Project For Institutional Capacity Development On Nation-Wide Solid Waste Management In Dominican Republic

Manual for Database of the Integrated Solid Waste Management

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GLOSSARY OF ACRONYMS

JICA	Japanese International Cooperation Agency
ADN	Municipality of the National District
SQL	Structured Query Language
MARENA	Ministry of Environment and Natural Resources
DP	Provincial Direction
DB	Database
FOCIMIRS	Project for the Strengthening of the Institutional Capacity of Integrated Solid Waste Management
UGAM	Units of Municipal Environmental Management
RS	Solid Waste
MIRS	Integrated Solid Waste Management
RED- GIRESOL	Integrated Solid Waste Management Web
TOT	Training of Trainers
GIS	Geographical Information System
XML	Markup Language
D.M	Municipal District

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INTRODUCTION

The following manual, is a didactic and practical guide for the Provincial Directions. This work instrument will serve as technical support for the establishment of an organized system of interrelated data management, where information from all the municipalities in the country can be stored in a structured and organized fashion with the objective of allowing different public and private users to access this data.

The establishment of this system started as a need within the FOCIMIRS project, due to the lack of or inexistence of a national system where data related to ISWM is stored.

This manual is structured with various steps or stages that describe different activities to be done for the Ministry of Environment, the Provincial Directions and the municipalities in order to establish an organized system of data related to ISWM. It also explain with detail the different procedures and provides tools with questionnaires, tables and forms that need to be understood before and after the implementation of this system.

The Development of this manual will be based on a flow of information with a vertical dimension of multilevel government.

The Data Base Program was developed in three Pilot Municipalities **Sánchez, Azua, Moca** and its Municipal Districts in the FOCIMIRS project. The short term and long term objective is extending the System to the other municipalities of the country in order to create a single data collection and storage network.

Goals and approaches of this manual

The goals will be:

- To be a guide for the Provincial and Municipal Directorates regarding the handling and storage of data and information related to the ISWM.
- To improve the storage conditions of data related to the collection, transportation and final disposal of Solid Waste, in order to make the service more efficient.
- Be able to determine the actual amount of solid waste produced by each municipality, as well as the calculation of the index of material that can be

recovered while promoting recycling and recovery of waste.

- To help the Municipalities in the organization of their data, as well as to handle the necessary information regarding solid waste management.

1 GENERALITIES

1.1 WHAT IS A DATABASE?

A database (DB) is a powerful tool that is developed through the collection of interrelated data, with the objective of processing, analyzing and interpreting, making projections, reports and handling of statistical data on the management of solid waste. These data projections can be used as an instrument for decision-making, strategies and guidelines for improvement in the service of Solid Waste.

Its target is the public and private level because all its operations fuses as one central entity, however, said entity has nation-wide coverage.

1.1.1 Advantages/Benefits of using this new DB system

The use of this new System offers multiple advantages, such as:

- Doing consultations and reports according to the need of the user, such as: Reports and monthly projections, annual, etc.
- Getting to know the evolution and changes in current trends when it comes to solid waste management.
- Enable the user to obtain information: they are a tool for making decisions and chart policies and strategies.
- A database can combine and share data from several other institutions interrelated files and other databases on related topics.

1.1.2 Objectives and Approaches

1) Principal objective

The main objective of the DB is: Develop a new management system of organized information with a dimension of multilevel governance that descends from the Ministry of Environment and Natural Resources (MARENA) to the Provincial Directorates and Municipalities.

Based on the reality of MARENA, the database system will be carried out with the purpose of drawing up policies and strategies and improvements in the service of collection, transport, recycle and Intermediate treatment and final disposal of Solid Waste from the Ministry towards municipalities.

2) Specific objectives

- To analyze the evolution over time of variable solid waste data related to the application of the ISWM policy. Determine the amount of solid waste produced at municipal level in order to know the exact amount of waste produced in the country.
- Determine the amount of solid waste produced at the municipal level in order to know the exact amount of waste produced in the country
- Make a comparative assessment of changes and developments in the management of solid waste over time, as well as the projection of changes in society.
- Develop an efficient permanent data collection and feedback system using a multilevel scheme from MARENA, the Provincial Directions and the municipalities.

1.1.3 Framework of the database's basic policies

- The establishment of a database at a national level will be necessary for MARENA in order of capturing the situation of solid waste management in the Dominican Republic.
- The Database System must be updated and continuously provided with maintenance.
- The parts that compose the Database component (MARENA, PD, Municipalities) must establish the commitment of upholding and providing feedback to the database.
- The information must be linked to the context of application of the "General Law of Solid Waste".

1.1.4 Methodology

To collect the data that will feed the Database, different descriptive tools, statistics, surveys and interviews were applied to the three pilot municipalities: **Azua**, **Moca** and **Sanchez**. In these three pilot projects a diagnosis of the current situation was done in the SWM, furthermore, various interviews to the key personnel related to the topic were done, such as: UGAM, other officials of the municipality and representative public and private institutions.

In said investigation, a guide or questionnaire previously made was used. Equally, on-site investigations were made, for which strategic places of the

municipality were toured with the objective of observing the services, basic sanitation works, material recovery areas, final disposal sites and spaces focused on classifying solid waste.

The practical work that has been developed comes from the need to know the current solid waste management that municipalities are doing. This process involves the use of forms, questionnaires and tables on the ISWM topic, previously developed by the Database team.

1.1.5 Expected results: Published by MARENA.

As part of the expected results within the database component, there is the power of being able to establish a system of data analysis not only in the three pilot municipalities, but nationally where all information concerning the management of solid waste is stored in one place where people can access this information through the creation of reports that will be distributed as follows:

1) External dissemination of information to the public:

At this point is where the type of access to information to be published, for the population, such as maps, ISWM statistics, results of performance indicators at the national, provincial and municipal levels will be evaluated, among others.

2) The Internal dissemination of information:

Regarding the type of information to be published internally, it will be wider than the external publication where not only statistical data come to light, but also tables and other information such as collected raw data and other internal interest data.

2 FRAMEWORK/STRUCTURE OF THE DATABASE

2.1 Database mechanism

As mentioned earlier, MARENA is implementing a new Database System under the framework of the FOCIMIRS project in three pilot municipalities: **Moca, Azua and Sanchez** with their respective municipal districts.

The Technology Department used the **SQL programming language** for the creation of the BDD, they are in charge of the creation, installation, operation maintenance and feedback of the database system (DB). This Management has already made sure that the system is operational in each of the pilot municipalities (Moca, Sánchez and Azua) and works in coordination with the Directorate of Solid Waste of MARENA applying improvements to the system.

The maintenance and feedback process will be done through the inputs obtained with the information collected in the questionnaires

2.2 Structure of the database

The structure of the Database System will be composed of a flow of information with a vertical multilevel dimension of governance that descends in the following way:

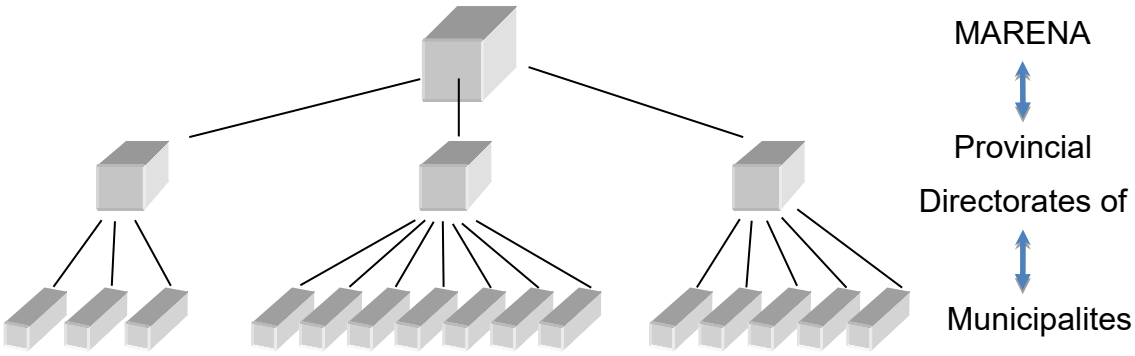


Figure 1 The vertical dimension of multilevel governance

MARENA create and manage the Database System. The use of this will allow the Ministry to connect via Internet with the Provincial Directorates, which will be assigned a User and Password that will allow them to connect directly with the central server where they will send the information obtained in the municipalities.

The following diagram shows the general structure of the DB and how the information flow will be between the parts that integrate the complete system of DB integrated by: MARENA, the **PD** and the municipalities.

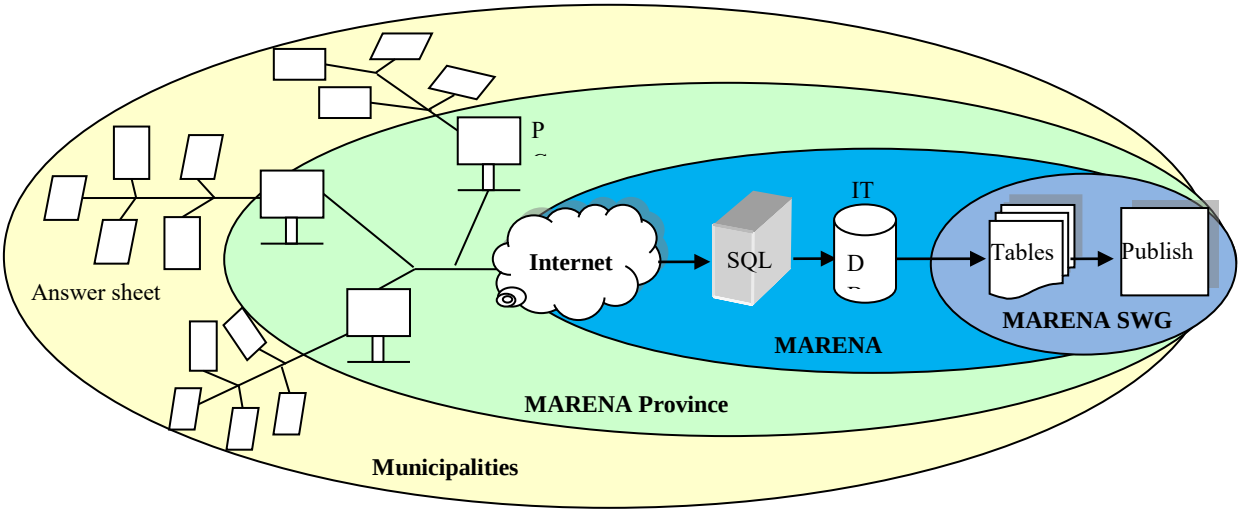


Figure 2 General structure and Database design

3 RESPONSIBILITIES AND ROLES OF DIFFERENT GROUPS

MARENA, the Provincial Offices and municipalities are the key actors for the operation and maintenance of the database structure. In this system, each of the members play an important role to ensure the sustainability of this project during the design stage, creation, maintenance, information gathering and feedback from it.

