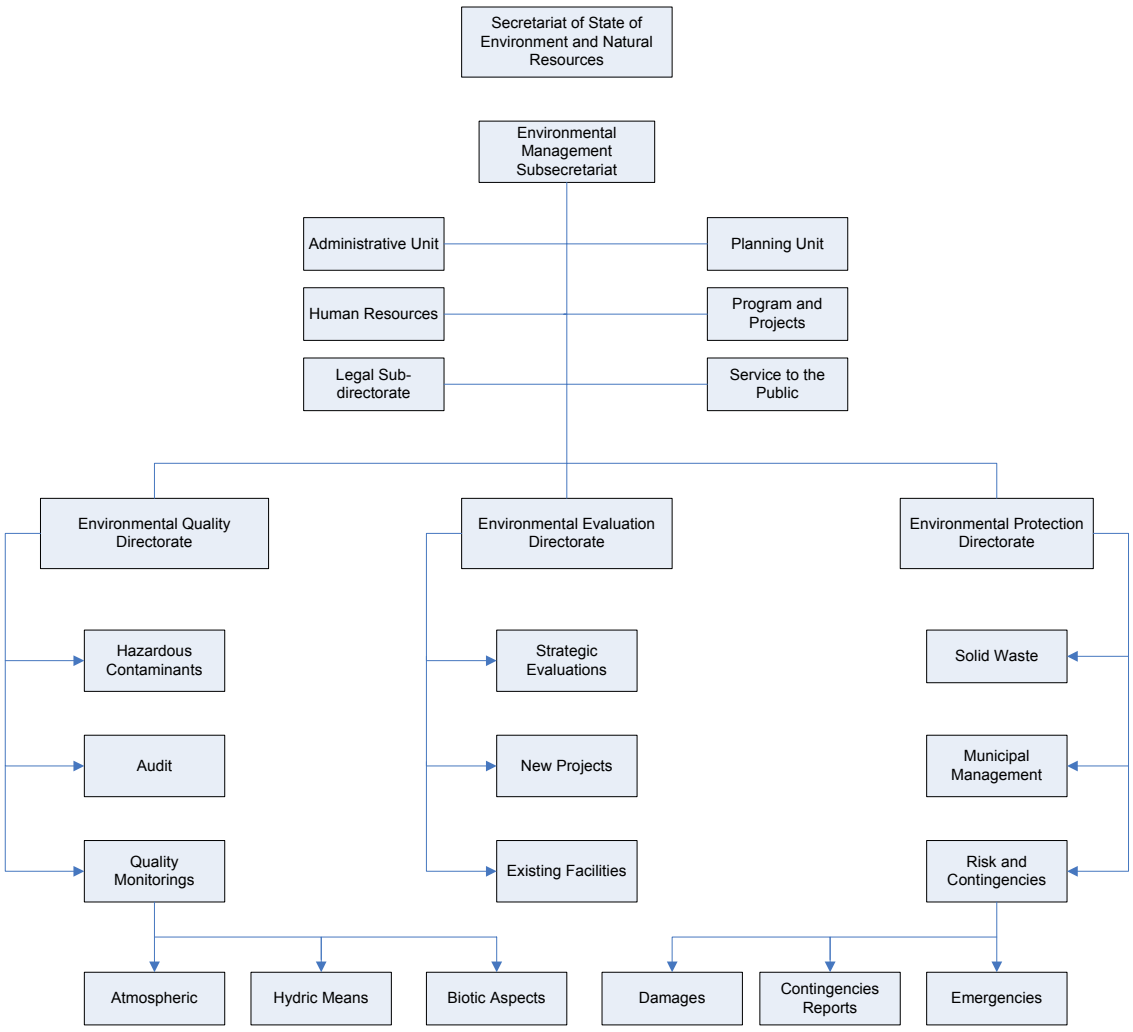



Figure O-2: Organization Flowchart

## O.4 Justification of the Master Plan

The current rapid population growth, the income growth and the economic growth have been increasing the waste amount.

At present, ADN has been taking various measures such as contracting our the waste collection work to private companies, contracting out the disposal operation to the private company, starting the waste collection by using ADN's truck to supplement the private companies' collection capacity, increasing the number of street sweepers. Even though ADN has been doing such various improvement measures with huge expenditure, the effects obtained have been little. For example, the private collection companies collect only waste which they can collect easily, only parts of many street sweepers work hard due to lack of ADN's supervision capability, citizens discard their waste in public spaces without any attention.

The solid waste problems in ADN lead not only sanitary problems in ADN. For example, the tourist industry is one of very important industries not only for ADN but also for Dominican Republic. The current waste problems would disappoint tourists and decrease the number of foreign tourists to Dominican Republic. Failure of the improvement of SWM

works will, therefore, give negative impact to the national economy.

## O.5 Concept of SWM Master Plan

Although SWM problems generally get serious with the economic development, the economic development is higher priority than the good SWM. However, the SWM problems disturb the economic development, if it gets too serious. The good SWM is essential to make the economic development sustainable.

The fundamental policy of the master plan is to overcome the SWM problems by taking the integrated measures consisting of the arrangement of SWM by-law, the organizational reform, the waste collection fee system reform, the strengthen of managerial capability of ADN, work efficiencies of waste collection and transportation, waste disposal operation and facilities, public private partnership, public cooperation, etc. The master plan aims to establish the sound SWM system as the optimum system with the minimum expenditure which ADN can afford to do.

The master plan, therefore, has given the high priority to the institutional improvement measures than the capital investment projects because they are more cost effective at this moment. To improve the efficiency of the existing resources and facilities by the improvement of institutional system and the strengthening the managerial capability with citizens' cooperation is the top priority.

As for the capital investment projects, the master plan, therefore, suggested only the necessity of the following three projects.

a) A new landfill site substituting the existing one due to the exhaust of its capacity
b) A new transfer station to reduce the current waste transportation cost.
c) A new composting plant to reduce waste final disposal amount.

However, the master plan proposed only the construction period of these facilities without identifying their locations because these have to be done carefully in the transparent procedure with involving many stakeholders. These activities which the master plan formulation process could not deal with should be executed by ADN.

IEE and EIA, if necessary, have to be executed for these facilities respectively after their locations are finalized.

## O.6 Adverse Environmental and Social Impacts to be Predicted

TOR requested the study team to assist counterparts to do the initial environmental evaluation (IEE) for the projects proposed in the master plan. The master plan proposed three capital investment projects, however it does not identify neither the locations nor technologies adopted because the both have to be decided in the transparent way with participation of many stakeholders. What we can do at this moment is to generally predict the adverse environmental impacts given by the transfer station, the composting plant and the landfill site proposed in the master plan.

Evaluation of possible environmental impact is expressed by ranks from A to D.

- A: Serious impact expected
- B: Some impact expected
- C: Not clear
- D: IEE or EIA is not necessary (no expected impact)

Table O-1: Results of Screening

| No. | Items | Impacts | Brief Description |
|---|---|---|---|
| Environmental Impacts | | | |
| 1 | Air pollution | B | Emission gas and dust may be caused by collection vehicles and landfill equipment. |
| 2 | Water pollution | B | Both surface and ground water contamination may be brought about by the leachate to be generated in the transfer station, the composting plant and the landfill operation. The water pollution can be avoided by the proper leachate control measure. |
| 3 | Soil pollution | B | Soil contamination may be caused at the transfer station, the composting plant and the landfill where the waste is disposed of, but not outside the site. In addition, such contamination will be avoided by installation of impermeable liner if necessary. |
| 4 | Waste | B | Residues may be generated by the operation of the composting plant. |
| 5 | Noise and vibration | B | Although there will be noise by collection vehicles and landfill equipment, and vibration by landfill equipment, the impacts of them depends on the site location. |
| 6 | Ground subsidence | D | Few pumping up of ground water. |
| 7 | Offensive odor | B | Waste may generate offensive odor at the transfer station, the composting plant and the landfill site. It can be minimized by the daily soil cover. |
| 8 | Geographical features | C | Although it depends on the site location, probably no critical geographical feature change will occur by construction of an enclosing dam and filling operation of waste. |
| 9 | Bottom sediment | B | Discharge of treated water from the landfill site may generate bottom sediment. It can be avoided by the proper wastewater control. |
| 10 | Biota and ecosystem | B | It may be impacted by the landfill site. It can be minimized by selecting the proper site. |
| 11 | Water usage | C | Some wells and streams in the downstream of the landfill site may be impacted. |
| 12 | Accidents | B | There is few possibility of land slide because of limited earth cutting and filling work. |
| 13 | Global warming | B | Methane gas may be generated at the landfill site, but it may be recovered. The impact depends on the technology adopted. |
| Social Impacts | | | |
| 1 | Involuntary Resettlement | C | This highly depends on the selected sites of the transfer station, the composting plant and the landfill site. |
| 2 | Local economy such as employment and livelihood, etc. | C | This highly depends on the selected sites of the transfer station, the composting plant and the landfill site. |
| 3 | Land use and utilization of local resources | B | It may be impacted by the landfill site because the required areas are wide. |
| 4 | Social institutions such as social infrastructure and local decision-making institutions | C | This highly depends on the selected sites of the transfer station, the composting plant and the landfill site. |
| 5 | Existing social infrastructure and services | C | This highly depends on the selected sites of the transfer station, the composting plant and the landfill site. |
| 6 | The poor, indigenous and ethnic people | B | The waste pickers working in the present Duqesa disposal site may be impacted by its closure. It may be minimized by providing them substitute job opportunities. |
| 7 | Misdistribution of benefit and damage | B | It may be caused in the development of the SWM facilities. The site development has to be conducted with close collaboration with the neighborhoods under transparent and fair manner. |
| 8 | Local conflict of | C | Because the SWM facilities give nuisance more or less, |

| No. | Items | Impacts | Brief Description |
|---|---|---|---|
| | interests | | everybody doesn't want it nearby. Installation of SWM facilities should fully consider the local conflicts to be created so that the proper supplementary measures are taken. |
| 9 | Gender | D | There are not many women are involved in the current disposal site. There will be no impact predicted to women by the proposed SWM facilities. |
| 10 | Children's rights | D | There are few children work at the current disposal site. There will be no impact predicted to children's right by the proposed SWM facilities. |
| 11 | Cultural heritage | C | It may be impacted depending on the site locations. The site should avoid the cultural heritage site to eliminate the impact. |
| 12 | Infectious diseases such as HIV/AIDS, etc. | D | No adverse impacts. Since the new landfill mitigates adverse impacts of current dump site operation, it will also contribute to the elimination of infectious diseases. |

## O.7 Categorization of the Projects

The construction of a transfer station, a composting plant and a new landfill site respectively require IEE and probably EIA. After the site is finalized, IEE and EIA, if necessary, has to be executed in accordance with the required procedure before the commencement of the construction.

# Annex P

*Integrated Improvement to the Collection Service*

Contents



Tables



Figures

# P Integrated Improvements to the Collection Service

## P.1 Background

At the moment the waste collection service in the National District is developed by private companies, micro-companies and directly by the Municipality through two units that depend directly of the Environmental Management and Urban Cleansing Directorate.

The private companies that carry out the domiciliary collection service correspond to ADN Service and DSC, the first one operates in the district I and III, and the second in the district II, both companies collect 70% of the domiciliary waste approximately. The wastes collected by these companies are deposited in Duquesa. The remaining 30% of domiciliary solid waste is collected by the Municipality through two units, the first denominated ADNAU who carries out the service with personnel and compactors trucks of the Municipality. The second unit denominated ADN carries out the service with small dump and bed trucks leased to diverse persons who at the same time provide the drivers, the rest of the personnel is responsibility of the Municipality, both services don't have restrictions as for territory. The wastes collected by ADNAU are deposited in Duquesa while those of ADN are taken to the Transfer Station located in the district III.

The waste coming from big generators (for example buildings in height, trade and industries) are collected by 4 private companies, that operate indistinctly in the three districts, and bill directly to the generators, paying a percentage of their utilities to the Municipality. For the case of the waste collection generated in the municipal markets, the Municipality maintains a contract with the company SERTEX for its collection. All the wastes collected by private companies are taken directly to Duquesas' sanitary landfill.

The collection service in the marginal sectors, summoned in the district II and III is carried out through 5 community micro-companies (CMC), which operate with dump trucks of their own and discharge the waste in the transfer Station located in Villa Agrícola District III. The operation of the transfer Station is carried out directly by the Municipality, while the transfer transport is carried out by different private companies.

The contracts that maintain the Municipality with the private companies establish exclusivity in the assigned territories, however, it is not fulfill and inclusive the companies operate in areas different to those indicated in the contract. On the other hand, the collection carried out by ADN with small trucks and that it was planned to collect in areas of difficult access and support the collection works of the sweeping waste, doesn't fulfill with it purpose and they generally carry out the service in the same areas assisted by the private companies.

The above-mentioned jointly with the planning lack and routes of the collection service, it is in an overlapping of actors, concentrating the service on the urban areas of easy access and in main or wide avenues, being a high percentage of the territory without covering.

The previous situation generates a new effect, since there are sectors without covering the residents transfer their waste to the main avenues, becoming a continuous flow of waste that gives place to big accumulations of waste independently that the collection truck pass reiterate times by such avenues.

The continuous flow of waste toward the main avenues, the inadequate storage of the waste (small bags, containers of insufficient capacity, discharge of waste randomly) and the collection carried out with small open trucks (part of the waste collected is scattered in the avenues during the transport), constitute some of the main causes for which the city is constantly dirty.

In general terms we can say that the planning, structures and organization of the current

collection service doesn't respond to the necessities of the city and the achieved quality is very below the good standards for this type of service.

The collection service was planned initially to give answer to a critical situation of waste accumulation that presented the city, such a situation was overcome, however, the planning of the service has not changed and therefore, it responds to the daily urgencies, without having a global vision of the necessities, where on one hand each operator has become exclusively a waste collector without any responsibility on the quality of the service, and for other, the Municipality has gotten used to act under a strategy that we could say it is a constant "turn off fire."

With the above-mentioned is the lack of legal instruments that allow the Municipality regulate and investigate the activity, in fact doesn't exist a cleansing regulation and the valid contracts don't establish the quality of the service hired, the responsibilities of the operators, the inspection systems and sanctions of non fulfillment.