Each of these institution have an established function, said functions are summarized in the following table:

Table 1 General Responsibilities of the Database

Responsibility/Instrument	Responsibility	Observations
Creation of the database	Technology/ MARENA	Technology equipment.
Questionnaire Design	MARENA	Subject to modifications.
Questionnaire distribution	Provincial offices	
Generation, Collection and data delivery to P.D.	Municipalities	The municipality will assign a person.
Generation, collection and delivery of data to P.D.	P.D.	Monthly, annually, it depends.
Quality control of the data	P.D.-Data Base Team	
Delivery of the solid waste collection trip table to MARENA	P.D.	Monthly /annual
Data input to Database server	MARENA/ P.D.	Technology
Publishing of data/report	MARENA.	Depends on the need

3.1 Role of the Ministry of Environment (MARENA)

MARENA is the **coordinator, creator** and **administrato**r of the design and creation of the database. MARENA is also responsible for the publication of articles and bulletins related to the topic, as well as the control of data, calculation of it, and general responsibility for the sustainability of the system.

3.1.1 The functions of the Ministry are the following:

- It is a coordinating agent and, as such, it is responsible for the creation and management of the database with the collaboration of the **Department of Technology**, which will be responsible for creating and maintaining the database system.

- **MARENA** create and distribute questionnaires, forms and solid waste collection trip tables that the municipalities will work with. These materials should be available in the institution and / or be supplied and distributed by the Provincial Directions.
- MARENA will be responsible for reporting publications, reports and statistics on the **ISWM** every certain time.

3.2 Role of MARENA's Provincial Directions

The Provincial Directions are the next link in this chain. They represent the link between the Ministry of Environment and the municipalities. Among its roles are:

- **The Provincial Direction** will receive the information, from the municipalities, that will feed the **DB** then it will analyze it and debug it before sending it to the Ministry through the P.D.'s link to the DB.
- It will be responsible for the distribution of questionnaires, forms and trip tables to municipalities.
- Each month / year they must collect information from questionnaires and trip tables, as well as monitoring their verification and subsequent scanning.
- They are responsible for quality control, verification and the authenticity of the data proving that it matches the reality of the municipality before being sent to the Ministry.

3.3 Role of the Municipalities

Municipalities and Municipal Districts are key actors where information that will feed the DB will be generated and where the project will be implemented. They will be trained for direct and continuous collection of data. Among their responsibilities are:

- Collecting raw data (trip and equipment tables) directly from the source responsible for ornaments and cleaning, municipal management and other personnel linked to the issue.
- Delivery and / or sending of data to the provincial offices each month / year.
- Necessary calculations, measurements and estimates of the vehicles, production, generation and recovery of waste.

4 DATA COLLECTION

Data collection must be a continuous activity and planned that is required all year round. The following is the complete scheme for data collection:

- Questionnaires (1/year).
- Amount of solid waste/ trip table (1/month).

The first is a questionnaire to determine the current status of solid waste management in each municipality. Data collection questionnaire will be filled out once a year. This topic will be explained in more detail in **Chapter 5**.

The second is the collection of data on the amount of solid waste. This information is collected once a month, if municipality does not have a weighing machine. This topic will be explained in more detail in **Chapter 6**.

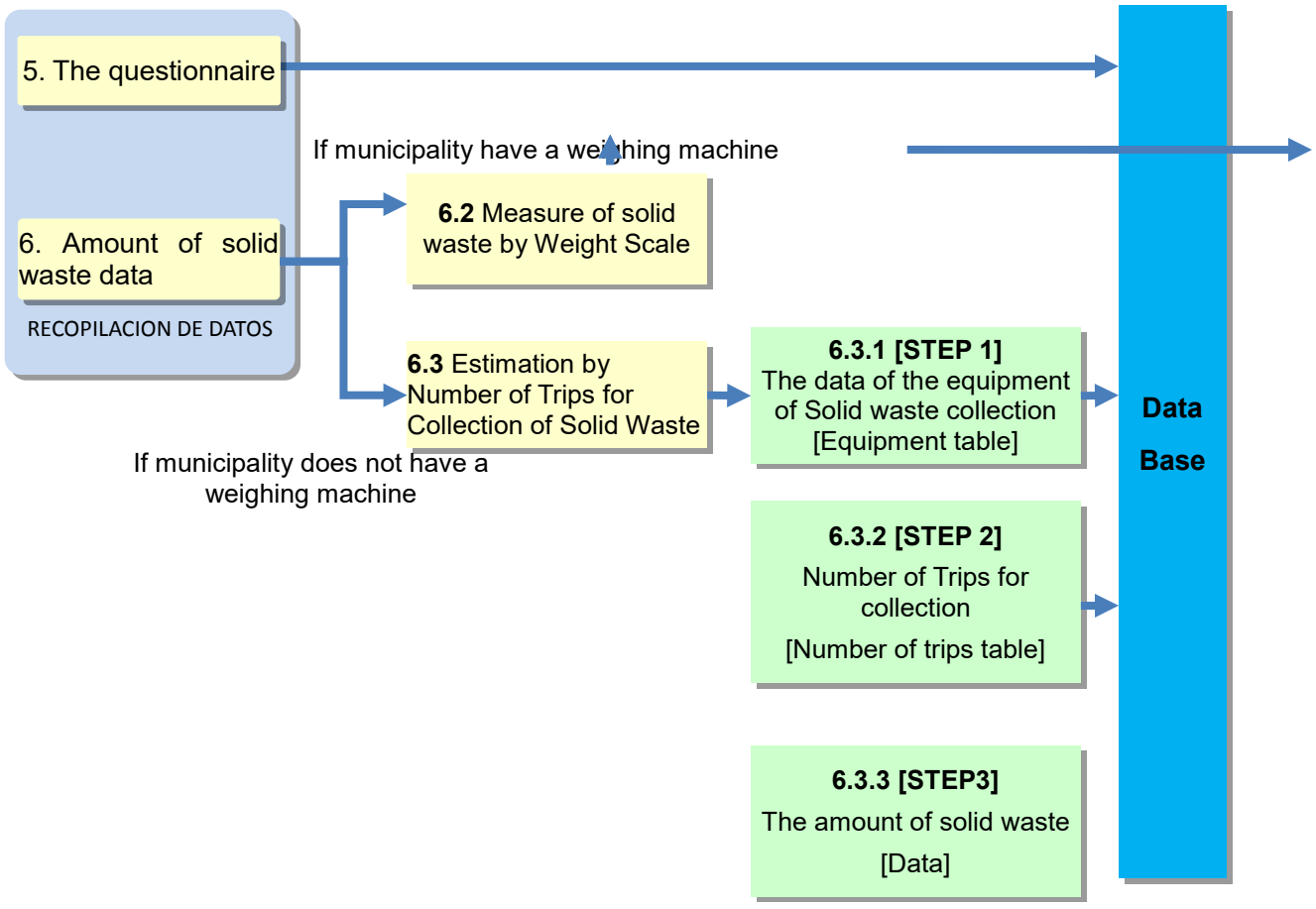


Figure 3 Data collection scheme

4.1 Data Collection Frequency

Once installed and running, the DB system of MARENA, the provincial offices and municipalities have the responsibility to collect and send the data obtained over a year to **MARENA**.

To maintain equanimity data, Solid Waste Management provides municipalities and provincial directions advice and ongoing monitoring to ensure the proper flow of information and its authenticity.

Then, in the figure below, the complete scheme for data collection is presented:

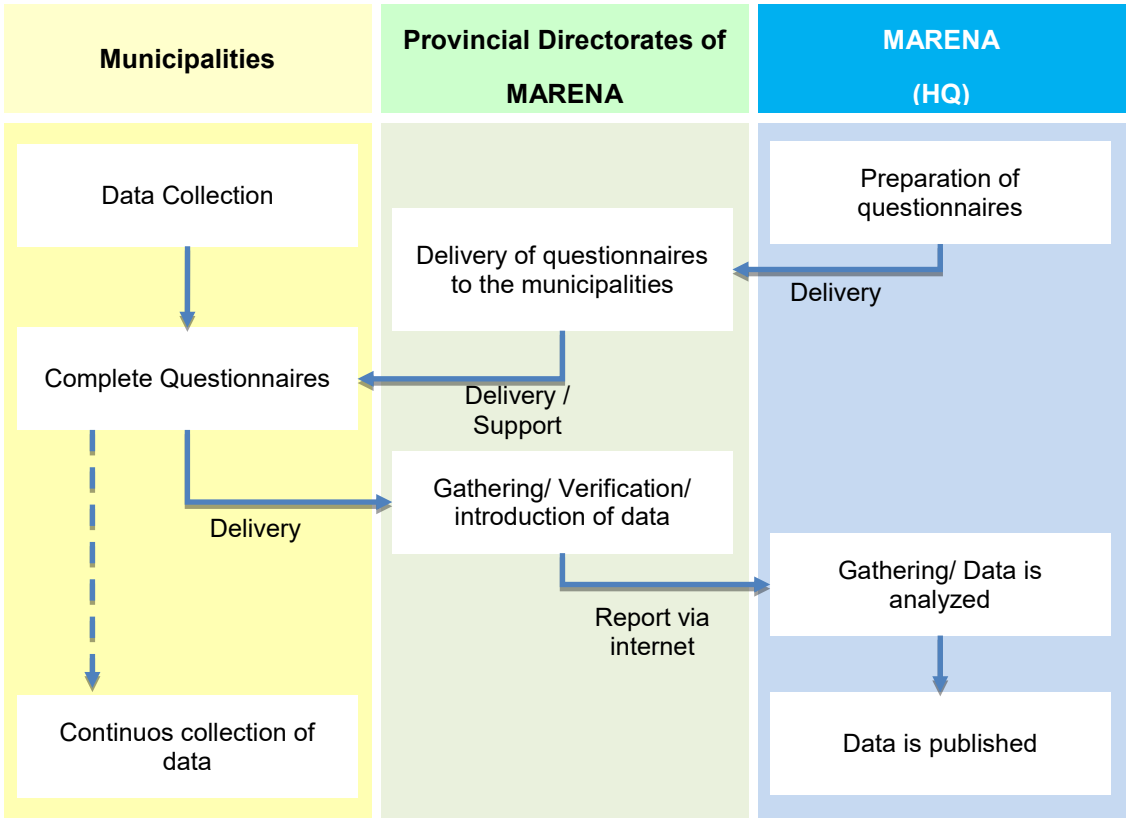


Figure 4 Data collection cycle

4.2 Frequency of Data Collection for the Questionnaire and the SW collection trips tables

The responsibility for collecting data rests intrinsically on the Provincial Directorate, but the Municipality also has an important function in this section as

we will see below.

4.3 Frequency of Data Collection for PD's:

They are the main point of liaison between the municipalities and MARENA, and are primarily responsible for the frequency of data collection.

- They are responsible for collecting monthly data supplied by municipalities.
- Once a month, when this data is obtained, the Provincial Offices have the responsibility to review this information and then introduce it into the DB, before being sent to MARENA.
- They must maintain permanent contact with the municipalities and staff responsible for data collection in order to maintain the flow of information.

4.4 Data collection frequency for the Municipality:

For annual results, the municipality needs daily and monthly data record. The organization and storage of this data can be digital or physical, depending on the availability of equipment. To collect the data follow these steps:

- The municipality has the responsibility to designate a person who will be responsible for performing daily data collection**.**
- The municipality must keep a daily record of trip tables for gathering public and private data.
- The municipality must collect and send the data from trip tables or daily collection (tons per day) to the PD's once a month.

4.5 Frequency of Data Collection for the Questionnaire and Equipment Inventory

The collection of data from the questionnaire and equipment inventory will be done once a year or at the beginning of the ISWM program. The updating of this information will be done annually or depending on the need to update the data.

The Provincial Directorates are responsible for completing and updating the information.

5 THE QUESTIONNAIRE

The questionnaire is another tool, in addition to the trip table used in the data collection in the municipality. As previously stated, its collection frequency takes place once a year. It is structured by different issues related to the collection, transportation, final disposal and recovery of solid waste, so that it can capture as much information as possible.

The questionnaire is composed by the following points (See 10.1):

Municipalities' general information

I Solid waste collection

II Recycling and intermediate treatment

III Final Disposal

IV Fare system

V Outsourcing

VI Amount of personnel for solid waste collection

VII Amount of waste

Photo 1 Data collection for the questionnaire at Sanchez's Municipality

5.1 Instructions on how to fill out the questionnaire

To fill out this questionnaire, we present to the Provincial Directorates some general instructions that the interviewer must take into account when applying it. In the following chapters we will detail point by point how to complete step by step the questionnaire.

5.1.1 The general instructions

The general instructions that the interviewer must take into account before beginning to fill out the questionnaire are:

- Read the instructions correctly.
- Ask all the questions order (do not skip questions) it is important to follow the order.
- Do not shorten or summarize the questions.
- The answers and all its possible options must be done without summarizing.
- When it comes to Yes or No answers, place an S (It stands for Sí, Yes in Spanish) in the case of Yes and an N if the answer is No. Where options are

listed, enclose responses.

- In the event that the question does not apply to the municipality, this must be indicated with an N / A in the "other" field.
- In the case of question No 4 on Biomedical / hazardous waste, the interviewer should clarify or emphasize on these to avoid confusing them with common or household waste generated in health centers.
- If the respondent does not know the answer, it is advisable to leave that questions for the end or make them to be completed or investigated afterwards.
- In Section II, on recycling and intermediate treatment, it should be clarified that this activity does not include informal materials recovery by gatherers or divers in the landfill. This activity refers to activities that the municipality receives some income from, such as the sale of recovered materials.
- In Section V, on company outsourcing refers to hiring companies and drivers for collection, transportation and disposal of waste, this does not apply if only the equipment will be rented.

5.1.2 Detailed instructions on how to fill out the questionnaire.

1) General information of the Municipality or Municipal District

The starting point of the questionnaire is the general information of the municipality, the interviewer should introduce the data or general information about the municipality and key stakeholders in regards of solid waste management. This data will allow us to know the key personnel and how to contact them if additional information is required. In addition, general information allows to make an organization hierarchy or structure, such as Province-Town-District Municipal etc.

General information of the Municipality or Municipal District		
Province _____ Municipality/ DM_____ Date _____		
Mayor _____	Phone _____	Email_____
UGAM's Chief _____	Phone _____	Email_____
Ornamental and cleaning chief_____	Phone _____	Email_____
Provincial Director(MARENA)._____	Phone _____	Email_____
Personnel in charge of DB at PD _____	Phone _____	Email_____

2) Solid waste collection

I- Solid waste collection	
Question	**Answer**
1. What is the size of the population in the Municipality/DM? 1-1.The number of households?	_____ Hab. _____ Households.

This point is very important to know the generation of municipal solid waste produced by individuals and households. This point is important for municipalities as they can carry out a more efficient and organized planning for the collection, transportation and final disposal of waste.

How to fill this point: To complete this point and determine the number of inhabitants, the data are available in the National Statistics Office (ONE) in the last National Census.

The number of households is a little more difficult for municipalities, as it does not appear exactly in the census. The same can be obtained with a census of the municipality by households, sectors and neighborhoods etc.

2. Do they have improvised / informal dumping sites?	S/N

The improvised / informal dumping site refers to improvised or clandestine landfills not authorized by the municipal council. These are the places where people, companies throw solid waste to the streets, sidewalks, vacant lots and glen etc.

It is important for the municipality to have a record of the location of the dumps to account for the amount of waste that does not reach the landfill and which in turn is not collected adequately, in order to be able to trace control strategies.

Note: do not confuse improvised dumps with the municipal dumping site.

3. What is the total coverage rate of the MSW collection in the Municipality / DM?	_____ %

The coverage index is an important parameter because it allows us to determine the actual coverage of the collection, helps in the future planning of routes, the number of trucks necessary, the number of trips to satisfy the demand of the population.

The answer to this question usually is the one in charge of routes, or Ornament and Cleaning.

This question is complementary to the previous one, but the answer is based on the range of 0 to 100%. The majority of the municipal collection personnel usually precipitate a response of a 100% coverage index. Our duty is to inquire based on the previous answer on the truthfulness of this.

This point is important because it shows how it works and the efficiency of the waste collection system implemented by the Municipality. When you asked the municipality's staff, most of them say that solid waste **collection rate is at 100%**, when it is known that in reality, many times, it is not.

When the number of households using the collection system is mentioned, it refers to how many households use the collection service.

In general, in rural areas, access for trucks is more limited than in urban areas. And/or there are very distant areas or narrow streets, etc to which trucks do not arrive or do not provide the service. On the other hand, many families tend to burn garbage and is not counted in the production of Solid Waste since they have not reached the landfill or has not been accounted for.

In addition, such information is useful to calculate **kg / person / day** whose index serves for collection service planning, establishing routes, charging for services, amount of waste generated in rural and urban areas etc.

4. What is the total number of habitants using the MSW collection service in the municipality / DM?	_____ Hab.
4-1.The number of households?	_____ Households.

This question refers to the number of inhabitants and households that the collection truck passes by and provides the service to. Please calculate from the

above-mentioned question 1 (number of population) and question 3 (total coverage rate of MSW collection).

5. The municipality collects **hazardous / biomedical** waste from Hospitals and / or health centers?	S / N _____
> If the answer is "YES", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____

Concerning the collection of Biomedical / Hazardous Waste there are usually some doubts and confusion with the collection of common waste. As it is already known biomedical or bio-infectious waste is a kind of special waste which has a separate standard and its collection and management is not the responsibility of the town hall.

The interviewer should clarify or emphasize these and not confuse with the collection of non-hazardous waste generated in the different Health Centers (Hospitals, clinics, polyclinics, etc.).

In case the municipality collects them, the interviewer should clarify how they do it with one of the four options on the right.

Note: When option one is chosen (1) along with household waste, it refers to when the truck makes the collection route and the biomedical waste is collected along with the common ones without making a classification

6. Does the municipality collect or receive solid waste from **businesses, stores and markets**?	S/N _____
> If the answer is "YES", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____

This question refers to the collection of commercial waste, markets and squares are areas where large volumes of waste are generated. On the other hand, in some countries the collection of this waste is usually done separately from household waste. If the answer is "Yes" please specify one of the four options given to the right.

7. Are there industries in the Municipality/DM?	Y/N _____
7-1 If the answer is "NO", they are directly deposited in the landfill by the industry?	Y/N _____
8. Does the municipality collect **industrial** solid waste?	Y/N _____
> If the answer is "yes", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____

The responses to the collection of industrial waste will depend on whether or not there are industries in the municipality. If there are not any, choose the **"NO"** option and proceed to the next question.

If there are industries in the city, it means there is a generation of industrial waste, which needs special treatment and disposal. If the answer is "YES": Industries' solid waste is not collected by the municipality, specify how this type of waste is collected. The interviewer should clarify the fate of this waste, for example, if they are collected by the Municipality and how this collection is carried out by choosing one of four options on the right.