The conjunction of the previous aspects allows us to conclude that the solid waste collection in the National District is inefficient, due to the lack of planning and design of the service, to the inadequate organization that doesn't achieve an integral waste management, what considerably increases the costs and reduces the possibilities to improve the covering.

To revert the situation, is convenient to impel a project guided to organize and improve the current collection service, achieving an efficiency that allows in the short term to improve the quality, reduce the costs and reinforce the organization of the system so the waste management is carried out as an integral management achieving a better distribution of the resources and bigger covering of the service.

## P.2 Implementation Method

Considering that the operation of the collection service has been passed over mainly to the private sector, and being the Municipality the responsible of investigating the service, two pilot projects have been designed which objectives are:

Pilot Project 1 (denominated Pre Pilot Project P.P.P.),: Its objective is to establish a collection service that fulfills the quality fixed by the Municipality, executed directly by ADN with the purpose that the C/P is trained as for the design and inspection of the service and at the same time serve as reference for the private sector. The target area corresponded to the sector 6 according to nomenclature of collection routes of the cleaning service and it was executed from September to November of 2005.

Pilot Project 2 (denominated Pilot Project P.P.): Its objective is to establish a collection service of same quality to the one achieved in the sector 6 (P.P.P.), executed in this case by the private operator, investigated by the ADN who also makes the design of the service. The target area corresponded to the sector 5 according to nomenclature of collection routes of the cleaning service and it was executed from May to July 2006.

The implementation methodology through the development of PDM (Project Design Matrix), it is shown next.

### a. Project Design Matrix

The following Project Design Matrix was formulated with the purpose of clarifying the purpose, prospective results, activities and required inputs.

Table P-1: Project Design Matrix

| | |
|---|---|
| Name of the Project:<br>Collection Improvement | Period<br>P.P.P.: September 2005 to December 2005<br>P.P.: Mayo 2006 – Julio 2006 |
| Target Areas:<br>Pre- Pilot Project Area 6<br>Pilot Project Area 5 | Target Group<br>Personnel of ADN, Private Operator, Service Users. |

| Project Summary | Indicators | Inspection Means | Important Suppositions |
|---|---|---|---|
| Global Goal<br>A collection service of good quality is settled in the urban area of the DN (excluding marginal areas), and the collection service is executed according to the quality patterns. | The collection service is carried out according to a design that responds to technical approaches and fulfills the quality settled by the Municipality. | Monitoring by residents (interviews phone)<br>Registration of data of collection activities<br>- Registration of patrolling data of the collection conditions<br>- Reduction of complaints of the waste collection problems. | ADN establishes as a priority the improvement of the collection service. |
| Purpose of the Project:<br>Pre Pilot Project (P.P.P.)<br>1. The collection service is settled and is executed directly by ADN in the target area of the Project, Area 6.<br><br>Pilot Project (P.P.)<br>1. Is settled and executed the supervision method of the private company that operates in the target area of the Project Area 5. In the Project area, the private companies offer the same level of service that the one obtained in the Area 6. | The quality of the service in the area 6 fulfills with what is settled and the personnel of ADN are qualified to execute it.<br>The private Operator executes the service with the established quality and the ADN carries out the inspection in an effective form. | Monitoring by residents (interviews phone)<br>Registration of data of collection activities<br>Registration of patrolling data of the collection conditions<br>Reduction of complaint for waste collection problems. | ADN has the physical and personnel resources to carry out the service<br>The operator is willing to participate in the pilot project |
| Results:<br>Pre Pilot Project (P.P.P.)<br>1. The ND has an area where the collection service is of quality and it serves as reference for the personnel of the Municipality and for the private operators.<br>2. The Collection Improvement Manual is prepared based on analysis and evaluation.<br>3. The Manual of Supervision of the Service is prepared based on analysis and evaluation.<br>4. A method for the data management about the collection service is settled.<br>Pilot Project (P.P.)<br>1. The private operators understand that the results of the P.P.P. can be implemented so that their administration and operation are more efficient and this way improves the level of the service.<br>2. The design of the collection routes is carried out using the Collection Improvement Manual. | Pre Pilot Project (P.P.P.)<br>100% of the collection routes in the area 6 respond to a good design.<br>There is a document that defines the procedures detailed of the design of the collection service.<br>There is a document that defines the procedures detailed of the inspection and control of the service.<br>Statistical information is generated on the execution of the service<br>Pilot Project (P.P.)<br>The private operator develops the service in the area 5 according to the design elaborated by ADN.<br>The ADN carries out the | Pre Pilot Project (P.P.P.)<br>Plane with routes diagram<br>Collection Improvement Manual.<br>Manual of Supervision of the Service.<br>Registration of data of the collection service<br>Pilot Project (P.P.)<br>Plane with routes diagram<br>Registration of data of the collection service<br>Registration of data of the service inspection<br>Plane with sweeping routes diagram.<br>Registration of data of the streets sweeping service. | The ADN is willing to implement the improvement measures of the service and will assure the continuation of the program.<br>The operator carries out the modifications of the service according to the indicated by ADN. |

| Project Summary | Indicators | Inspection Means | Important Suppositions |
|---|---|---|---|
| 3. The inspection of the service the Manual of Supervision of the Service.<br>4. Improves the sweeping of streets<br>5. Strengthens the coordination between the ADN and the private operator.<br>6. Subsequently, similar results as those achieved in the area 5 are expected. | inspection and control of the service according to what is settled in the Manual of supervision of the service.<br>The sweeping service in the area 5 respond to a design developed under technical approaches.<br>Transfer of information exists between ADN and private operator. | | |
| Activities<br>Pre Pilot Project (P.P.P.)<br>1. Diagnostic of the service in area 6.<br>2. Service Design<br>3. Trainings to the C/P<br>4. Improvements Implementation<br>5. Monitoring of the service<br>6. Elaboration of the Improvement Collection Manual<br>7. Elaboration of the Manual for the Supervision of the Service.<br>8. P.P.P. Evaluation<br>Pilot Project (P.P.)<br>1. Diagnostic of the service in area 5.<br>2. Design of the Collection Service<br>3. Trainings to the C/P and private operators<br>4. Improvements Implementation<br>5. Implementation of the service supervision<br>6. Sweeping design<br>7. Trainings to the C/P as for sweeping<br>8. Settled of the sweeping project<br>9. Monitoring of the seeping<br>10. Projects evaluation | Entrances<br>＜Dominican Part＞<br>• C/P: one for the collection improvement, one for the data management, one for the patrolling of the collection conditions, as many as the necessaries for the other activities.<br>• Uniforms and other necessities for the collection and sweeping personnel.<br>• 2 vehicles for supervision<br>• Communication equipments<br>• Collection vehicles (ADN and private lenders of the service)<br>＜Japanese part＞<br>• Study Team Members: an expert in collection improvement (coordinator of the project), one for data management, one for patrolling of collection conditions<br>• Assistants: 3<br>• Vehicles: 3<br>• Communication equipments<br>● Computers: 1; printer 1; software: Auto CAD | | |

### b. Implementation Plan

| Activities | Tasks | Participation Level | | | Observations |
|---|---|---|---|---|---|
| Pre Pilot Project (P.P.P.) | | C/P | E/P | E/E | |
| 1. Diagnostic of the service in the area 6. | Conformation of the work group of the C/P | A | | R | |
| | Rising information of the area | R | | A | |
| | Diagnostic of the service | R | | A | |
| | Public Opinion Survey | R | | A | The surveys were carried out by AAA |
| | Determination of the resources available | R | | A | |
| | Definition of the responsibilities | A | | R | |
| 2. Improvement of the Collection Service | Establishment of the quality of the service | R | | A | |
| | Route evaluation | A | | R | |
| | Design of the collection service | A | | R | |

| Activities | Tasks | Participation Level | | | Observations |
|---|---|---|---|---|---|
| | Assignment of resources | R | | A | |
| | Technical personal training routes designs | | | R | |
| | Training to the collection personnel | | | R | |
| | Elaboration control service form | R | | A | |
| | Trainings to the personnel of information management | | | R | |
| 3. Improvements Implementation | Setting of the new service | A | | R | |
| | Setting of the information program to the community | A | | A | Support was given to the pilot project Community participation |
| 4. Monitoring | Rising information according to the monitoring program | R | | A | |
| | Inspection in land of the routes | R | | A | |
| 5. Elaboration of the Collection Improvement Manual | Draft document | A | | R | |
| | Final Document | A | | R | |
| 6. Elaboration of the Manual of Supervision of the Service | Draft document | A | | R | |
| | Final Document | A | | R | |
| 7. Project Evaluation | Evaluation pre pilot project | A | | R | |
| Pilot Project | | | | | |
| 1. Diagnostic of the service | Conformation of the work group C/P, E/P, E/E | A | A | R | |
| | Rising information of the area | R | A | A | |
| | Diagnostic of the project area service | R | A | A | |
| | Public Opinion Survey | R | | A | The surveys were carried out by AAA |
| | Determination of the resources available | R | R | A | |
| | Definition of the responsibilities among the parts | A | A | R | |
| 2. Improvement of the Collection Service | Evaluation of the routes | R | R | A | |
| | Design of the collection service | R | A | A | |
| | Assignment of resources | R | R | A | |
| | Trainings of the C/P personnel | | | R | |
| | Trainings of the P/C personnel | A | | R | |
| | Elaboration of the route sheet | A | R | A | |
| | Elaboration captures data form | R | | A | |
| 3. Improvements Implementation | Setting of the service | A | R | A | |
| | Setting of the inspection | R | | A | |
| | Setting of the information program to the community | A | A | A | Support the Pilot Project Information to the Community |
| 4. Sweeping Improvements | Design of the sweeping service | A | | R | |
| | C/P Trainings | | | R | |
| | Setting of the sweeping | R | | A | |
| 5. Monitoring | Monitoring | R | A | A | |
| | Inspection | R | | A | |
| 6. Project Evaluation | Evaluation of the Pilot Project | A | A | R | |

## c. Organization

### c.1 Pre Pilot Project Area 6

The pilot project in the area 6 was developed with the participation of the Municipality and of the S/T, under the following organization:

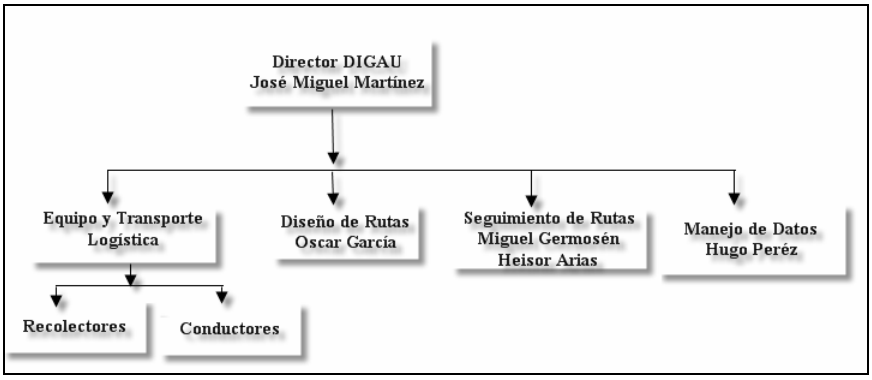



Figure P-1: Organization of the Pre Pilot Project

### c.2 Pilot Project Area 5

The following figure shows the organization for the pilot project

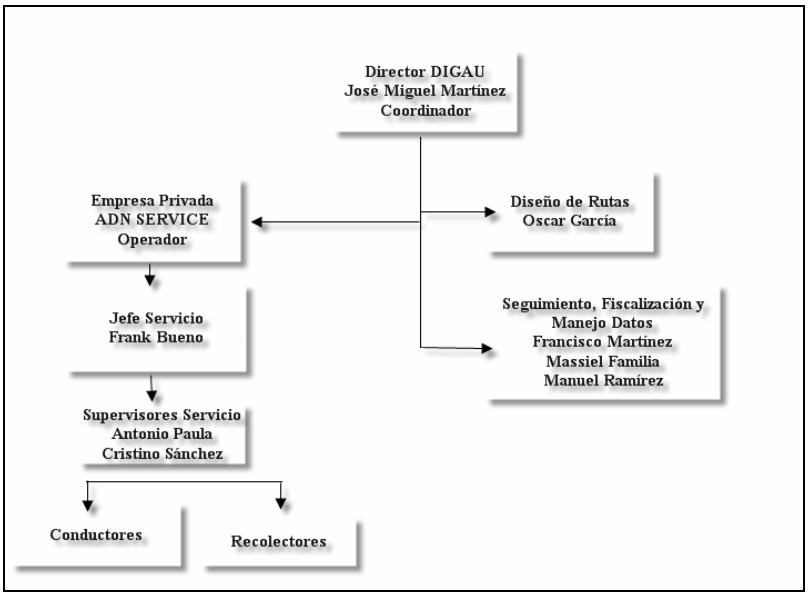



Figure P-2: Organization for the Pilot Project

### d. Work Program.

### d.1 Activities Program

The following table shows the activities program.

Table P-2: Activity Program of the Pre Pilot Project

| Pre Pilot Project Area 6 | | Work Program | | | | |
|---|---|---|---|---|---|---|
| ID | Activity | Sep-06 | Oct-06 | Nov-06 | Dic-06 | Jan-07 |
| 1 | Diagnostic of the service | | | | | |
| 1.1 | Conformation of the C/P work group | XX | | | | |
| 1.2 | Rising information of the area | X | X | | | |
| 1.3 | Diagnostic of the service in the Project area | | X | | | |
| 1.4 | Public Opinion Survey | | XX | XXXX | | |
| 1.5 | Determination of the resources available | | X | | | |
| 1.6 | Identification of the responsibilities of the work team | | X | | | |
| 2 | Improvement of the collection service | | | | | |
| 2.1 | Establishment of the quality of the service | | X | | | |
| 2.2 | Design f the collection service | | XX | | | |
| 2.3 | Assignment of resources | | X | | | |
| 2.4 | Technical personal training in design of routes | | XXXX | X | | |
| 2.5 | Trainings of the collection personnel | | X | X | | |
| 2.6 | Elaboration of the control service form | | X | | | |
| 2.7 | Elaboration of capture of data form | | X | | | |
| 2.8 | Personal training in information management | | X | X | | |
| 2.9 | The personnel's training in inspection of the service | | X | X | | |
| 3 | Improvements implementation | | | | | |
| 3.1 | Setting of the new service | | | XXXX | | |
| 3.2 | Support pilot project of information to the community | | XX | XXXX | | |
| 4 | Monitoring | | | | | |
| 4.1 | Rising of the information according to the monitoring program | | | XXXX | | |
| 4.2 | Inspection in land of routes | | | XXXX | | |
| 5 | Elaboration of the Collection Improvement Manual | | | | | |
| 5.1 | Draft | | | XXX | | |
| 5.2 | Final | | | X | | |
| 6 | Elaboration of the Manual for the Service Supervision | | | | | |
| 6.1 | Draft | | | XXX | | |
| 6.2 | Final | | | X | | |
| 7 | Project Evaluation | | | XX | | |

Table P-3: Activity Program Pilot Project

| Pilot Project Area 5 | | Work Program | | | | |
|---|---|---|---|---|---|---|
| ID | Activity | Apr-06 | May-06 | Jun-06 | Jul-06 | Aug-06 |
| 1 | Diagnostic of the service | | | | | |
| 1.1 | Conformation of the work groups S/T, C/P and private company (P/C) | | XX | | | |
| 1.2 | Rising information of the area | | XX | | | |
| 1.3 | Diagnostic of the service in the Project area | | XX | | | |
| 1.4 | Public Opinion Survey | | X | XXXX | | |
| 1.5 | Determination of the resources available | | | X | | |
| 1.6 | Identification of the responsibilities of the parts | | | XX | | |
| 2 | Improvement of the collection service | | | | | |
| 2.1 | Establishment of the quality of the service | | | X | | |
| 2.2 | Design f the collection service | | | XX | | |
| 2.3 | Assignment of resources | | | X | | |
| 2.4 | C/P Technical personal training in design of routes | | XX | XX | | |
| 2.5 | Trainings of the collection personnel of the P/C | | | XXX | | |
| 2.6 | The C/P technical personnel's training in inspection of the service | | | XX | | |
| 2.7 | Elaboration of the route sheet | | | X | | |
| 2.8 | Elaboration of capture of data form | | | X | | |
| 2.9 | C/P and E/P Personnel training in information management | | | XX | | |
| 3 | Improvements implementation | | | | | |
| 3.1 | Setting of the new service | | | XX | XXX | |
| 3.2 | Support pilot project of information to the community | | | XXX | XXX | |
| 3.3 | Setting of the inspection program | | | XX | XXX | |
| 4 | Improvement of the sweeping | | | | | |
| 4.1 | Design of the sweeping service | | | XX | | |
| 4.2 | C/P Trainings sweeping | | | X | | |
| 4.2 | Setting of the sweeping | | | X | XXXX | |
| 5 | Monitoring | | | | | |
| 5.1 | Rising of information according to the monitoring program | | | XX | XXX | |
| 5.2 | Inspection in land of the collection route and sweeping | | | XX | XXX | |
| 6 | Project evaluation | | | | XXXX | |

## d.2 Implementation of the Pre Pilot Project Area 6

### d.2.1 Diagnostic of the Service

The first activities that were carried out once the work team was conformed and the responsibilities of each one were defined; the diagnosis of the collection service in the sector 6 whose location is shown in the following figure was carried out.

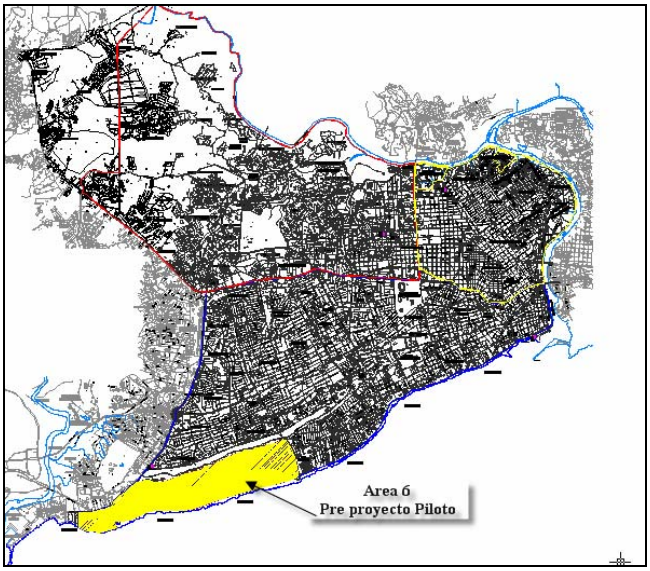



Figure P-3: Area 6 Pre Pilot Project

For it the area 6 was characterized, consigning in a plane the zoning of the area according to generator type (residential, commercial, institutional, of generator, other, etc.), the road conditions, peculiar antecedents of the area (such as only sense of traffic, narrow streets, etc.), additionally the number of inhabitants, trade and other was determined by sector according to the classification used by the Company AAA for the billing of the cleaning.

Also the characteristics of the collection service were analyzed, carrying out the pursuit of the routes in the area of the project, verifying frequencies, days and schedules of attention, number of vehicles and of personnel, times associated to the service, and particular characteristics. With the purpose of knowing the opinion of the users a public opinion survey was design, which was carried out by the company AAA in charge of the collection of the cleaning service, among the day 7 and 14 of October of 2005.

With the antecedents collected the diagnosis of the service was carried out, obtaining the following results:

The area 5 has approximately 70,000 inhabitants distributed in a total of 7 neighborhood units.

The constructions of the sector correspond mainly to housings of one level, been very few constructions in height.

There are four sectors where the streets are very narrow for what the service cannot be execute with the compactors trucks of the Municipality, being necessary the operation of small trucks.

The commercial activity concentrates on the Independence Avenue that crosses the project area. In the neighborhoods there are small groceries stores.

The daily production of waste has been calculated in 54 ton/day.

The collection service is carried out by the company ADN Service. The service doesn't respond to a rational design, and is developed under improvised programs that are pointed to solve the immediate problems.

The routes are not defined, and the attention is concentrated in the Independence Avenue being able to pass one or two trucks in the day. For the rest of the area the service is carried out once or twice per week, however, the days and schedules of attention vary considerably.

In general the development of the service responds to the availability of trucks and the journeys are established according to the approach of the drivers who privilege the sectors where it is easier to lift the waste and where they receive economic retributions by the users. This fact generates unnecessary displacements that only increase the journey times without collection, what rebounds in the duration of the work day and an increase of the costs of the service.

The vehicles used in the service are generally of 25 $yd^3$ that are in terrible condition and the personnel is conformed by a driver and two collectors, whose doesn't have uniform, protection equipments and tools to execute the service.

The service is of bad quality, all the waste is not collected, the areas are left dirty, where there are metallic tanks, only the bags that are in the superior part are collected, leaving them with waste which present an advanced level of decomposition. In the case of the plastic tanks, these are lifted and discharged in the truck and then are left in a disordered form on the roadway.

In the area was also observed that the waste collection was carried out with small dump trucks, which are directed by the Municipality. These trucks carry out the collection in specific areas that are defined by district manager. During the transport of the waste collected, the fall of bags takes place, which are left in the roadways and later on destroyed by the vehicles, contaminating even more the sector.

The previous situation has resulted in big accumulations of waste in the neighborhoods and the constant transfer of the waste by the generators to Independence Avenue which is always seen dirty.

There is no registration of the antecedents of the development of the routes like such as: times of exit and entrance to the parking place of the vehicles, times of beginning and term of the collection, quantity of waste collected, hours worked by the vehicle and personnel, fuel consumption, lubricant and other inputs, traveled distances, that allows to have reliable data for the later evaluation of the routes, costs control and elaboration of budgets for the service development.

The only registration that is kept is the entrance and exit control to Duchess, however, any process of it is carried out and it is not associated to the journey or area of attention of the truck.

On the other hand, the EMUCD doesn't make any inspection type and monitoring in land of the service, for what doesn't have antecedents to make a new design.

Due the above-mentioned is not possible to quantify the quality indicators and neither to determine the quantity of waste collected, even more when the trucks besides of collecting the waste in the area 6, collects those of other areas.

In relation to the results of the survey, these indicate that most of the users does not agree with the service (72%), 18% of those interviewed qualifies it as bad, 54% qualifies the waste service as irregular, and 28% qualifies it as good.

Within the aspects that the residents of the sector 06 understand that should be improve as for the waste collection service in the city, 63% coincides in that the most important thing is the quality of the service that should improve, pointing out as important points a clean collection (without leaving waste in the street neither spill of liquids, less noises by the trucks, place the tanks in its place once the waste is collected, etc.); 11% considers that more waste basket should be placed in the public spaces, 5% considers primordial the sweeping of streets and an important 20% made emphasis in setting schedules to regularize the waste collection service in a permanent way.

In relation to the delivery of waste, the users take out their waste every day and in any schedule. The storage is carried out mainly in small bags and in metallic tanks that makes more difficult the rising of waste. Additionally we could see that there are facilities in front of the properties for the installation of tanks, which have an inadequate design, and in most of the cases they only hinder the waste collection, even more when the community has the habit of discharging the waste randomly, becoming in unhealthy source.

Once the diagnosis was carried out the availability of trucks of ADNAU to use in the pre pilot project was analyzed, being in charge of the EMUCD their conditioning for the setting of the project.

### d.2.2 Improvement of the collection service.

The improvement of the collection service comprises the following activities:

**Establishment of the service quality.**

Based on the availability of resources and the service level that ADN wanted to impose in the sector the service quality was settled, that corresponds to:

The service will be developed from Monday to Saturday with a frequently of one day after for all the sectors where the collection is carried out with compactors trucks of 20 and 25 $yd^3$.
The sectors with narrow streets will be assisted daily with dump trucks which will discharge to the compactors trucks.
The work day will be developed between 06:30 to 14:30 hrs.
Each vehicle will have a driver and three collectors.
The whole personnel will be uniformed and provided of the necessary tools to make his work.
Strictly fulfill with the frequency and schedules
Not disseminate waste in streets and avenues
Clean the areas where the waste is accumulated
Treatment courts with the users
Not move away the waste of the interior of housings
Not collect debris or trunks
Not request or accept payments for the service
Use uniform correctly
Inform of irregularities in the service

**Design of the collection service.**

The first stage of the design of the new routes corresponded to the calculation of the tons to collect the heavy days[1] and normal days[2], according to the frequency and schedules of collection established. The tonnages were determined considering the PPC by type of generator existent in each sector. In the moment when the routes were designed, they were no tonnage antecedents for what you could not verify in this opportunity if the values assigned to the PPC were correct, later on when the project was settled the data was corroborated.

The area was divided in two sectors, sector A with attention Monday, Wednesday and Friday, sector B with attention Tuesday, Thursday and Saturday. In each sector was considered 6 routes, and also a route of daily attention that covers the whole Independence Avenue, because the users are accustomed to take their waste to this avenue. The following figures show the classification and established routes.

[1] Heavy day: day of maximum accumulation of waste
[2] Normal day: day of minimum accumulation of waste

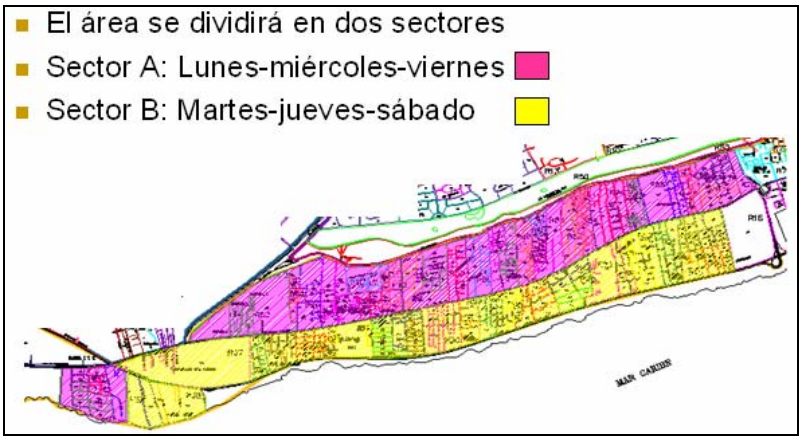



Figure P-4: Classification

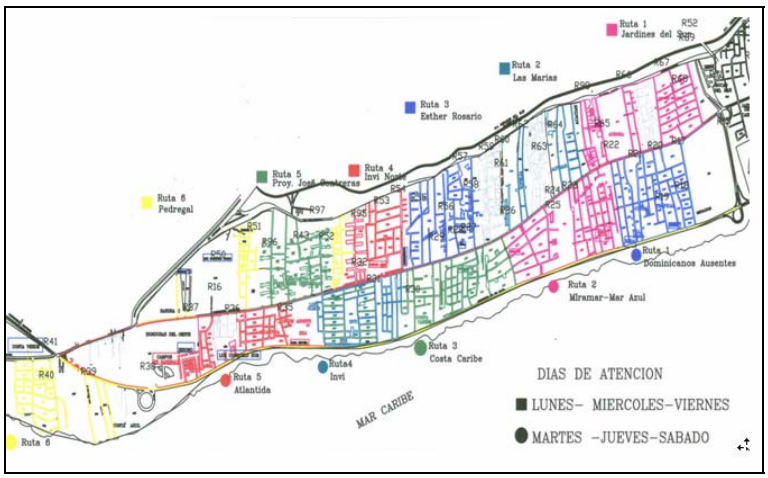



Figure P-5: Routes designed

Later on the routes diagramming was carried out, the following figure shows some routes diagrams of the service.