9. Is waste from **institutions** collected? * (E.g., Public and private schools, Police Stations, etc.)	S/N _____
>If the answer is "yes", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____

Waste collection from institutions, includes waste of schools (schools and public high schools, private schools), public and private institutions, as well as police, government offices, etc. Like the above questions the interviewer should clarify how the collection is made, if the answer is 'Yes,' the one of four options given to the right must chosen.

3) Recycling and intermediate treatment

II. Recycling and Intermediate treatment	
Question	**Answer**
1. Does a formal recycling/recovery activity organized by the Municipality exist in the municipality or that said Municipality receives income from?	Y/N _____

> If the answer is “Yes”, this activity is

2.Segregation at the source (as formal activity)	Y/N _____
> If the answer is “Yes”, this activity is 2-a) segregated at the source (as formal activity)	1) The whole city (municipality) 2) Parts of the city (i.e., community or zone)
What types of materials are segregated at the source?	2-1. Organics Y/N ___ , _____ kg/month
	2-2. Plastics Y/N ___ , _____ kg/ month
	2-3. Paper & cardboard Y/N ___ , _____ kg/ month
	2-4. Metal Y/N ___ , _____ kg/ month
	2-5. Glass Y/N ___ , _____ kg/ month
	2-6. Others(_____) Y/N ___ , _____ kg/ month

3. Intermediate treatment (As a formal activity)	Y/N _____
> If the answer is ‘’Yes’’, What types of materials are recycled by intermediate treatment?	3-1. Compost Y/N _____ , _____ kg/ month Where: 1) At theFDS 2) Another place (_____)
	3-2. Plastic Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-3. Paper & cardboard Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-4. Metal Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-5. Glass Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-6. Others(_____) Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)

This question only applies if a recycling or waste recovery activity exists within

the municipality. When it says **formal recycling** it refers to whether the recycling or recovery activity provides profit to the Municipality.

In this point it must specify:

- The informal recycling is the one that is done by waste pickers (Buzos) or informal collectors/waste pickers where the income is earned by them and not by the Municipality. In this case the question would not apply.
- If the answer is **Yes** it must be specified what the coverage of this recovery Project is, i.e., if it reaches the whole city, parts of it or just an specific community, etc.
- For example, in the case of Moca, the Municipality is carrying out a pilot project of collection and selective recycling of waste at Villa Elsa.
- It must be specified if the segregation takes place at the source or if (i.e., in the same place where it is generated) there is intermediate treatment.
- In the agreement the type of material that is being recovered must be specified: (plastic, organics, metal, cardboard, glass, etc.).
- Other important aspects knowing the amount of solid waste that is being recovered (**Kg of material).**

4) Final disposal

III- Final disposal	
Questions	**Answers**
1. How many dumping sites exist in the municipality/Municipal District?	Amount _____
1-1.If answer is “yes”, please note the name of municipality	_____
1-2 if answer is 1 or more, Name and location of the dumping site/ sanitary landfill?	_____
2. If municipality have dumping site, please answer next question.	
2-1.Are the solid waste at the dumping site currently being covered at the dumping site/ sanitary landfill?	Y/N _____
>If the answer is “Yes”, How often is the coverage done?	1) Daily 2) Every other day 3) Weekly 4) Biweekly 5) Monthly 6) Others

2-2.¿Is there a leachate collection network at the dumping site?	Y/N _____
2-3.¿Is there a leachate collection pond?	Y/N _____
2-4.¿Is there a gas collection network in the dumping site?	Y/N _____
2-5.¿In the area where the dumping site is located waterproofed?	Y/N _____
2-6.¿Are the subterranean waters of the landfill/dumping site being monitored?	Y/N _____
2-6-1.If the answer is "YES", ¿How often are they monitored?	1) Daily 2) Every other day 3) Weekly 4) Biweekly 5) Monthly 6) Others

When it comes to this topic there are various aspects to be taken into account:

- In the question about the amount of dumping sites being used in the municipality, the interviewer must clarify if the municipality operates or deposits in more than one dumping site. On top of specifying clearly where they are located (i.e., physical address).
- When it comes to the coverage (i.e., coverage of the waste with material, such as dirt, etc.) in this case, if the answer is **Yes,** specify in the selection on the right hand side how often this coverage is done: e.g., daily, every other day, biweekly, monthly, etc.
- Questions 2-1 to 2-6 are **Yes** or **No** questions where there is no need to over explain the answers, i.e., whether there are leachate and gases collection networks, etc. Even though these items seem strange for the authorities, they are part of the specific techniques of what a landfill or a controlled dumping site must include, they are part of the technical specifications of what a landfill or controlled dumping site must include.
- Now some pictures relating to the topic.

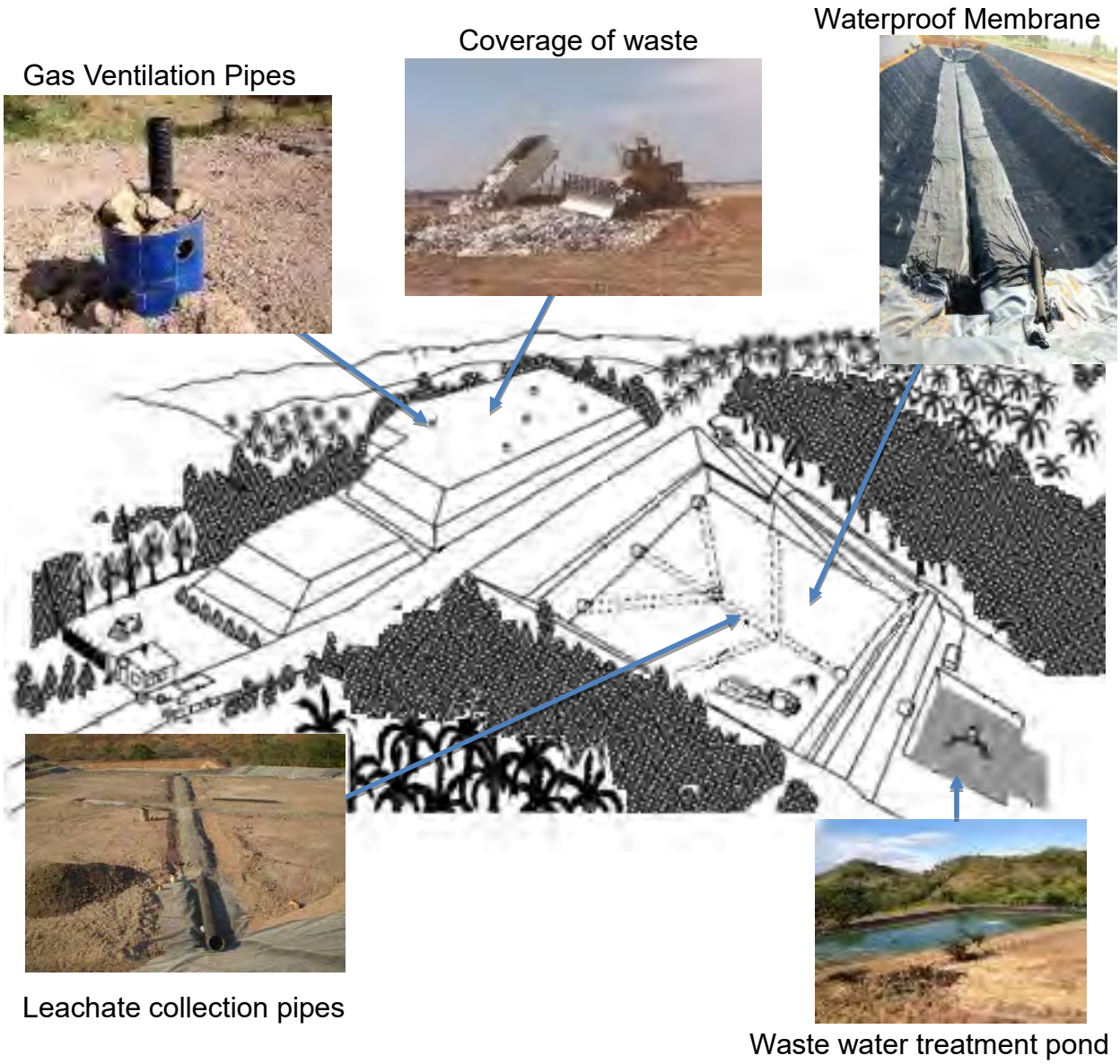


Figure 5 Some technical specifications for a landfill or controlled dumping site

5) Tariff system

IV- Tariff system	
Questions	**Answer**
1. Does the municipality charge the users for the Solid Waste collection service?	S/N _____
>If the answer is "YES",	
1-1.What is the Tariff systems for the households?	1) Fixed tariff 2) Depends on the generation 3) Others, specify_____
1-2.How often is the fee collected?	1) Weekly 2) Biweekly 3) Monthly
1-3.Payment method:	1) Together with water invoice 2) Together with electricity invoice 3) At the City Hall 4) Internet 5) Home delivery 6) Others, Specify_____
1-4.Amount of households that pay for the service:	%_____, Nº_____
2. Does the municipality charge the businesses for Solid the Waste collection service?	Y/N _____
>If the answer is "YES",	
2-1.What is the Tariff system for businesses?	1) Fixed tariff 2) Depends on the generation 3) Others, specify_____
2-2. How often is the fee collected?	1) Weekly, 2) Biweekly, 3) Monthly
2-3.Payment method:	1) With the water invoice 2) With the electricity invoice. 3) At the City Hall 4) Through the internet 5) Home Delivery 6) Others, specify_____
2-4.Amount of businesses that pay for the service:	%_____, Nº_____

3. Does the municipality charge the industries for Solid the Waste collection service?	Y/N _____
>If the answer is ”YES”,	
3-1.What is the Tariff for the industries?	1) Fixed tariff 2) Depends on the generation 3) Others, specify_____
3-2. How often is the fee collected?	1) Weekly 2)Biweekly 3)Monthly
3-3.Payment method:	1) With the water invoice 2) With the electricity invoice. 3) At the City Hall 4) Through the internet 5) Home Delivery 6) Others, specify_____
3-4.Amount of industries that pay for the service:	%_____, Nº_____

It is common knowledge that the D.R. does not have a fixed and standardized regulation for the collection of a solid waste collection fee. The fee collection criteria for solid waste are not unified and due to its absence, each Municipality or D.M. (Municipal District) as autonomous entities, they choose whether to collect it or not and when they do, they charge whatever they consider should be charged based on their independent criteria.

Due to the lack of a solid waste collection fee or of a fair solid waste collection fee, this situation is reflected on a deficient solid waste collection that affects the Integrated Solid Waste Management, this affects solid waste collection and final disposal the most.

In the questionnaire, the tariff system establishes different levels:

- ✓ Tariff established for households.
- ✓ Tariff established for businesses.
- ✓ Tariff established for industries if such entities exist in the municipality.

• If the answers to these questions is **YES,** then the interviewer must keep

asking questions about the topic. If the answer to the question is **YES**, then the interviewer must keep asking about the topic. If the answer is **No,** it must automatically progress to the next level of fee collection.

- The first question says that if the municipality collects a fee or not for the collection service to households, if the answer is **YES,** the type of tariff applied to households must be asked, specifying if it is fixed or if it is based on the amount of waste generated by each household.
- Once this information is obtained, it is necessary to know how often this fee is collected (i.e., monthly, bimonthly, etc.) and how it is done (home delivery, with the water invoice, with the electricity invoice, etc.).
- Another important question is asking for the percentage of households, businesses and industries that pay for the service. With this answer it can be determined the amount of income for solid waste collection that gets to the City Hall, among other things.
- With the following questions on the collection of a solid waste collection fee to industries and businesses the same scheme established for the households will be followed.

6) Outsourcing (Subcontract)

V- Outsourcing (Subcontract)	
Question	**Answer**
1. Is the solid waste collection service being outsourced?	Y/N_____
>If the answer is ”YES”, 1-1.please select the option that applies:	1) The whole city 2) Some parts of the city 3) Others, Specify:_____
2. Is the recycling and intermediate treatment service being outsourced?	Y/N_____
>If the answer is ”YES”, 2-1.please select the option that applies:	1) Only for operations 2) Operations and construction
3. Is there outsourcing at the landfill/dumping site?	Y/N_____
>If the answer is ”YES”, 3-1.please select the option that applies:	1) Only operation 2) Operations and construction

Outsourcing or subcontracting is an optional process that is done by some

Municipality, when they do this they choose to rent an operator or private Company for collecting and transporting urban solid waste.

Most of the outsourcing of private companies happen when there is not enough equipment or personnel for carrying out the activities related to solid waste collection, transportation and final disposal of solid waste.

- On outsourcing, the questionnaire includes 3 questions. If the answer is "**YES**" each question must have a specific answer.
- An important fact that must be clarified is that when referring to outsourcing in this manual, it refers to the contracting of ‘’X’’ Company for the completion of certain operations, i.e., when the company is contracted with its equipment and its driver/operator. It is not outsourcing when only the equipment is rented and it is operated by an employee of the Municipality.
- The first question refers to the contracting of equipment for solid waste collection and if its answer is **YES**, specify it is only for a part of the city or for the whole city, etc.
- The second question refers to outsourcing if there is a formal **recycling project** (Municipality’s operator). The place where the service was outsourced to must be specified, also it must be specified whether both the operation and the construction are being outsourced or only one of them.
- The third question refers to the outsourcing of the operation of the landfill/dumping site. What was outsourced for the operation and was outsourced for the construction of the site must be specified.

7) Amount of personnel for Solid Waste collection

VI- Amount of personnel for Solid Waste	
Question	**Answer**
1. How many people work in the administration?	_____ people
2. How many people work in the street sweeping?	_____ people
3. How many people work in the collection and transportation of waste?	_____ people
4. How many people work in the intermediate treatment of solid waste?	_____ people
5. How many people work in the final disposal site?	_____ people

Within the pay sheet and the municipal budget there is a part focused solid waste management and beautification and cleanliness.

The answers to this section are specific.

- The 1st question refers to the personnel that works in the administration of the waste. It is important to point out that this manual is referring to the administrative personnel of the Municipality, if not to the Directorate or Department of Cleanliness and Beautification if administrative personnel exists in said department. If it does not exist, please write a **0.**
- Question number (**2)** on the number of people that work as street sweepers, if the answer is **YES**, specify the number of sweepers in the crew.
- Question number **(3)** on the number of people that work with solid waste collection and transportation. This question includes the drivers of the trucks and his assistants.
- Question number **(4)** on intermediate treatment personnel, it only applies if the municipality does intermediate treatment.
- Question **(5)** the personnel that works on final disposal on the dumping site operation must be numbered, specify.

Photo 2 Introduction of data to the DB questionnaire of Moca

6 AMOUNT OF SOLID WASTE DATA

The amount of solid waste produced daily or monthly is an important piece of data that every Municipality must know. In this chapter, some methods are explained for the measuring of the amount of solid waste.

Most of the Municipalities or D.M. in the Dominican Republic are not aware of the amount of solid waste produced by their respective jurisdictions. In most of the cases this happens due to deficient solid waste collection and storage equipment, final disposal, storage and the technical capacity of Municipalities and D.M.

6.1 Methods for Determining the Amount of Solid Waste

Some methods for determining the amount of Solid Waste depend on factors within the Municipality, such as economical capacity, equipment availability, political willingness, change of administration, etc.

The following are the most common methods of solid waste generation measuring:

- **Method A: Measure by weight scale (6.2)**
- **Method B: Estimation by number of trips for solid waste collection (6.3)**

The municipalities will choose the method that is more adequate depending on the availability of equipment. Because of this, only the municipalities that have a weighing machine will choose **method A**. Since only a few municipalities have weighing machines, they will have to choose **method B**.

Now both methods will be detailed:

6.2 Method A: Measure of Solid Waste by weight scale

This method is one of the most accurate, but not a lot of municipalities have a weighing machine for solid waste collection. Following some of the municipalities that actually have weighing machines will be found:

- Rafey's Dumping Site, Santiago.

- Duquesa's Dumping Site in the Great Santo Domingo.
- Transference Station of the D.N. in Villas Agrícolas.
- Villa Altagracia's Dumping Site, weighing machine of the New Landfill.

If the Solid Waste is weighed directly while the collection truck is loaded with them, the result will be obtained by calculating the difference between weights with the following formula:

$$\underline{\boldsymbol{Final\ Weight\ (Full\ truck - Initial\ Weight(Empty\ truck)}} \\ \underline{\boldsymbol{= Weight\ of\ Waste}}$$

Note: Previously, the Municipality can weigh its empty trucks, so carrying out this activity can be avoided each time solid waste collection trucks dump.

Figure 6 Weighing machine at Duquesa Landfill in North Santo Domingo

This method is very easy to use, a weighing machine is needed, so the solid waste received by the dumping site can be placed on it.

It is most advisable for the dumping site to have a weighing machine for weighing the amount of solid waste in order to keep a record of the daily solid waste production.

In the dumping sites where there is a weighing machine weighing the amount of solid waste and doing the necessary calculations is all that needs to be done, the they go directly into the "**VII-Amount of solid waste"** in the questionnaire.

VII- Amount of Solid Waste	
Question	**Answer**
1.Amount of Solid Waste disposed at the dumping site/landfill by the municipality/D.M. (tons/month)	_____ ton/month
2.Amount of solid waste disposed in the dumping site/landfill by businesses or industries, taken directly to the dumping site (ton/month)	_____ ton/month
3. Amount of Solid Waste disposed by other Municipalities/DMs in their Dumping Site/Landfill.	_____ ton/month

6.3 Method B: Estimation by Number of Trips for Solid Waste Collection.

The current situation of the Municipalities and D.M. (Municipal Districts) is that they are not aware of the amount of solid waste produced within their jurisdictions, only a minority receives data constantly on the production and daily amount (tons) of solid waste, for the rest of the Municipalities this information is unknown.

Taking into account this situation, this chapter describes the method for determining the amount of solid waste produced by the municipalities when there is not a weighing machine available.

This method is used as an alternative when the municipalities do not have their own weighing machine, this method is carried out by calculating the **amount of trips for solid waste collection**.

As shown in the following figure, this method is carried out through the following steps.

- Step 1: The collection equipment information will be organized.
- Step 2: Based on this a Solid Waste Collection Trips Table will be created.
- Step 3: Finally, the amount of solid waste is calculated.