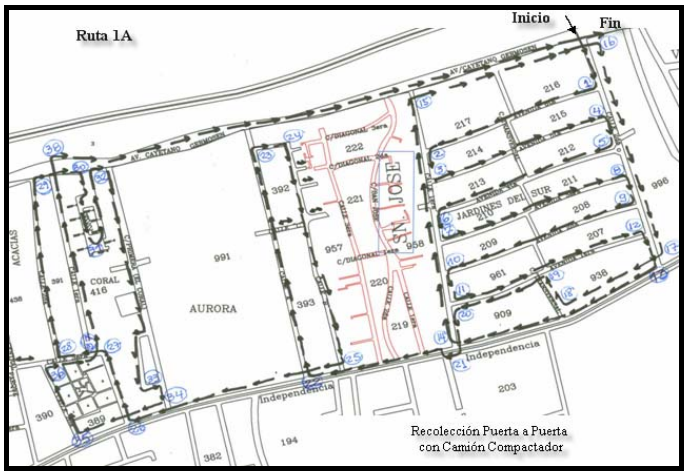



Figure P-6: Diagram Route 1A

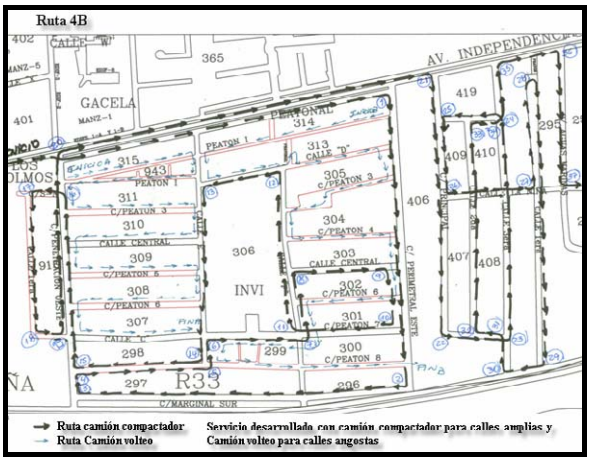



Figure P-7: Diagram Route 4B

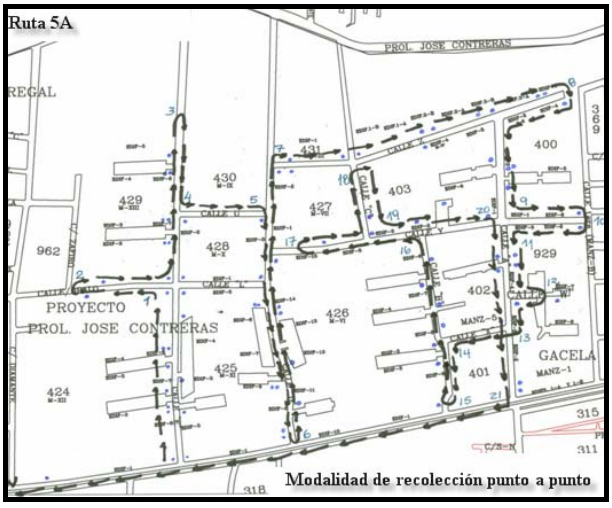



Figure P-8: Diagram Route 5 A

**Resources assignment**

For the execution of the project the following resources were considered:

Vehicles

- ❑ 7 plant compactors trucks
- ❑ 2 dump trucks
- ❑ 3 vehicles to pursuit the routes

C/P Personnel

- ❑ 1 Service manager
- ❑ 2 Supervisors
- ❑ 7 compact truck drivers
- ❑ 21 compactor collection helpers
- ❑ 2 dump truck drivers
- ❑ 7 dump collection helpers
- ❑ 3 drivers pursuit vehicles

Implements

- ❑ Work cloth
- ❑ Protection gloves
- ❑ Communication equipments

- ❑ Shovel-broom
- ❑ First-aid kit

**Personal Training**

The technical and operative personnel that participate in the P.P.P. were trained, the activities comprised:

Calculation procedure to determine the waste generation, production heavy and normal days, according to collection frequency.
Calculation procedure of indicators
Calculation procedure to determine sectors and sub-sectors
Diagramming Procedure, Diagramming rules
Routes verification procedure
Procedures for the installation of routes
Routes evaluation method

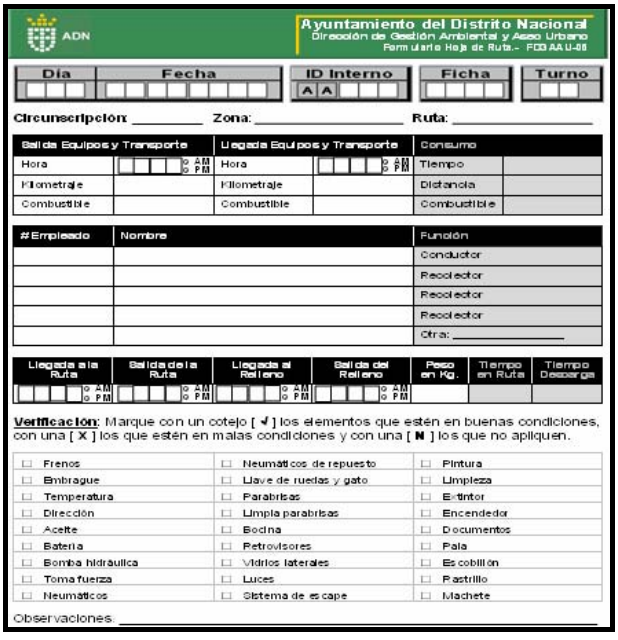
The training was carried out in parallel form to the activities of improvement of the collection service; later on this was reinforced in the whole implementation period of the project.

Once made the design of the service and foresaw to the setting of the service, we proceed to train the operative personnel in relation to the form of developing the service, the approached topics were:

Training in the route sheet
Forms of making the collection and security measures
Training in the journey of the route assigned.
The training was reinforced during the project development.

**Elaboration of service control forms (Route Sheet) and capture of data forms.**

A Route Sheet was designed for the rising of the daily antecedents of the routes; also a sheet for the information of the previous and later calculation of parameters of service evaluation was elaborated in Excel. The following figure shows the route sheet used.


ADN

Ayuntamiento del Distrito Nacional
Dirección de Gestión Ambiental y Aseo Urbano
Formulario Hoja de Ruta.- FDAAU-08

| Día | Fecha | ID Interno | Ficha | Turno |
|---|---|---|---|---|
| | | A A | | |

Circunscripción: _____ Zona: _____ Ruta: _____

| Salida Equipos y Transporte | | Llegada Equipos y Transporte | | Consumo | |
|---|---|---|---|---|---|
| Hora | AM PM | Hora | AM PM | Tiempo | |
| Kilometraje | | Kilometraje | | Distancia | |
| Combustible | | Combustible | | Combustible | |

| #Empleado | Nombre | Función |
|---|---|---|
| | | Conductor |
| | | Recolector |
| | | Recolector |
| | | Recolector |
| | | Otra: _____ |

| Llegada a la Ruta | Salida de la Ruta | Llegada al Relleno | Salida del Relleno | Peso en Kg. | Tiempo en Ruta | Tiempo Descarga |
|---|---|---|---|---|---|---|
| AM PM | AM PM | AM PM | AM PM | | | |

Verificación: Marque con un cotejo [ ✓ ] los elementos que estén en buenas condiciones, con una [ X ] los que estén en malas condiciones y con una [ N ] los que no apliquen.

| | | |
|---|---|---|
| ☐ Frenos | ☐ Neumáticos de repuesto | ☐ Pintura |
| ☐ Embrague | ☐ Llave de ruedas y gato | ☐ Limpieza |
| ☐ Temperatura | ☐ Parabrisas | ☐ Extintor |
| ☐ Dirección | ☐ Limpia parabrisas | ☐ Encendedor |
| ☐ Aceite | ☐ Bocina | ☐ Documentos |
| ☐ Batería | ☐ Retrovisores | ☐ Pala |
| ☐ Bomba hidráulica | ☐ Vidrios laterales | ☐ Escobillón |
| ☐ Toma fuerza | ☐ Luces | ☐ Rastrillo |
| ☐ Neumáticos | ☐ Sistema de escape | ☐ Machete |

Observaciones: _____

Figure P-9: Service Control Route Sheet

The design of the route sheet and of the data management form was made together with the C/P; later on the C/P was trained in the use of these documents.

**The personnel's training in inspection works.**

Before the of the pre pilot project, the personnel was qualified in relation to the methodology of the service inspection.

### d.2.3 Setting of the New Service

In date 31de October of 2005, the new collection service started, monitoring every day the times and journeys, using for it the route sheet.

During the first week the routes were monitored by the S/T and the C/P and with the data the routes were gauge.
Starting from the 2ª week the route sheet was completed by the trucks drivers.
Every week the execution of the routes was inspected by the service manager.
Daily the information contain in the route sheet was entered to the data form.
During the development of the project new surveys were made in order of knowing the opinion of the residents.
The tonnage collected was determined starting from the entrance data to Duchess.

## d.3 Implementation of the Pilot Project Area 5

The implementation of the pilot project followed the same methodology used for the Pre Pilot Project; in this case the activities of the EMUCD were directed to the design and inspection of the service and the Private Company P/C was in charge of the operation of the service. Next are the main aspects of the implementation of the P.P.

### d.3.1 Diagnostic of the Service

The Pilot Project Area is shown in the following figure.

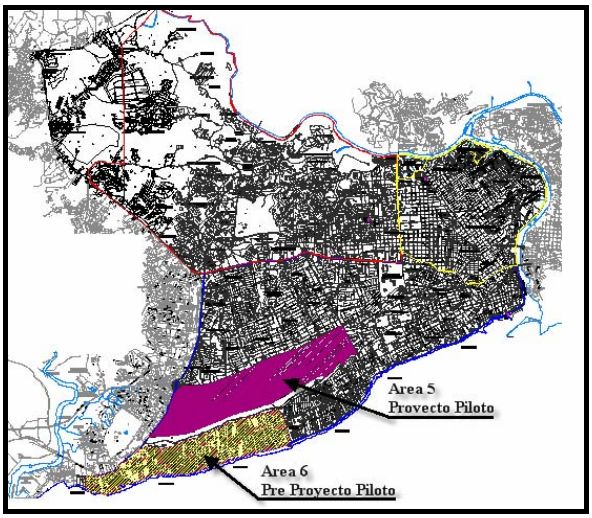



Figure P-10: Area 5 Pilot Project

The diagnosis of the Service allows concluding the following:

The area 5 has approximately 90,000 inhabitants distributed in a total of 9 neighborhood units.
In the area there are three zones, one just residential of wide streets, other with a high trade percentage and floating population and a third with narrow streets and high population density.
The collection service is carried out mainly by the company ADN Service, also having the operation of private companies that assist big generators (commercial centers and buildings of great height).

Although the private company has identified attention sectors, the service doesn't respond to a rational design, and is developed according to the availability of resources that are distributed based on the accumulation of waste that exists in the area, assisting mainly the big avenues, by what great accumulation of waste is observed in the neighborhoods.

The service is generally carried out with 5 trucks, which begin the works after the 08:00 hrs. and is extended beyond the 18:00 hrs.

Defined routes don't exist, and the attention is concentrated in the big avenues being able to pass once or twice a day for each one of them. For the rest of the area the service can be carried out until twice per week, however, the days and schedules of attention vary considerably.

As in the area 6, the development of the service responds to the availability of trucks and the journeys are established according to the approach of the drivers who privilege the sectors where it is easier to lift the waste and where they receive economic retributions by the users. This fact generates unnecessary displacements that only increase the times of journey without collection, what rebounds in the duration of the work day and in an increase of the costs of the service.

The vehicles used in the service are generally of 25 $yd^3$ that are in terrible conditions and the personnel is conformed by a driver and two collectors, which doesn't have uniforms, protection equipments and tools to execute the service.

The service is of bad quality, all the waste is not collected, the areas are left dirty, where there are metallic tanks, only the bags that are in the superior part are collected, leaving these with waste which present an advanced level of decomposition. In the case of the plastic tanks, these are lifted and discharged in the truck and then left in a disordered form on the roadway.

As in the area 6, the operation of small dump trucks was observed, which are directed by the Municipality. These trucks carry out the collection in specific areas that are defined by the district manager. During the transport of the waste collected, the fall of bags takes place, those that are in the roadways and later on are destroyed by the vehicles, contaminating even more the sector.

The previous situation has resulted in big accumulations of waste in the neighborhoods and the constant transfer of the waste by the generators to the big avenues, it was also observed that wastes coming from other areas are taken in vehicles and discharged in this avenues.

There is no registration of the antecedents of the development of the routes such as: times of exit and entrance to the parking place of the vehicles, times of beginning and ending of the collection, quantity of waste collected, hours worked by the vehicle and personnel, fuel consumption, lubricant and other inputs, traveled distances, that allows to have reliable data for the later evaluation of the routes, costs control and elaboration of budgets for the service development.

The private company has divided the area in two zones, each one in charge of a supervisor who verifies the development of the service and also distributes the trucks according to the necessities or the users' complaints, for it in many occasions the trucks are removed from the areas assigned to converge to other areas not completing the service.

As in the area 6, the only registration that is taken, is the entrance and exit control to Duquesa, however, any process of it is carried out and it is not associated to the journey or attention area of the truck, but it is used by the company to determine the quantity collected by each driver and collector to determine its salary.

The EMUCD doesn't carry out any inspection type and monitoring in land of the service, for what there are no antecedents to make a new design.

In the same way due to the lack of information it is not possible to quantify the quality indicators and neither determines the quantity of waste that is really collected in the area.

In relation to the results of the survey, these indicate that 73.51% said to be satisfied with the service and only 26.49% said not to be satisfied with the waste collection service.

Of those that answered not to be satisfied (26.49%), 10.60% claims that after the elections they have been neglected, 2.12% says that the truck lasted more than one month without passing, while 13.77% says that the truck doesn't frequently pass.

In the area 5 the same problems are observed in the storage and delivery of waste that for the area 6.

### d.3.2 Improvement of the Collection Service

**Establishment of the service quality.**

For the service improvement in the area 5, the same suitable quality parameters indicated for the P.P.P. were established.

**Design of the collection service.**

It proceeded as in the pilot project; the service was designed as it is shown in the following figure:

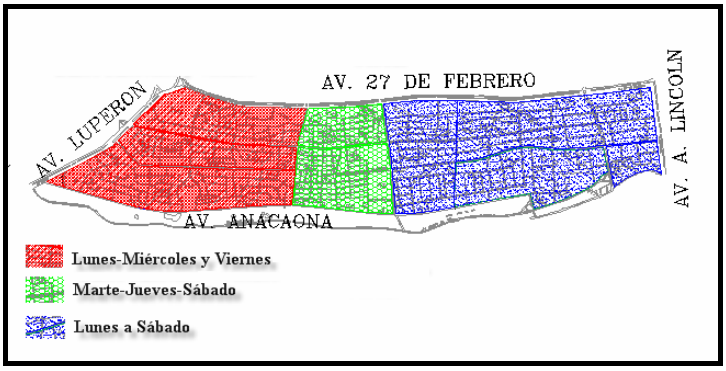



Figure P-11: Initial Classification of the Collection Service

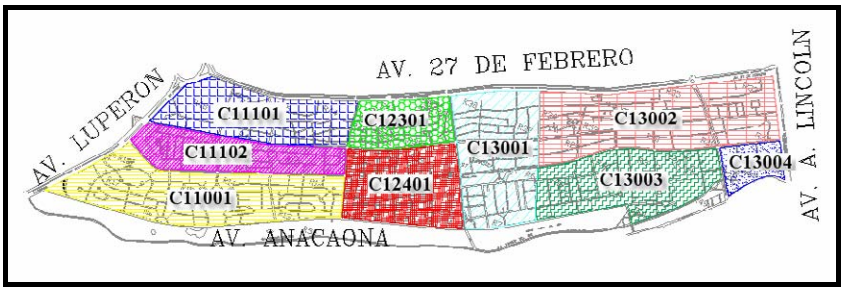



Figure P-12: Initial Design of the Routes

Once the project was implemented, the routes were gauged resulting how is shown in the following figures.

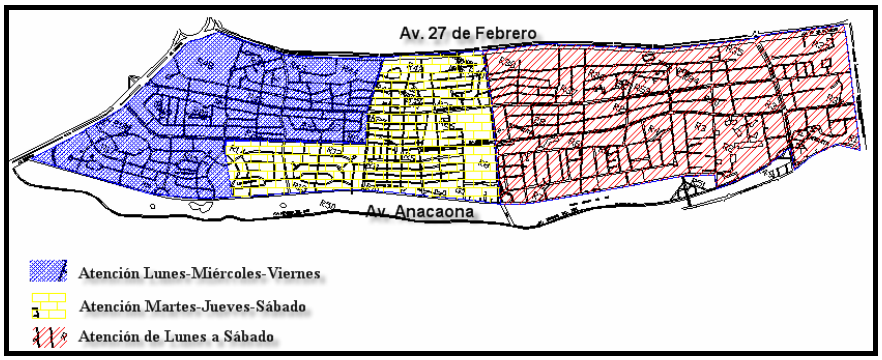



Figure P-13: Final Classification of the Service

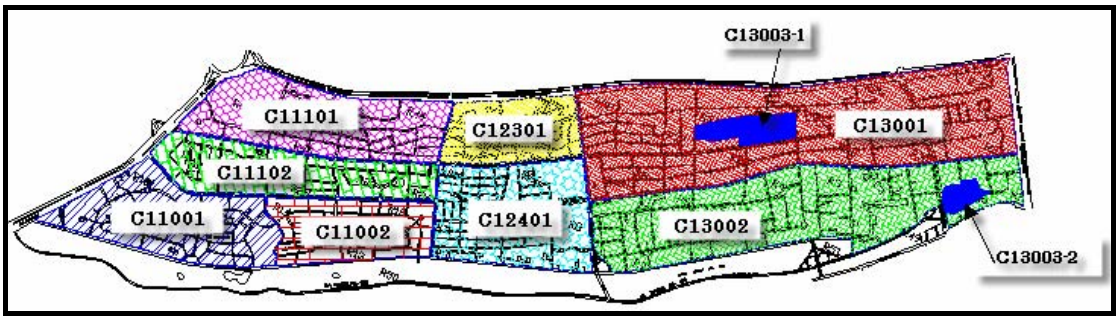



Figure P-14: Final Design of the Routes

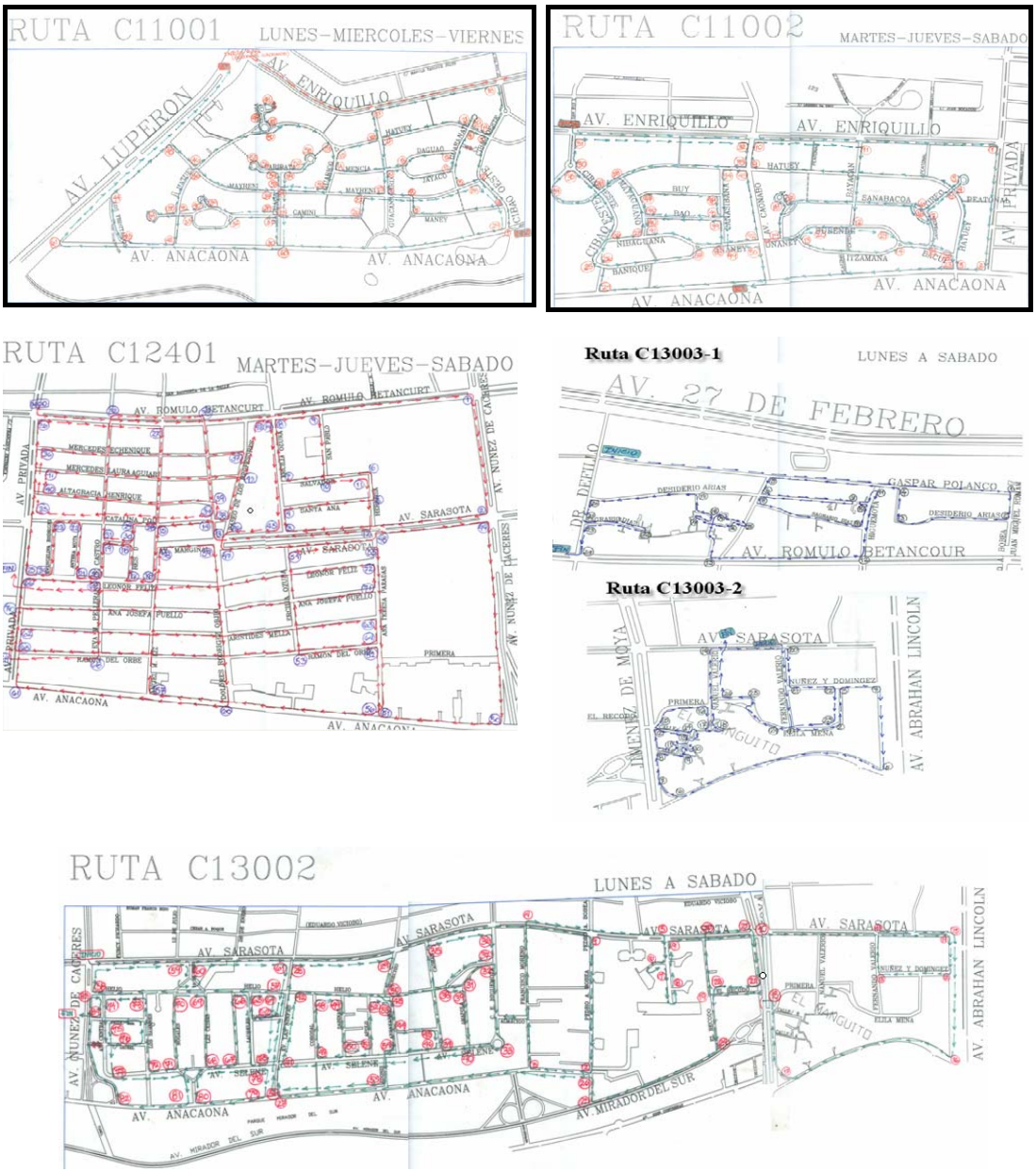



Figure P-15: Route Diagramming

**Recourses assignment**

The following resources were used in the implementation of the pilot project

Vehicles

- ❑ 5 compactor trucks of 25 $yd^3$
- ❑ 1 small compactor truck (2.5 ton)
- ❑ 2 vehicles for the supervision of the service carried out by the P/C
- ❑ 3 vehicles for the inspection of the service carried out by the C/P

C/P Personnel

- ❑ 3 inspectors

7. P/C Personnel
   - ❑ 1 Service manager

- 2 Supervisors
- 6 drivers compactor truck
- 18 collection helpers compactor

8. S/T Personnel
   - 3 Engineers that later on will be hired by the Municipality to become part of the EMUCD.
   - 1 Advisor
   - 3 Drivers for inspection vehicles

Implements

- Work cloth
- Protection gloves
- Communication equipments for supervisors, inspectors
- Shovel-broom
- First-aid kit

**Training**

Before beginning the setting of the service the training of the whole personnel of the Municipality and of the Private Company was carried out.

As part of the project to 3 engineers were hired, who once finished the pilot project will become part of personnel's of the EMUCD, in charge of the design and inspection of the collection service. These professionals participate in all the training programs as well as in all the activities developed during the pilot project.

The training programs for the Municipality were the ones indicated in the PPP, reinforcing the aspects related with the design, setting and inspection of the service.

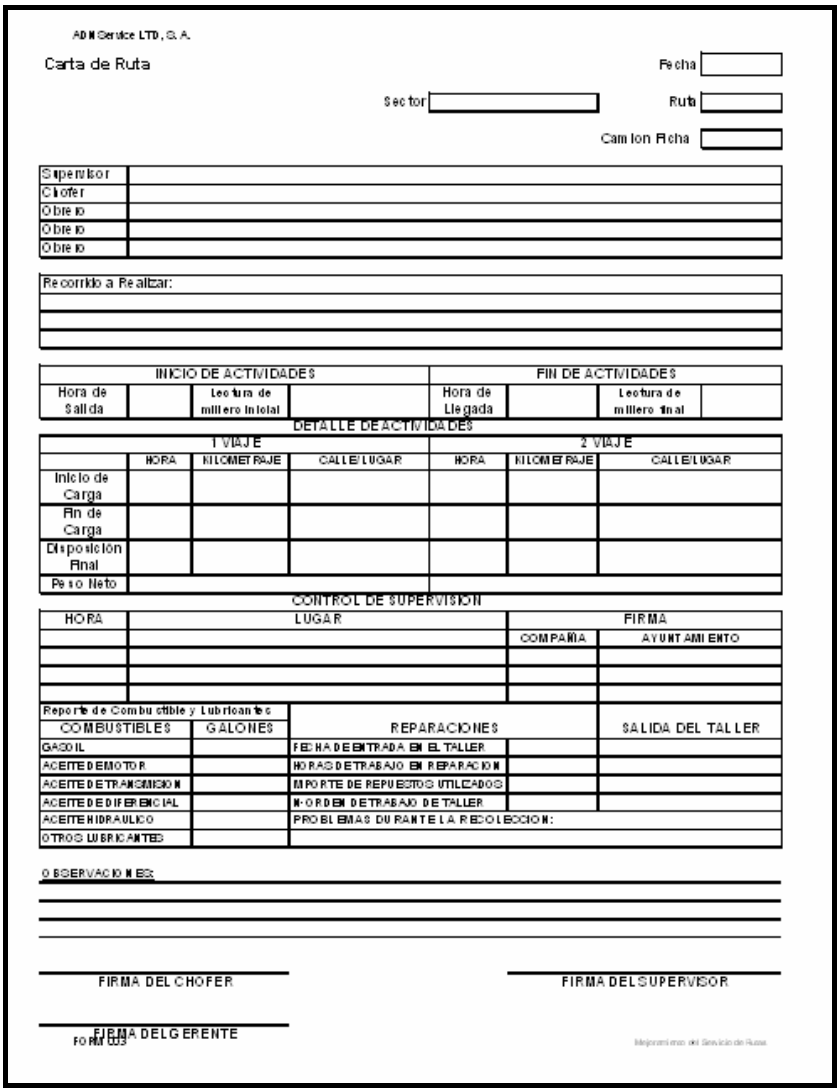
The service manager of the private company also participated in the training programs of design and setting of the service. The rest of the personnel participated in the training directed to improve the form of developing the service and prevention of accidents.

**Elaboration of service control form (Route Sheet) and capture of data form.**

Taking into account that the private company already had designed a route sheet that it’s still not in operation, it was decided to change the route sheet used in the PPP by the one provided by the P/C.

Based on the information to register in the route sheet a form was elaborated for the storage and data management, qualifying the C/P personnel in its use.

In the same way a document of registration of the inspection process in land was elaborated. The following figure shows the detail of the Route Sheet used.



ADM Service LTD, S. A.

Carta de Ruta

Fecha

Sector Ruta

Camion Ficha

| | |
|---|---|
| Supervisor | |
| Chofer | |
| Obrero | |
| Obrero | |
| Obrero | |

Recorrido a Realizar:

| INICIO DE ACTIVIDADES | | | | FIN DE ACTIVIDADES | | | |
|---|---|---|---|---|---|---|---|
| Hora de Salida | | Lectura de millero inicial | | Hora de Llegada | | Lectura de millero final | |

DETALLE DE ACTIVIDADES

| | 1 VIAJE | | | 2 VIAJE | | |
|---|---|---|---|---|---|---|
| | HORA | KILOMETRAJE | CALLE/LUGAR | HORA | KILOMETRAJE | CALLE/LUGAR |
| Inicio de Carga | | | | | | |
| Fin de Carga | | | | | | |
| Disposición Final | | | | | | |
| Peso Neto | | | | | | |

CONTROL DE SUPERVISION

| HORA | LUGAR | FIRMA | |
|---|---|---|---|
| | | COMPAÑIA | AYUNTAMIENTO |
| | | | |
| | | | |
| | | | |

| Reporte de Combustible y Lubricantes | | | | |
|---|---|---|---|---|
| COMBUSTIBLES | GALONES | REPARACIONES | | SALIDA DEL TALLER |
| GASOIL | | FECHA DE ENTRADA EN EL TALLER | | |
| ACEITE DE MOTOR | | HORAS DE TRABAJO EN REPARACION | | |
| ACEITE DE TRANSMISION | | IMPORTE DE REPUESTOS UTILIZADOS | | |
| ACEITE DE DIFERENCIAL | | N-ORDEN DE TRABAJO DE TALLER | | |
| ACEITE HIDRAULICO | | PROBLEMAS DURANTE LA RECOLECCION: | | |
| OTROS LUBRICANTES | | | | |

OBSERVACIONES:

FIRMA DEL CHOFER

FIRMA DEL SUPERVISOR

FIRMA DEL GERENTE

FORM 003

Mejoramiento del Servicio de Aseo

Figure P-16: Route Sheet Private Company

### d.3.3 Setting of the New Service

On June 19 of 2006, the new collection service started, monitoring every day the times and journeys, using for it the route sheet.