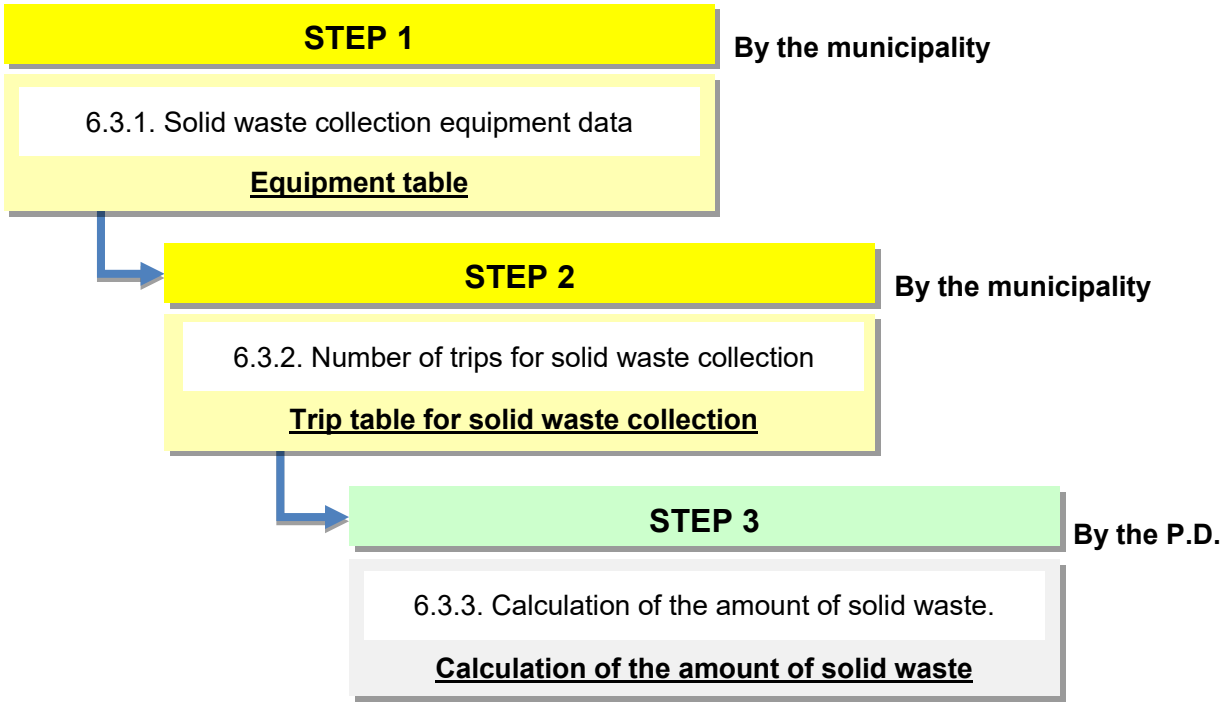


Figure 7 Step for estimating the amount of solid waste without a weighing machine

Each of the steps are described in the following section:

6.3.1 Solid waste collection equipment data [STEP 1]

The Municipality must register the data of the solid waste collection equipment by creating **"An Equipment Table/Inventory"**. If the municipalities receive solid waste from private institutions, it will be necessary to keep track of private vehicles as well.

1) How to create an equipment table / Inventory of vehicles of the Municipality and private companies

First step, create the inventory table of public solid waste collection equipment (Municipality) or private (Direct Collection)". This is done manually and/or digitally by both the **Department of beautification and Cleanliness** including the person in charge of equipment and maintenance, as well as the person in charge controlling the entry and exit of vehicles from the dumping site.

This inventory will make obtaining information on the amount of available equipment easier to the employees of the municipality, as well as knowing collection equipment needs, such as the ones that need to be fixed and/or

receive maintenance, etc.

a. Type of collection equipment. (Dump truck, Compactor, Flat Bed truck, etc.)

b. Equipment ID (Plate, Chassis, File, Brand, Color, etc.)

c. Capacity or Measures of the equipment (tons or M³)

For creating this inventory the following aspects must be taken into account:

a. Type of collection equipment (Vehicles)

In the market there are different types of solid waste collection equipment. The Municipality must acquire these vehicles according to the needs of their respective municipalities, such as: Production of Solid Waste, Economic Capacity, Efficiency, availability of spare parts in the local market, depreciation value and rescue, based on the task that the collection vehicles are assigned to, specifying what their purpose is (Compaction, Transportation, etc.).

Ejemplos:

- Big Dump Trucks.
- Compactor (side, front and rear load, with mechanical arm)
- Dump truck(large and small)
- Truck(fixed bed)
- Tractor
- Carts
- Special trucks
- Others

Now some examples of the vehicles used for collection.

Dump truck

(Transference Station)

Dump truck

(Transference Station)

Compactor Truck

Compactor Truck

Dump Truck

Dump Truck

Photo 3 Various models of collection vehicles (1)

Flat bed

Flat bed

Tractor with its cart

Cart

Photo 4 Various models of collection vehicles (2)

The following figure shows how to allocate the different types of vehicle in the equipment table where the different types of equipment/vehicles are recorded. Further instructions are found within the blue boxes:

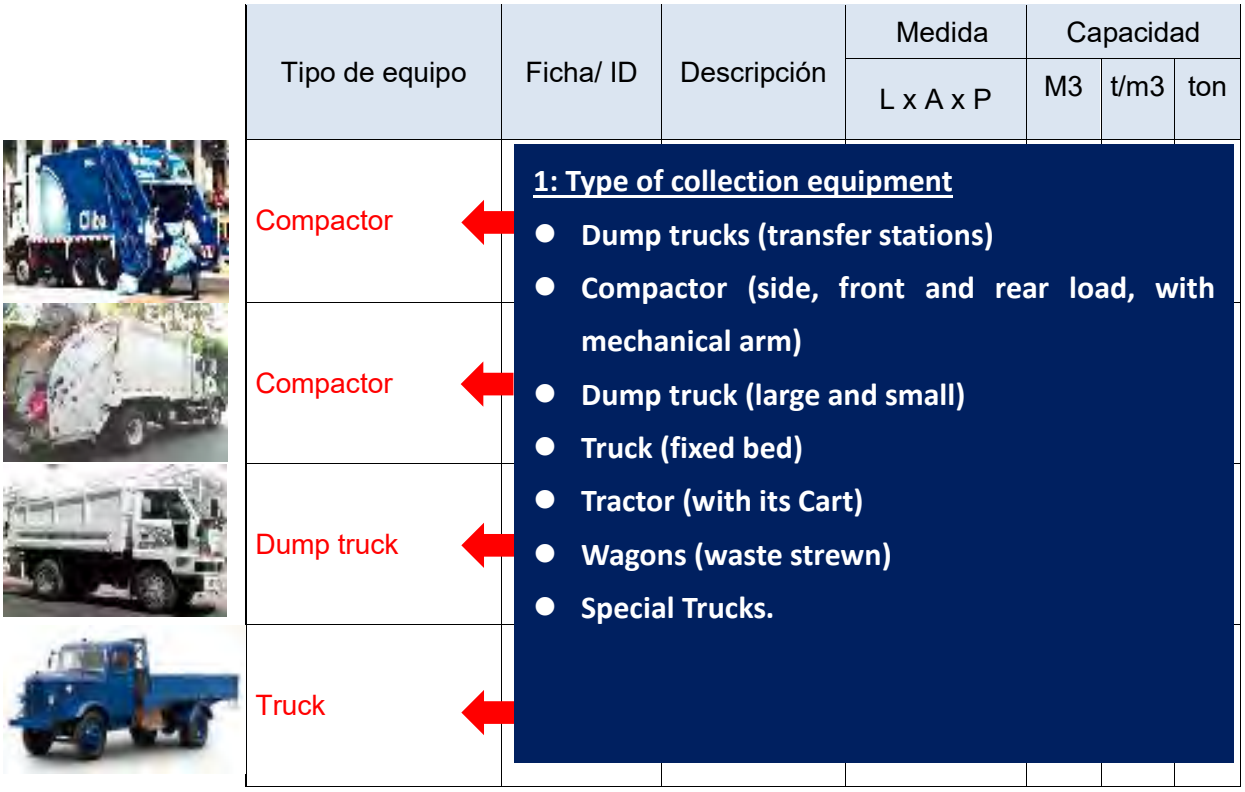


Figure 8 Equipment table and how to introduce the types of vehicle

b. Equipment ID

It refers to the collection equipment identification, i.e., **the plate, chassis, brand or color.**

For database purposes, this part is very important because it allows the System to establish unique **ID's** without repetition, this is essential for telling equipment apart.

Example:

- Chasis: xm12235nb
- License plate: L309262
- ID: F-1035, F-750...
- Brand: Como Toyota1, Toyota2. Daihatsu…
- Color: Blue, Green, Red, etc.

Type of equipment	ID	Description	Measures L x H x W	Capacity M³	Capacity t/m³	Capacity ton
Compactor	F-1 or Isuzu01					
Compactor Truck	F-2 or Isuzu02					
Dump truck	F-3 or Daihatsu03					
Truck	F-4 or Mack04					

2: ID of equipment

- **ID: F-1, F-2, F-3....**
- **Brand: Daihatsu-01, Mitsubishi-02, Isuzu...**
- **Color: Blue-01, Red-02,**
- **License plate:**
- **Chassis, etc.**
- **Cama-01, Cama-02, Cama-03.....**

Figure 9 How to properly fill the ID fields for Equipment Table

Notes: It is advisable for the ID field to be completed with a specific #, the municipalities can keep using the same names that identify these pieces of equipment.

The description field can be filled with data like Brand, color, chassis and plate.

c. Capacity or Measures of the equipment (Tons or M³)

In this point the capacity in Tons or M^3 of each piece of municipal or private solid waste collection equipment will be discussed. This calculation must be applied to each and every single piece of solid waste collection equipment. If the weight in tons is unknown, the municipality must measure in M³ with this formula:

- **L (Length) x W (Width) x H (Height).**

With this formula, take into account the dimensions and the capacity of the vehicle in M^3. Where the bed of the collection vehicle is measured (L=Length, W= Width and H= Height) raking into account the different dimensions and capacity of the vehicle in cubic meters. Where the bed of the solid waste collection vehicle is measured (L=Length, H=Height y D= Depth).

- ✓ **The following example shows how the formula is used:** Meters High x Meters wide x Length of the truck's bed
  : = 1.72m x 2.45m x 0.96m = 4.04 m^3

Note: When the measures of the trucks are carried out in **m³**, it must be taken into account that if the vehicle has any kind of annex or **railings** to increase their collection capacity. These must also be measured.

Figure 10 Analytical method for determining the measures of the equipment

The previously mentioned formula must be applied in order to determine the capacity in **m^3** of each collection equipment, as shown by the following table:

Type of equipment	ID	Description	Measure	Capacity		
			L x H x W	M^3	t/m^3	ton
Compactor Truck	F-1	Isuzu	2.0 x 1.8 x 2.8	10.1	0.3	3.0
Compactor Truck	F-2	Isuzu	1.9 x 1.8 x 3.0	10.3	0.3	3.1
Dump Truck	F-3	Daihatsu	1.8 x1.6 x 2.9	8.35	0.3	2.5
Truck	F-4	Mack	1.7 x 1.6 x 2.5	7.23	0.3	2.2

Figure 11 How to properly fill the Measure fields for Equipment Table

Note: Please introduce the values measured for each piece collection equipment in the ''measure'' column and complete the "m^3" column with the result of the calculation obtained from the following equation:

- **Volume (m^3) = Width (m) x Height (m) x Length (m).**

To convert a value in m^3 to Tons, once the capacity of the vehicle in m^3 is determined, this value is multiplied for the apparent density of solid waste in order to obtain its weight in tons.