During the first week the routes were monitored by the S/T, the C/P and P/C.

Starting from the results obtained during the first week it was proceeded to gauge the routes, generating the definitive diagrams.

Starting from the 2nd week the route sheets were completed by the drivers of the trucks which were given directly to the inspection personnel of the C/P.

Every week the execution of the routes was inspected by the part of the inspection personnel and by the supervisors of the P/C.

Daily the information contained in the route sheet was entered in the data form.

During the development of the project new surveys were made in order of knowing the residents opinion.

The tonnage collected was determined from the entrance data to Duquesa.

## d.4 Improvement of the Sweeping Service

### d.4.1 Diagnostic

Once the collection improvement project is implemented, we proceed to select a sector in the area 5 to carry out the pilot project of improvement of the sweeping service and at the same time the diagnosis of the service was carried out.

The following figure shows the area selected.

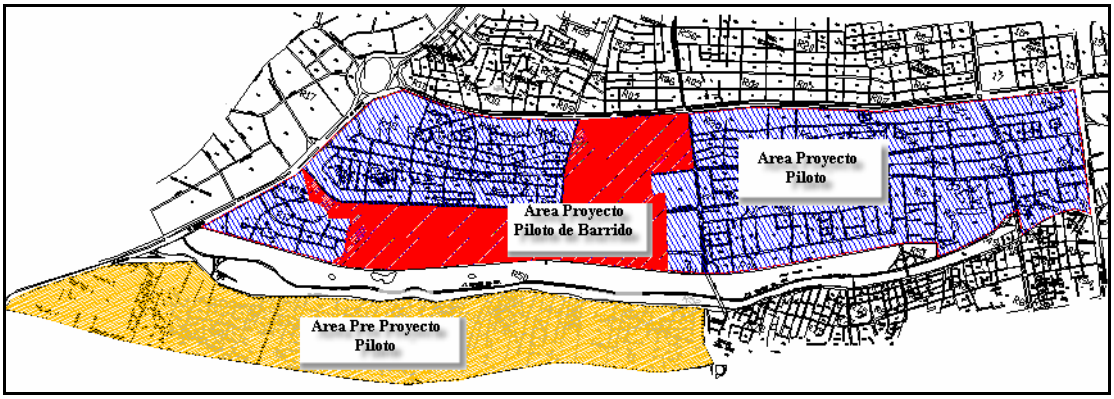



Figure P-17: Area of the Sweeping Pilot Project

Based on the information the following was the diagnosis of the sweeping service

The Area 5 only has the sweeping service in the main avenues, such as Anacaona, Rómulo Betancourt, Sarasota, Enriquillo, 27 de Febrero, Jiménez Moya, A. Lincoln, the rest of the streets doesn't have service.

The sweeping service is carried out directly by the ADN and is directed by the District Manager.

The service is generally carried out from Monday to Saturday, starting from 8:30 hr. and generally extends until the 12:00 hrs.

The works are carried out in groups formed by three people; one of them carries out the sweeping, another takes the bags and a third pick up the waste resulting of the sweeping.

The sweeping wastes are placed in bags which are left in the same avenues for their later collection that is carried out by dump trucks coordinated by the district manager. The collection of the bags is not always carried out, in the same day and inclusive in many cases they remain more than one day in the area.

The personnel have uniform and they are provided of broom, bags and implements to collect the waste.

The personnel is conformed mainly by women whose ages fluctuate from 25 to 55 years.

The personnel is assigned by area, doesn't exist a diagram routes, registrations are not taken as for the sweeping yields, use of resources, distances sweep, worked hours, lifted waste and neither the service is evaluated.

### d.4.2 Improvements of the Sweeping Service

**Establishment of the service quality**

Based on the availability of resources and the level of service that the ADN wanted to impose in the sector the quality of the service was settled, that corresponds to:

The service will be developed exclusively in the area selected, not involving the main avenues.

The sweeping frequency will be one day after other, from Monday to Saturday, in schedule from the 08:00 hr to 11:00 hr, due to the personnel availability.

The sweeping will be carried out in groups of 2 people.
Sweeping routes will be designed whose extension is from 1.2 to 1.6 km.
The waste will be collected with a dump truck, during the course of the day, so 100% of the waste product of the activity will be lifted not later than one hour after having concluded the service.
The waste will be transferred and discharged in the Transfer Station that is located in the District III.
They will have a service manager and a supervisor.
Daily the routes will be monitored and evaluated.
The personnel will be trained in relation to the form in how the works should be developed and in aspects related with prevention of risks and accidents.
All the workers will be uniformed and they will be provided of the necessary tools.

**Design of the sweeping service.**

On the base of the characteristics imposed to the service a total of 33 routes which are shown in the following figure were designed:


Figure P-18: Sweeping Routes 1 to 20

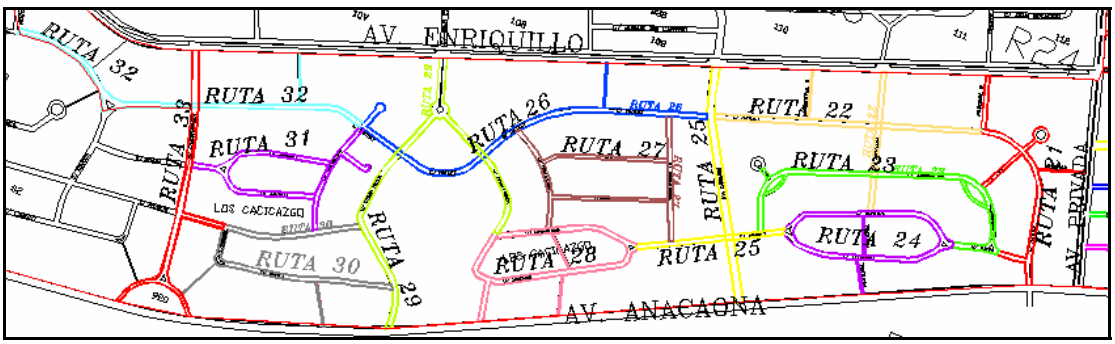



Figure P-19: Sweeping Routes 21 to 33

Table P-4: Routes Longitude

| Route | KM | Route | KM |
|---|---|---|---|
| 1 | 1,510 | 18 | 1,319 |
| 2 | 1,510 | 19 | 1,520 |
| 3 | 1,510 | 20 | 1,536 |
| 4 | 1,510 | 21 | 1,357 |
| 5 | 1,600 | 22 | 1,530 |
| 6 | 1,610 | 23 | 1,550 |
| 7 | 1,520 | 24 | 1,430 |
| 8 | 1,449 | 25 | 1,300 |
| 9 | 1,510 | 26 | 1,530 |
| 10 | 1,550 | 27 | 1,570 |
| 11 | 1,270 | 28 | 1,580 |
| 12 | 820 | 29 | 1,529 |
| 13 | 1,420 | 30 | 1,479 |
| 14 | 1,430 | 31 | 1,330 |
| 15 | 1,260 | 32 | 1,500 |
| 16 | 1,500 | 33 | 1,600 |
| 17 | 1,325 | | |

**Recourses assignment**

The following resources were considered for the execution of the Project:

Vehicles

- 1 dump truck for collection
- 1 vehicle for supervision
- 1 vehicle for personnel transport

C/P Personnel

- 1 Service manager
- 1 Supervisor
- 7 drivers compactor truck
- 16 sweepers
- 1 drivers collection vehicle
- 1 waste collector

Implements

- Work cloth
- Protection gloves
- Broom
- Shovel
- Bags
- Communication equipments

**Personnel Trainings**

The technical and operative personnel that participated in the sweeping pilot project was trained in:

Technical Personnel:

Design of the sweeping service
Routes diagramming
Procedure for the calculation of indicators
Procedure for the route inspection

- Procedures for the installation of routes
Route evaluation method

Operative Personnel

How to carry out the sweeping and security measures
Training in the journey of the assigned route

The training was reinforced during the development of the Project.

**Elaboration of service control form (Route Sheet) and capture of data form.**

A format for the inspection and monitoring of the route was design and a form for the entrance and management of the information was elaborated in Excel.

**The personnel's training in inspection works**

Before the setting of the sweeping pilot project, the personnel were trained in relation to the methodology of the service inspection.

**Setting of the new service**

On July 03 of 2006, the new sweeping service started, monitoring every day the execution of the routes, swept distances, worked hours, the data were consigned in the inspection sheet and later on passed over to the Excel form.

## P.3 Results

### a. Achievements

The following table shows the achievements reached by the pre pilot project and by the pilot project.

Table P-5: Achievement of the Pilots Projects

| Objective | Achievements |
|---|---|
| Global Goal<br>A collection service of good quality is settled in the urban area of the ND (excluding marginal areas), and the collection service is executed according to the quality patterns. | With the implementation of the pre pilot project and the collection and sweeping pilot project has been possible to develop in two areas a collection service that fulfills the quality settled by the Municipality and that responds to the international standards, approximately assisting 160.000 inhab. The new service has achieved the covering of 100% of the areas with a total execution of the frequency, days and schedules of attention, being constituted in a model to be replied for both the Municipality and the private company. The appropriate use of the resources as well as the classification of the service (market) will rebound in the costs, achieving economies that can be designated to increase the covering of the service in the marginal areas and in the urban areas.<br>On the other hand the pilot project has allowed that the EMUCD and ADN Service understands the responsibilities that each one has in the development of the service and it has been possible to establish the communication between both entities, what impacts directly in the sustainability of the service. |
| Purpose of the Project:<br>Pre Pilot Project (P.P.P.)<br>The collection service is settled and is executed directly by ADN in the target area of the Project, Area 6. | With the implementation of the pre pilot project the planning and optimized design of routes was achieved, improving the collection efficiency when increasing the general yield of the service, increase the yield of the workers and the quantity of tons transported by trip, reaching values for the quality indicators within those recommended internationally. The entrance in operation of the monitoring system and pursuit of routes has given the necessary information, through which the EMUCD can evaluate the service and make the corrections that are necessary.<br>The routes control program allowed to detect problems regarding the conditioning and delivery of waste, therefore the EMUCD will take the necessary measures to eliminate such problems and achieve an |

| Objective | Achievements |
|---|---|
| | appropriate participation of the community in the service, what will impact positively in the efficiency of the service and in savings.<br>The optimized routes have a diagram and control points that facilitate the inspection and avoid that the service is carried out according to the shift driver's approach.<br>Through pre pilot project, the EMUCD has been able to observe that it is possible to develop a quality service in the measure that the rules are clear, that the service responds to a rational design and it stays in a constant inspection.<br>The results of the pre pilot project, will allow the Municipality to show directly to the private operator the conditions under which the Municipality expects that the service is developed. |
| Purpose of the Project:<br>Pilot Project (P.P.P.)<br>The supervision method of the private firm that operates in the target area of the Project Area 5 is settled and executed. In the Project area, the private firms offer the same level of service that the one obtained in the Area 6 | Through the implementation of the pilot project the operation of the collection service under the same quality parameters established in the pre pilot project was achieved, and where also the Municipality passes to exercise its main function that is of inspector and the private company as exclusive operator in the area.<br>On the other hand, the pilot project allowed the EMUCD to put into practice the Manual of Improvement of the Collection Service, designing and gauging the routes under a technical approach, acquiring the necessary experience to design the service in the rest of the District.<br>In the same way, it was put into practice the Supervision Manual, what allowed monitoring and investigating the service in an appropriate form, and under clearly defined procedures.<br>On the other hand, the private operator could appreciate the benefits that it reports executing the service under a technical approach, being able to detect a series of problems associated to the current operation and that can be overcome when applying the established techniques for the good design of the service. Additionally was checked the necessity to strengthen their organizational structure, service supervision, as well as their personnel's training in order to achieve the sustainability of the service and reduce their costs.<br>Just as it happened in the pre pilot project, the design of the service under the new quality concepts reported a series of changes in the indicators, been able to increase the general efficiency of the service, increase the yield of the workers, reduce the time outs and of collection, the journey distances, etc. taking the indicators to near values or similar to those recommended by the CEPIS.<br>With the implementation of the pilot project it was possible to establish the communication mechanisms between the private operator and service inspectors, defining the procedures that should follow the supervisors of the private company and the inspectors of the service, in the non fulfillment of the quality, emergency situations and answer to complaints on behalf of the users.<br>The coordination achieved between operator and inspector allowed to detect and propose solutions to the problems associated to the bad storage and surrenders of the waste.<br>Lastly, both projects allowed to demonstrate to the private operator and to the personnel of the EMUCD that the execution of quality service is not only associated to the purchase of new trucks, but mainly to the rational use of the resources, to the continuous control of the service and the opportune and appropriate communication among operator, inspector and generator.<br>Through the implementation of the pilot project the operation of a quality sweeping service and of lower cost to the current one was achieved. This project allowed the technical personnel of the EMUCD to acquire the knowledge for the design and inspection of the sweeping service that will allow them to expand this experience to other areas. |
| Products | |
| 1. Improves the service quality | Pre Pilot Project<br>Through the improvement of the collection it was achieved:<br>The covering of 100% of the area<br>Execution of the frequency, days and schedules of attention in 100%<br>Execution of the legal day of work, 100% of the routes was developed in |

| Objective | Achievements |
|---|---|
| | the day of 8 hours<br>Increase the quantity of waste transported by trip, achieving an average of 93% of use of the load capacity.<br>Increase of the yield of tons collected by collection time, achieving an increase of 15% with regard to the yields measured in time and movement.<br>The previous results are reflected in the decrease of the direct costs of the service, among them fuel, lubricant, maintenance of the vehicle, and personnel cost.<br><br>Pilot Project<br>Through the improvement of the collection it was achieved:<br>The covering of 100% of the area<br>Execution of the frequency, days and schedules of attention in 98%, of the total of routes, with 70% of the routes with execution of 100%<br>Reduction of the work day in 17%<br>Increase of the yield of tons collected by collection time, achieving an increase of 11% with regard to the yields measured in time and movement.<br>Additionally along the pilot project it could be seen that the quality indicators reached values that are in the established ranges at international level. |
| 2. The collection was programmed | Pre Pilot Project<br>Diagrams planes of routes were made, indicating in them the beginning points and term of each trip, besides the location of the control points for inspection.<br>The EMUCD incorporated in its administrative and operational process the use of the Route Sheet for the rising of the information of all the collection routes.<br>It was design and entered in operation the form for the entrance and management of data that will allow obtaining the consolidation of the information lifted through the routes sheets, calculating the quality indicators and evaluating the service. Additionally with this forms and the information given by Duquesa the crossing of informations can be settled what will allow having a bigger control of the service.<br>A procedure was settled for the installation of routes and its calibration.<br><br>Pilot Project<br>The EMUCD made the diagramming planes of routes, indicating in them the beginning and term points of each trip, besides the location of the control points for inspection.<br>The private operator put into operation the Route Sheet for the rising of the information of all the collection routes.<br>The setting of the pilot project was carried out by the personnel of the EMUCD, according to the procedures settled in the pre pilot project.<br>The EMUCD monitored the collection routes according to the Supervision Manual and entered the antecedents of the service in the forms designed, evaluating weekly the routes and gauging those that required it, was related the inspection made in land with the entrance antecedents to Duquesa.<br>The private operator carried out modifications in the procedures related with maintenance of vehicles, service supervision, entrance and exit control of vehicles, entrance of data and information management.<br>The EMUCD with the private operator, starting from the fourth week of the pilot project, replied the experience in other 6 routes following the same procedures carried out in this project. |
| Preparation of Manuals | A Manual was elaborated for the Improvement of the Collection.<br>A Manual was elaborated for the Supervision of the Service<br>The personnel was trained in the use of both documents |
| Improvement of the Sweeping service | Through the improvement of the sweeping service it was achieved:<br>The covering of 100% of the considered area<br>Execution of the frequency, days and schedules of attention in 100% |

| Objective | Achievements |
|---|---|
| | Execution of the day of work proposed<br>Increase of the personnel's yield in comparison with the service given in the main avenues.<br>Change in the modality to carry out the sweeping reducing the groups to two people<br>The increase of the yields as well as the decrease of personnel per group will rebound favorably on the costs, achieving its reduction. |

### a.1 Pre Pilot Project Evaluation

To evaluate the results of the pre pilot project were considered the antecedents of the studies of time and movement carried out to the routes assisted by ADNAU, since in the area 6, previous to the pre pilot project; the service was not developed according to a routes system. Next are the results of the evaluation of the variable monitored during the course of the project

Table P-6: Results of the Evaluation of the Service.

| Route | Ton/trip | Hr/journey | Collection Hours | Ton/help/day | Ton/hr | % execution frequency |
|---|---|---|---|---|---|---|
| 1 A | 9.9 | 7.1 | 4.6 | 3.29 | 2.15 | 100% |
| 1 B | 9.1 | 6.8 | 4.3 | 3.03 | 2.12 | 100% |
| 2 A | 8.7 | 7 | 4.5 | 2.89 | 1.93 | 100% |
| 2 B | 10.95 | 7.4 | 4.9 | 3.65 | 2.23 | 100% |
| 3 A | 10.08 | 7 | 4.5 | 3.36 | 2.24 | 100% |
| 3 B | 11.5 | 7.7 | 5.2 | 3.84 | 2.21 | 100% |
| 4 A | 10.5 | 7 | 4 | 3.50 | 2.63 | 100% |
| 4 B | 8.9 | 7.8 | 4.8 | 2.95 | 1.85 | 100% |
| 5 A | 10.4 | 7.3 | 4.8 | 3.45 | 2.17 | 100% |
| 5 B | 9.38 | 7 | 4 | 3.12 | 2.35 | 100% |
| 6 A | 10.3 | 7.2 | 4.7 | 3.43 | 2.19 | 100% |
| 6 B | 11.7 | 7.2 | 4.7 | 3.89 | 2.49 | 100% |
| 7 | 11 | 7.6 | 5.1 | 3.66 | 2.16 | 100% |
| Average | 10.19 | 7.24 | 4.62 | 3.39 | 2.21 | 1.00 |

#### a.1.1 Efficiency

**Tons transported per trip**

With the routes diagram, it was possible to increase the quantity of waste transported by trip, obtaining an average of 10.2 ton/trip that in front of the nominal capacity that is of 11 ton/trip represents 93% of the maximum load that can be transported.

This increase in the capacity of transport, (it is necessary to remember that according to Duquesas' registrations a great number of trips carried out by ADNAU takes a smaller load than 50% of the nominal capacity of the vehicles), indicates a good use of the resources, and that is the result of a correct design of the routes, where the drivers stop looking for waste, adjusted to a journey pre established.

The increase in the load transported by trip rebounds directly in the costs of the service, because it reduces the number of trips and therefore all the costs of operation of the truck are minimized and it also reduces personnel's necessities reducing the manpower costs.

**Journey Hours**

Through the improvement of the collection service, the times of transport were reduced;

increasing the times dedicated to collection and the quantity of worked hours was increased.

One of the biggest problems that could be appreciated during the studies of time and movement and at the beginning of the pre pilot project is related with the work day. The work day generally began after the 07:30 hr., leaving the trucks to the routes or sectors assigned in the hour of more traffic congestion, considerably increasing the times of transport. With the implementation of the P.P.P. it was possible to modify the beginning hour of the service, leaving the vehicles of Equipment and Transport before the 7:00 hr. reducing the arrival time to the route in 50%.

Another aspect that was detected during the study of time and movement that due to the delay of starting the routes and as the vehicles work in two journeys, the collection was generally developed until the 12:00 a.m. in order of having the enough time to go to Duquesa and to begin the afternoon journey at the 14:00 hr., with it the hours dedicated to the collection don't overcome the 3,5 hr, being one of the reasons for which the trucks don't travel full loaded. With the implementation of the P.P.P. it was possible to increase the collection time in average 1,1 hr.

The increase of the time dedicated to the collection with the execution of the diagramming of the routes allows the efficient use of the resources, reducing the personnel and truck operation costs.

**Tons collected vs. Collection time.**

The total of tons collected per hour of collection on average was increased in 15%, if its compared with the yields measured in the studies of time and movement that reached 2,0 ton/hr, with those obtained in the P.P.P. where the value average for all the routes of 2.21. Inclusive for some routes the yields overcame the value 2.3 that fulfills the standards recommended by the CEPIS.

The yield increase shows again the appropriate design of the routes and the optimization of the use of resources, what will be reflected in the service costs.

### a.1.2 Effectiveness.

The purpose of the project was achieved since the design of the routes allowed to improve the covering of the service, improve the collection yield, increase the times dedicated to the collection, reduce the time outs, maximize the use of resources, and increase the work journey according to the indicated by Law.

With the improvement of the service was achieved a resources control, its quantification and minimization.

The optimization of the service and the resources control, allowed reducing considerably the direct costs of the collection service of the optimized routes. The application of this model to the other routes will generate important savings to the Municipality who will be able to use this savings in the improvement of the service in other areas, fulfilling the goals of the M/P.

### a.1.3 Impact

One of the positive main impacts of the P.P.P., it is that the EMUCD has been able to check that it is possible to have a collection service that responds to a planning and technical design through which is possible to inspect the service, reduce the costs and to offer a quality service.

The above-mentioned has had a positive impact on the procedures of the EMUCD; they have taken decisions that allowed the incorporation of new control and inspection systems, in land and by means of the prosecution of the information.

The project has had a strong impact in the operation of the Equipment and Transport Directorate who has implemented an inspection system for the exit of the trucks, had modified the beginning hours of the services and the most important thing that has begun a work coordinated with the EMUCD.

In the measure that the EMUCD has obtained bigger information of the service has been able to detect problems, mainly related with the personnel, who makes inadequate use of the resources or charge for the service, this has had a positive impact, because they have been applying a series of measures that will allow to correct and/or eliminate these bad habits and at the same time to count with personnel suitable for the tasks.

### a.1.4 Relevance

The improvement of the collection service and the direct operation of the service by the personnel of the Municipality, has allowed the EMUCD have a quality service and at the same time have a model area through which will be able to demonstrate to the private operator how the services should be executed and based on what variables the service quality hired will be measured. This fact will assure the implementation of the measures settled in the M/P.

### a.1.5 Sustainability

Through the different measures adopted for the improvement of the collection service, service inspection, routes evaluation, execution of goals proposed, optimization of routes, etc. the sustainability of the project is assured.

The EMUCD has qualified personnel that it will allow them to plan, design and operate in an efficient form the collection service.

### b. Evaluation of the Pilot Project

To evaluate the results of the pilot project the antecedents of the studies of time and movement carried out to the routes assisted by ADN Service were considered, since in the area 5, previous to the pilot project, the service was not developed according to a routes system. Next are the results of the evaluation of the variable monitored.

Table P-7: Results of the Evaluation of the Pilot Project Service

| Route | Frequency | Week | Ton/trip | ton/hr | Ton/work/day | Ton/week | Hours worked hr/week | (%) of execution |
|---|---|---|---|---|---|---|---|---|
| C11101 | Mon/ Wed / Fri | week 1 | 13.59 | 2.75 | 4.53 | 40,780 | 6.58 | 100% |
| C11101 | Mon/ Wed / Fri | week 2 | 11.37 | 2.73 | 3.79 | 45,470 | 7.29 | 100% |
| C11101 | Mon/ Wed / Fri | week 3 | 12.25 | 3.07 | 4.08 | 61,260 | 8.31 | 100% |
| C11101 | Mon/ Wed / Fri | week 4 | 12.67 | 2.82 | 4.22 | 50,670 | 8.48 | 100% |
| C11101 | Mon/ Wed / Fri | week 5 | 11.53 | 3.01 | 3.84 | 46,120 | 7.47 | 100% |
| C12301 | Tue / Thu / Sat | week 1 | 12.05 | 3.38 | 4.02 | 48,180 | 7.36 | 100% |
| C12301 | Tue / Thu / Sat | week 2 | 13.83 | 2.62 | 4.61 | 41,500 | 7.19 | 100% |
| C12301 | Tue / Thu / Sat | week 3 | 11.45 | 2.91 | 3.82 | 45,800 | 7.33 | 100% |
| C12301 | Tue / Thu / Sat | week 4 | 11.22 | 2.53 | 3.74 | 56,080 | 8.02 | 100% |
| C12301 | Tue / Thu / Sat | week 5 | 10.65 | 2.93 | 3.55 | 31,950 | 6.65 | 100% |
| C11001 | Mon/ Wed / Fri | week 1 | 11.24 | 1.67 | 3.75 | 33,720 | 9.46 | 100% |
| C11001 | Mon/ Wed / Fri | week 2 | 8.94 | 2.15 | 2.98 | 44,680 | 9.61 | 100% |
| C11001 | Mon/ Wed / Fri | week 3 | 8.53 | 2.04 | 2.84 | 51,170 | 9.28 | 100% |
| C11001 | Mon/ Wed / Fri | week 4 | 9.91 | 2.00 | 3.30 | 29,730 | 8.83 | 100% |
| C11001 | Mon/ Wed / Fri | week 5 | 7.46 | 2.18 | 2.49 | 29,850 | 8.38 | 100% |
| C11002 | Tue / Thu / Sat | week 1 | 10.91 | 1.94 | 3.64 | 32,730 | 8.77 | 100% |
| C11002 | Tue / Thu / Sat | week 2 | 10.18 | 1.84 | 3.39 | 30,540 | 7.86 | 100% |