To obtain the tons, the weight is calculated through the following equation:

- **Capacity (Ton) = Volume (m^3) x 0.3 (t/m^3) for flat beds.**
- **Capacity (Ton) = Volume (m^3) x 0.5 (t/m^3) for compactors.**

2) Study cases of the Pilot Project

The collection equipment table was designed with the objective of organizing the daily activities of collection and transportation of Solid Waste, as well as increasing the capacity of the municipalities for solid waste collection.

The following equipment tables were made by the pilot projects of the cities of **Azua, Sánchez and Samaná,** where for about two weeks, the weight of the solid waste was documented for about two weeks with a private weighing machine.

Now the weighing data of the solid waste from each of the collection vehicles is presented, where the following data was the result:

Table 2 Example 1. Solid Waste Collection Equipment for Sanchez Municipality

Equipment type	ID	Description	Capacity (TON)
Dumping site	F-26	Isuzu Green	2.4
Dumping site	F-29	Daihatsu Blue	3.6
Compactor truck	F-30	Iveco White	5.4
Compactor truck	F-31	Iveco White	5.4
Compactor truck	F-33	Iveco	9.6
Compactor truck	F-36	Hino Green	2.6
Dump truck	F-39	Isuzu White	2.4
Dump truck	F-40	Fuso Blue	3.5
Dump truck	F-42	Isuzu Blue	2.4
Compactor truck	F-43	Mack	13.2
Dump truck	F-44	Daihatsu White	3.6
Dump	F-45	Daihatsu	3.6
Compactor	F-46	Isuzu Blue	2.6
Compactor	F-68	Mitsubishi Green	1.7
Dumping site	F-101	Toyota 6000	3.5
Trucks			BROKEN

Source: Azua's Municipality, Azua's province

Table 3 Example 2 Solid Waste Collection Equipment for Sanchez Municipality

Type of Equipment	ID	Description		Capacity (Ton)
Compactor truck	MACK-01	Plastic containers and scattered waste at businesses and residential areas.	American	10
Compactor truck/ Metal containers	IVECO-02		*Italian/Only metal containers. *In process of dissolution	6.0
Compactor	DAIHATSU-03	Residential area	Japanese	1.5
Compactor	ISUZU-04	Residential area	Japanese	1.5
Compactor	ISUZU-05	Residential area	Japanese	1.5
Dump Truck	TOYOTA-06	Pruning, debris and others, commercial residences.	Japanese	1.5
Dump trucks	NISSAN-07	Pruning, debris and others, commercial residences.	Out of order for about year.	1.5
Dump trucks	DAIHATSU-08	Pruning, residential organics.	Japanese	1.0

Source: Sanchéz' Municipality, Samaná Province.

6.3.2 Number of trips for solid waste collection [STEP 2]

STEP 2: Is the creation of the number of solid waste collection trips table**,** with the objective of registering the data on amount of trips for solid waste collection, this must be created based on the solid waste collection equipment table created by following the instructions found on **STEP 1**.

The number of solid waste collection trips table was design to monitor and record the collection activities of the **Municipality**, as well as the **private companies** that dump in the dumping site. These tables are a powerful tool that enables them to monitor each collection equipment on daily basis.

The task of filling out these tables is up to the personnel that is managing the collection of solid waste and the personnel allocated at the final disposal site, who must register the amount of amount of solid waste collection trips on a daily basis.

1) Types of trip tables.

In a dumping site, very often, not only municipal solid waste is deposited, but also private solid waste.

To make the data collection activities easier, two types of table were designed, they are described as follows:

a. Tables of trips for the Municipal Solid Waste collection (Public)

b. Tables of trips for direct SW collection (Private and Other Municipalities)

a. **Tables of trips for the Municipal Solid Waste collection (Public)**

This table is used to create a record of the different trips done by the solid waste collection trucks of the Municipality. The objective of these tables is organizing the municipality's solid waste collection activities **(Public).**

- Instructions on how to fill out the Number of Trips for Municipal Solid Waste Collection Table:
  - ✓ **Part 1:** The **"Type of truck", "ID"** and **"Capacity"** fields must be filled out.

(As seen in Table 5 Part1 Fill in the equipment [Public]).

- ✓ **Part 2:** The amount trips done by every truck on a daily basis, will recorded within the cell that corresponds the day and month when this took place. (As seen in Table 6 Part 2 Fill in the number of trips [public]).
- ✓ **Part 3:** At the end of each month, the **total amount of trips will be calculated** truck by truck. The total will be recorded within the last cell of each column. (As seen in Table 7 Part 3 Total number of trips [Public]).

Table 4 Tables of trips for the Municipal Solid Waste collection (Public)

Tabla III-1: Recolección(publica): Número de Viajes Nombre del Municipio/D.M. _____

		1	2	3	4	5	6	7	8	9	10
Tipo de camion											
Ficha/ ID del Camion											
Capacidad Ton											
Fecha (Junio)	1-Jun Lun										
	2-Jun Mar										
	3-Jun Mie										
	4-Jun Jue										
	5-Jun Vie										
	6-Jun Sab										
	7-Jun Dom										
	8-Jun Lun										
	9-Jun Mar										
	10-Jun Mie										
	11-Jun Jue										
	12-Jun Vie										
	13-Jun Sab										
	14-Jun Dom										
	15-Jun Lun										
	16-Jun Mar										
	17-Jun Mie										
	18-Jun Jue										
	19-Jun Vie										
	20-Jun Sab										
	21-Jun Dom										
	22-Jun Lun										
	23-Jun Mar										
	24-Jun Mie										
	25-Jun Jue										
	26-Jun Vie										
	27-Jun Sab										
	28-Jun Dom										
	29-Jun Lun										
	30-Jun Mar										
Numero Total de Viajes											

Table 5 Part1 Fill in the equipment [Public]

	1	2	3	4
Tipo de camion	Compactador	Compactador	Volteo	Volteo
Ficha/ ID del Camion	F1 o Isuzu01	F2 o Isuzu02	F3 o Daihatsu03	F4 o Mack4
Capacidad Ton	3	3.1	2.5	2.2
Fecha 1-Jun Lun				
2-Jun Mar				
3-Jun Mie				
4-Jun Jue				
5-Jun Vie				
6-Jun Sab				
7-Jun Dom				
8-Jun Lun				
9-Jun Mar				
10-Jun Mie				
11-Jun Jue				
12-Jun Vie				
13-Jun Sab				
14-Jun Dom				
15-Jun Lun				

(Each column represents a truck)

Part 1:
Include ALL trucks owned by the city, including those in maintenance.

Table of Equipment

Tipo de equipo	Ficha/ ID	Descripcion	Medida	Capacidad		
			L x A xP	M3	t/m3	ton
Compactador	F-1	Isuzu	2.0 x 1.8 x 2.8	10.1	0.3	3.0
Compactador	F-2	Isuzu	1.9 x 1.8 x 3.0	10.3	0.3	3.1
Volteo	F-3	Daihatsu	1.8 x1.6 x 2.9	8.35	0.3	2.5
Camion	F-4	Mack	1.7 x 1.6 x 2.5	7.23	0.3	2.2

Table 6 Part 2 Fill in the number of trips [public]

		1	2	3	4	5
Tipo de camion		Compactador	Compactador	Volteo	Volteo	
Ficha/ ID del Camion		F1 o Isuzu01	F2 o Isuzu02	F3 o Daihatsu03	F4 o Mack4	
Capacidad Ton		3	3.1	2.5	2.2	
Fecha	1-Jun Lun	3	4	3		
	2-Jun Mar	2	3	2	2	
	3-Jun Mie	2	2	2		
	4-Jun Jue	2	2	2	2	
	5-Jun Vie	1	2	2		
	6-Jun Sab		1	1	2	
	7-Jun Dom					
	8-Jun Lun	2	4	4		
	9-Jun Mar	3	3	2	2	
	10-Jun Mie	3	2	2		
	11-Jun Jue	2	2	2	2	
	12-Jun Vie	2	2	2		
	13-Jun Sab	1	2	1	2	
	14-Jun Dom					
	15-Jun Lun	3	4	2		
	16-Jun Mar	2	3	2	2	
	17-Jun Mie	2	2	3		
	18-Jun Jue	2	2	2	2	
	19-Jun Vie	1	2	2		
	20-Jun Sab	1	2	1	2	
	21-Jun Dom					

(Each column represents a truck).

Each cell represents a day and the numbers, the amount of trips per truck.

Part 2:
Record, daily, the number of trips made by each truck and in the cell that corresponds to the date of the day in which the trips took place.