| Route | Frequency | Week | Ton/trip | ton/hr | Ton/work/day | Ton/week | Hours worked hr/week | (%) of execution |
|---|---|---|---|---|---|---|---|---|
| C11002 | Tue / Thu / Sat | week 3 | 9.68 | 1.89 | 3.23 | 38,730 | 9.17 | 100% |
| C11002 | Tue / Thu / Sat | week 4 | 8.91 | 2.00 | 2.97 | 35,640 | 8.45 | 100% |
| C11002 | Tue / Thu / Sat | week 5 | 11.62 | 2.40 | 3.87 | 34,850 | 8.19 | 100% |
| C11102 | Mon/ Wed / Fri | week 1 | 11.23 | 2.52 | 3.74 | 44,920 | 7.23 | 100% |
| C11102 | Mon/ Wed / Fri | week 2 | 10.47 | 2.08 | 3.49 | 41,860 | 8.86 | 100% |
| C11102 | Mon/ Wed / Fri | week 3 | 10.16 | 2.37 | 3.39 | 50,790 | 8.57 | 100% |
| C11102 | Mon/ Wed / Fri | week 4 | 10.46 | 2.59 | 3.49 | 52,280 | 8.26 | 100% |
| C11102 | Mon/ Wed / Fri | week 5 | 10.66 | 2.73 | 3.55 | 63,960 | 8.22 | 100% |
| C12401 | Tue / Thu / Sat | week 1 | 9.91 | 1.92 | 3.30 | 39,640 | 8.67 | 100% |
| C12401 | Tue / Thu / Sat | week 2 | 8.36 | 1.93 | 2.79 | 50,162 | 9.78 | 100% |
| C12401 | Tue / Thu / Sat | week 3 | 9.82 | 2.11 | 3.27 | 49,120 | 9.04 | 100% |
| C12401 | Tue / Thu / Sat | week 4 | 9.89 | 2.13 | 3.30 | 49,460 | 10.55 | 100% |
| C12401 | Tue / Thu / Sat | week 5 | 10.97 | 2.22 | 3.66 | 43,870 | 9.33 | 100% |
| C13001 | Daily | week 1 | 8.61 | 1.87 | 2.87 | 68,909 | 9.90 | 83% |
| C13001 | Daily | week 2 | 10.04 | 2.56 | 3.35 | 80,290 | 7.95 | 100% |
| C13001 | Daily | week 3 | 10.78 | 2.69 | 3.59 | 118,580 | 9.67 | 100% |
| C13001 | Daily | week 4 | 11.03 | 2.64 | 3.68 | 110,320 | 9.62 | 100% |
| C13001 | Daily | week 5 | 12.48 | 2.84 | 4.16 | 112,330 | 8.71 | 100% |
| C13002 | Daily | week 1 | 10.88 | 1.94 | 3.63 | 54,410 | 7.93 | 83% |
| C13002 | Daily | week 2 | 11.51 | 2.49 | 3.84 | 103,590 | 8.29 | 100% |
| C13002 | Daily | week 3 | 10.83 | 2.24 | 3.61 | 86,600 | 8.24 | 100% |
| C13002 | Daily | week 4 | 10.31 | 2.29 | 3.44 | 72,190 | 6.92 | 100% |
| C13002 | Daily | week 5 | 11.54 | 2.75 | 3.85 | 57,680 | 7.79 | 83% |
| C13003 | Daily | week 1 | 9.72 | 2.02 | 3.24 | 58,340 | 7.31 | 83% |
| C13003 | Daily | week 2 | 2.36 | 1.12 | 0.79 | 18,840 | 5.06 | 100% |
| C13003 | Daily | week 3 | 2.24 | 1.17 | 0.75 | 26,930 | 9.02 | 100% |
| C13003 | Daily | week 4 | 2.45 | 1.25 | 0.82 | 26,960 | 6.34 | 100% |
| C13003 | Daily | week 5 | 2.33 | 1.57 | 0.78 | 27,970 | 8.75 | 100% |
| C1AV01 | Daily | week 1 | 9.36 | 1.40 | 3.12 | 65,490 | 8.89 | 100% |
| C1AV01 | Daily | week 2 | 10.04 | 1.66 | 3.35 | 50,210 | 8.02 | 83% |
| C1AV01 | Daily | week 3 | 8.89 | 1.53 | 2.96 | 62,260 | 8.76 | 100% |
| C1AV01 | Daily | week 4 | 8.45 | 1.82 | 2.82 | 50,690 | 9.52 | 100% |
| C1AV01 | Daily | week 5 | 8.81 | 2.32 | 2.94 | 44,030 | 7.41 | 67% |

Table P-8: Results of the Evaluation of the Average Values

| Route | % Used Load Vehicle | ton/hr | Ton/work./day | Ton/week | Hours worked hr/week | (%) of execution |
|---|---|---|---|---|---|---|
| C11101 | 102% | 2.88 | 4.09 | 48,860 | 7.63 | 100% |
| C12301 | 99% | 2.88 | 3.95 | 44,702 | 7.31 | 100% |
| C11001 | 92% | 2.01 | 3.07 | 37,830 | 9.11 | 100% |
| C11002 | 103% | 2.01 | 3.42 | 34,498 | 8.49 | 100% |
| C11102 | 96% | 2.46 | 3.53 | 50,762 | 8.23 | 100% |
| C12401 | 98% | 2.06 | 3.26 | 46,450 | 9.48 | 100% |
| C13001 | 96% | 2.52 | 3.53 | 98,086 | 9.17 | 97% |
| C13002 | 100% | 2.34 | 3.67 | 74,894 | 7.83 | 93% |
| C13003 | 94% | 1.28 | 0.78 | 25,175 | 7.29 | 100% |
| C1AV01 | 91% | 1.75 | 3.04 | 54,536 | 8.52 | 90% |

Table P-9: Results of the Sweeping Pilot Project

| ID | Time | | | Distance | | Yield |
|---|---|---|---|---|---|---|
| | hh:mm | Hours | Hr - Man | mt | km | km/hr-man |

| ID | Time | | | Distance | | Yield |
|---|---|---|---|---|---|---|
| | hh:mm | Hours | Hr - Man | mt | km | km/hr-man |
| Route 1 | 3:37 | 3.62 | 7.23 | 1,510 | 1.51 | 0.21 |
| Route 2 | 3:18 | 3.30 | 6.60 | 1,510 | 1.51 | 0.23 |
| Route 3 | 3:11 | 3.18 | 6.37 | 1,510 | 1.51 | 0.24 |
| Route 4 | 2:51 | 2.85 | 5.70 | 1,510 | 1.51 | 0.26 |
| Route 5 | 3:39 | 3.65 | 7.30 | 1,600 | 1.60 | 0.22 |
| Route 6 | 3:23 | 3.38 | 6.77 | 1,610 | 1.61 | 0.24 |
| Route 7 | 3:12 | 3.20 | 6.40 | 1,520 | 1.52 | 0.24 |
| Route 8 | 2:50 | 2.83 | 5.67 | 1,449 | 1.45 | 0.26 |
| Route 9 | 2:54 | 2.90 | 5.80 | 1,510 | 1.51 | 0.26 |
| Route 10 | 3:49 | 3.82 | 7.63 | 1,550 | 1.55 | 0.20 |
| Route 11 | 2:55 | 2.92 | 5.83 | 1,270 | 1.27 | 0.22 |
| Route 12 | 3:23 | 3.38 | 6.77 | 820 | 0.82 | 0.12 |
| Route 13 | 3:20 | 3.33 | 6.67 | 1,420 | 1.42 | 0.21 |
| Route 14 | 2:57 | 2.95 | 5.90 | 1,430 | 1.43 | 0.24 |
| Route 15 | 3:12 | 3.20 | 6.40 | 1,260 | 1.26 | 0.20 |
| Route 16 | 3:10 | 3.17 | 6.33 | 1,500 | 1.50 | 0.24 |
| Route 17 | 3:05 | 3.08 | 6.17 | 1,325 | 1.33 | 0.21 |
| Route 18 | 3:08 | 3.13 | 6.27 | 1,319 | 1.32 | 0.21 |
| Route 19 | 3:00 | 3.00 | 6.00 | 1,520 | 1.52 | 0.25 |
| Route 20 | 3:48 | 3.80 | 7.60 | 1,536 | 1.54 | 0.20 |
| Route 21 | 3:47 | 3.78 | 7.57 | 1,357 | 1.36 | 0.18 |
| Route 22 | 2:45 | 2.75 | 5.50 | 1,530 | 1.53 | 0.28 |
| Route 23 | 3:16 | 3.27 | 6.53 | 1,550 | 1.55 | 0.24 |
| Route 24 | 3:07 | 3.12 | 6.23 | 1,430 | 1.43 | 0.23 |
| Route 25 | 3:46 | 3.77 | 7.53 | 1,300 | 1.30 | 0.17 |
| Route 26 | 3:08 | 3.13 | 6.27 | 1,530 | 1.53 | 0.24 |
| Route 27 | 3:45 | 3.75 | 7.50 | 1,570 | 1.57 | 0.21 |
| Route 28 | 3:44 | 3.73 | 7.47 | 1,580 | 1.58 | 0.21 |
| Route 29 | 3:56 | 3.93 | 7.87 | 1,529 | 1.53 | 0.19 |
| Route 30 | 2:56 | 2.93 | 5.87 | 1,479 | 1.48 | 0.25 |
| Route 31 | 3:28 | 3.47 | 6.93 | 1,330 | 1.33 | 0.19 |
| Route 32 | 2:59 | 2.98 | 5.97 | 1,500 | 1.50 | 0.25 |
| Route 33 | 3:38 | 3.63 | 7.27 | 1,600 | 1.60 | 0.22 |
| | | Average | 6.60 | 1,453 | 1.45 | 0.22 |

### b.1.1 Efficiency

**Tons transported per trip**

With the routes diagramming, it was achieved that the quantity of waste transported was adjusted to the nominal capacity of load of each vehicle, avoiding this way the situations that were observed during the studies of time and movement, where the trucks transported 20% more than the nominal load of the compacted boxes. The values of load transported obtained during the pilot project go from 103 to 91% of the load allowed for the vehicles.

The appropriate load of the vehicles allows increasing their useful life and reducing the maintenance costs.

**Journey Hours**

Through the improvement of the collection service, they reduced the transport times, increasing the times dedicated to collection and the working hours were adjusted to the ones established by Law.

One of the biggest problems that could be appreciated during the studies of time and movement is that the work journey overcame the 10 hr and inclusive the same group of workers carried out two followed shifts, what contradicts the labor Law. Through the pilot project, the routes were designed in order to be developed in a period of 8 hours excepting the heavy days where it was considered a maximum journey of 10 hr. and that the private operator remunerates the worker through the payment of overtime.

Of the monitoring it could be observed that only a route and in one week it overcomes the 10 working hours, the average of hours worked for the service is of 8.31 hr., that is to say, the journey stand for 17% less with regard to the average of the journeys measured during the study of time and movement.

An important aspect that influenced in the reduction of the journey work corresponded to the schedule change in the beginning of the service, where the same approach of the pre pilot project was applied being able to reduce the times of transfer to the route up to 45 minutes.

Taking the journey work to the suitable ranges it was not only carried out with the purpose of fulfilling the labor Law, but also with the purpose of increasing the collection yields, objective achieved as it is indicated in the following point.

The increase of the time dedicated to the collection with the execution of the diagramming of the routes allows the efficient use of the resources, reducing the personnel and truck operation costs.

**Tons collected vs. Collection time.**

The total of tons collected per hour in average was increased in 11%, if the yields measured in the studies of time and movement that reach 2,10 ton/hr is compared with those obtained in the P.P.P. where the average value for the routes carried out with the compactor truck of 20 and 25 $yd^3$ is of 2.39 ton/hr. It was not considered in the average the small compactor truck since the collection method is different due to the difficulty of trafficking in the narrow streets. In 5 of the 9 routes the standards recommended by the CEPIS were reached.

The yield increase reflects the appropriate design of the routes and the optimization of the use of the resources, what is translated in a decrease in the service costs.

**Km./hr-man**

In the sweeping project it was possible to increase the yields of the personnel's sweeping and fulfill the goal proposed that was of 0.13 Km. / hr-man, through the design the achieved yield was of 0.22 Km. / hr-man which represents an increment of 69% with regard to the goal.

This bigger yield will serve as base for the design of the routes in the rest of the area of the national district, and will allow reducing the number of personnel per route, reducing the personnel costs and being able to enlarge the covering area of the service.

### b.1.2 Effectiveness.

The purpose of the project was achieved since the design of the routes allowed to improve the covering of the service, improve the collection yield, increase the times dedicated to the collection, reduce the time outs, maximize the use of resources, and take the work journey according to what is indicated by Law. On the other hand, it allowed the EMUCD to make the inspection and monitoring according to the procedures established.

With the new design the service quality was improved, carry out a constant inspection and use the resources rationally.

Also the purpose of the sweeping pilot project was fulfill, a quality service with less

resources was implemented and it was possible to establish base yields for future designs.

### b.1.3 Impact

The biggest impact in the pilot project is to have achieved a quality service with the same actors and resources that at the moment are used. The private operator could observe the benefits that are obtained when operating a service that responds to technical approaches, the EMUCD understood that the continuous and appropriate inspection is the only form through which can assure a quality service to the community and that the participation of the community is indispensable to achieve a Clean City.

The project has had a strong impact on the operation of the private Company who has incorporated important changes to its organization and operational processes in order OF achieving in the short term the implementation of good routes in the whole assigned territory.

As in the P.P.P. the EMUCD lifted information on the development service being able to gauge the routes, taking them to the good one proposing and implementing the changes with the private operator.

The main impact of the sweeping pilot project is that a new modality of service is implemented, and is not directed to the main avenues as it happens at the present time and that the works are carried out by groups of two peoples, reducing in 1/3 the necessities of personnel per route, having these a bigger longitude in relation to the traditional sweeping made in the N.D.

### b.1.4 Relevance

The implementation of the pilot project has allowed the EMUCD to conform a team of professionals qualified to plan, design and operate in an efficient form the collection and sweeping service, at the same time the private company is under conditions of generating the changes to offer a quality service.

### b.1.5 Sustainability

In the measure that the operator and the EMUCD fulfills with their respective responsibilities and the Municipality respects the contracts terms it will assure the sustainability of the project. On the other hand, if the EMUCD implements a sweeping service designed under a technical approach with yields achieved in the pilot project it will be able to make important economies that will assure the sustainability of the service from the economic point of view.

## P.4 Conclusion

The strategy and measures proposed for the M/P are been executed.

The good design of the collection and sweeping service, has demonstrated to the EMUCD that is feasible to reach a quality service through a rational plan of collection, what will allow not only increasing the efficiency and service quality but also reaching an appropriate level of competitiveness, and achieving an important reduction of the costs.

During the development of the experience have been in evidence a series of problems that affect the quality and efficiency of the service, and that they don't keep relation with its design, but with the form in how the users condition and give their waste. This situation should be controlled through communication programs with the community that includes aspects as characteristic of the service, obligations and the users' rights according to the indicated in the Regulation and aspects related with the health risks due to a wrong solid waste management. Additionally it is recommended to implement in a short term containerization projects, especially in areas of narrow streets, constructions in height and small commercial (groceries stores). The improvement of the storage and delivery of waste

will increase the collection yields and will impact the landscape positively since will decrease the problems generated by the spill of waste.

The implementation of a quality service and an inspection program has allowed assuring the execution of the frequency, days and schedules of attention established, where after executing the service dispersed waste are not observed in the streets. These achievements are the result of the application of the knowledge acquired by the personnel of the EMUCD and private operator during the training programs.

The appropriate diagramming and the daily control of the parameters monitored by the EMUCD, allowed to make the calibration of the routes, additionally the constant inspection of the routes, assured the execution of the journeys and with it the covering of the service. Lastly, the correct execution of the routes, rise and load of waste, the implementation of the adjustment and improvements by the private operator, impacted strongly in the increase of the yields and effectiveness of the service.

The EMUCD has coincided in the importance of optimizing and inspecting the service, organize the market and implement in a short term communication programs with the community that result in an improvement in the delivery of the waste that will allow assuring its sustainability. In a same way it has understood the necessity to strengthen their organization in order of having the enough qualified personnel to make the design and inspection of the service in the rest of the District.