Table 7 Part 3 Total number of trips [Public]

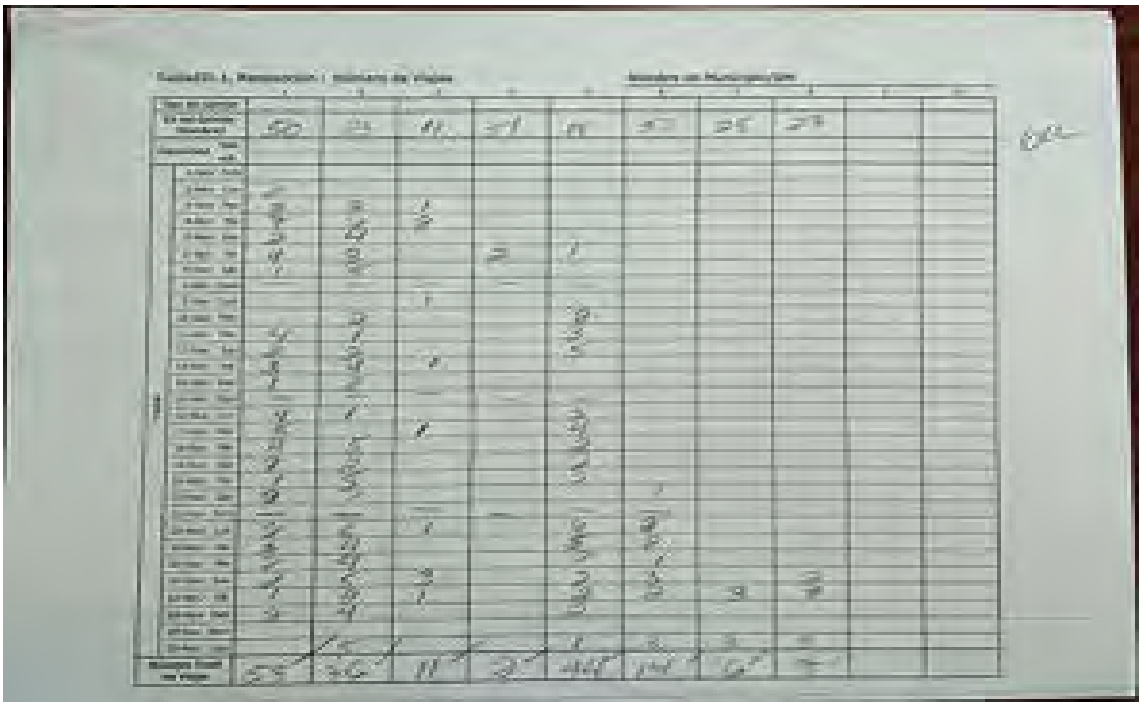
Tipo de camion		Compactador	Compactador	Volteo	Volteo	
Ficha/ ID del Camion		F1 o Isuzu01	F2 o Isuzu02	F3 o Daihatsu03	F4 o Mack4	
Capacidad Ton		3	3.1	2.5	2.2	
Fecha (Junio)	1-Jun Lun	3	4	3		
	2-Jun Mar	2	3	2	2	
	3-Jun Mie	2	2	2		
	4-Jun Jue	2	2	2	2	
	5-Jun Vie	1	2	2		
	6-Jun Sab		1	1	2	
	7-Jun Dom					
	8-Jun Lun	2	4	4		
	9-Jun Mar	3	3	2	2	
	10-Jun Mie	3	2	2		
	11-Jun Jue	2	2	2	2	
	12-Jun Vie	2	2	2		
	13-Jun Sab	1	2	1	2	
	14-Jun Dom					
	15-Jun Lun	3	4	2		
	16-Jun Mar	2	3	2	2	
	17-Jun Mie	2	2	3		
	18-Jun Jue	2	2	2	2	
	19-Jun Vie	1	2	2		
	20-Jun Sab	1	2	1	2	
	21-Jun Dom					
	22-Jun Lun	3	4	2		
	23-Jun Mar	2	2	1	2	
	24-Jun Mie	2	3	2		
	25-Jun Jue	2	2	2	2	
	26-Jun Vie	1	2	3		
	27-Jun Sab	1	2	1	2	
	28-Jun Dom					
	29-Jun Lun					
	[illegible]					
Numero Total de Viajes		45	59	48	24	

Part 3:

At the end of each month, add the number of trips made by each truck, separately, and the total will be placed in the last cell of their respective columns.

Here the number of trips per column will be added. The total will be entered in the last cell of each of the columns.

Table 8 Manual Record of the number of trips of Moca's Municipality.



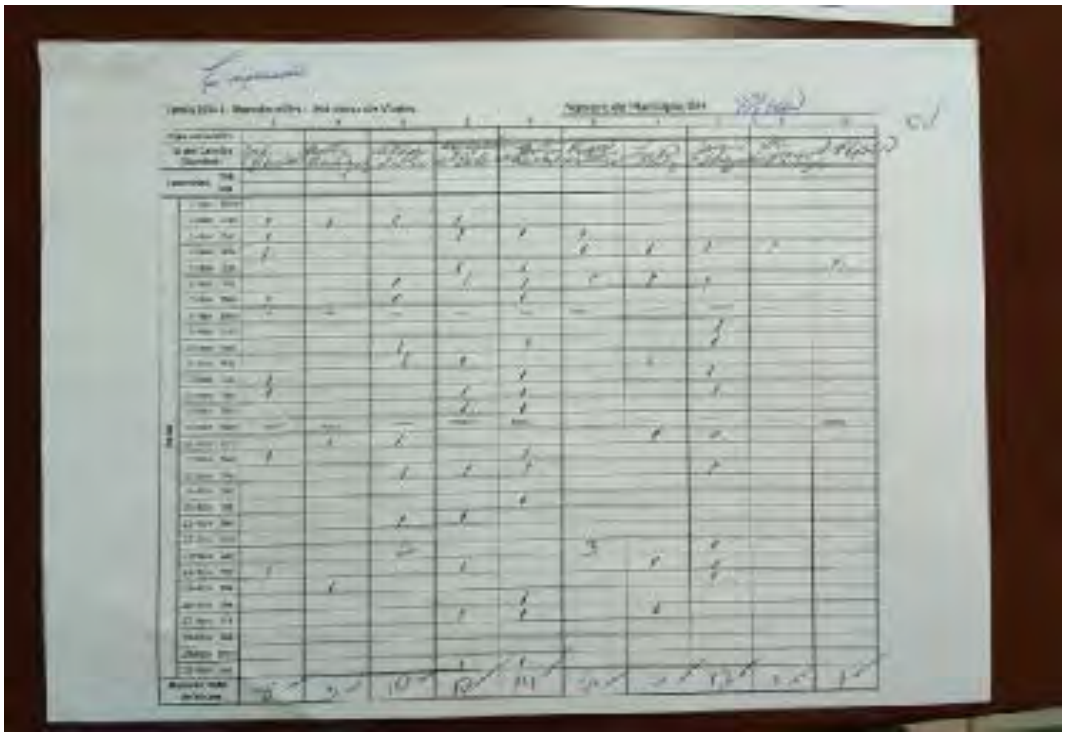
b. Tables of trips for direct Solid Waste collection (Private and Other Municipalities)

This table was designed with the objective of organizing the **Direct (Private and other Municipalities)** solid waste collection activities**.** This solid waste collection trips table must register **ALL** the trucks from private companies that dump at the final disposal site. This table is used to create a record of the number of trips done by the trucks of private companies and industries or when other municipalities come to dump their solid waste.

- How to use the direct collection table:
  - ✓ **Part 1:** Introduce the name of each Company or other municipalities, to whom the solid waste collection equipment belongs, in the first cell (Top to bottom) of each column in order of arrival.
  - ✓ **Part 2:** On a daily basis, the amount of solid waste will be recorded in m^3 (Volume) per trip done by each Company or other municipalities, in the cell of the day when the waste was deposited in the final disposal site. At the end of the day everything will be added up, separately, the m^3 (Volume) correspondent to each trip will be recorded within the cells of that day.
  - ✓ **Part 3:** At the end of each month, the amount of trips done by each

Company or other municipalities will be added up, separately, and the total will be placed within the last cell of each column.

Table 9 Direct Collection Table (Private, Other municipalities)



Note: This table is the case of Moca's Municipality, which is part of the pilot Project.

Table 10 Tables of trips for Direct SW collection (Private and Other Municipalities)

Tabla III-2: Directa: Número de Viajes

Nombre del Municipio/D.M._____

		1	2	3	4	5	6	7	8	9	10
Nombre de la Empresa											
Fecha (Junio)	1-										
	2-										
	3-										
	4-										
	5-										
	6-										
	7-										
	8-										
	9-										
	10-										
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	23-										
	24-										
	25-										
	26-										
	27-										
	28-										
	29-										
	30-										
Total número de viajes											

Note: It is also advisable to measure the capacity of each piece of equipment with the objective of reporting a more accurate volume of the amount of solid waste being produced.

Table 11 Part 1 Fill in name of company & Part 2 Fill in amount of Volume [Direct]

Tabla III-2: Directa: Número de Viajes

	Nombre de la Empresa	1 Ferreteria El Fuente	2 Taller Mueble	3 Rigo Motors	4 Agroindustrial
Fecha (Junio)	1-Jun Lun				
	2-Jun Mar	3m3			
	3-Jun Mie				
	4-Jun Jue	2m3	3m3	2m3	
	5-Jun Vie				6m3
	6-Jun Sab		2m3		
	7-Jun Dom				
	8-Jun Lun	2m3			
	9-Jun Mar	2m3			5m3
	10-Jun Mie		2m3		
	11-Jun Jue		2m3	3m3	
	12-Jun Vie				5m3
	13-Jun Sab				
	14-Jun Dom				
	15-Jun Lun				
	16-Jun Mar	2m3			
	17-Jun Mie				
	18-Jun Jue	2m3	2m3	5m3	
	19-Jun Vie				4m3
	20-Jun Sab	2m3	2m3		
	21-Jun Dom				
	22-Jun Lun		2m3		
	23-Jun Mar	2m3			
	24-Jun Mie			4m3	
	25-Jun Jue				
	26-Jun Vie				
	27-Jun Sab				
	28-Jun Dom				
	29-Jun				
	30-Jun				
Total Volu m3		21m3	19m3	14m3	25m3

Part 1:
Enter the name of each company or other municipalities, to which the collection equipment that dumps in the final disposal site belong, in the first cell (Top to bottom) of each column in order of arrival.

Part 2:
Daily amount of m^3 (Volume) for each trip made by each company or other municipalities, shall be recorded in the respective cell of the day in which the solid waste was deposited. At the end of the day, the m^3 (Volume) corresponding to each trip will be recorded into the cells of that day.

(Each cell represents a truck)

Each cell represents one day and the numbers, the amount of trips per truck.

Table 12 Part 3 Total number of volume [Direct]

Tabla III-2: Directa: Número de Viajes

Nombre del Municipio/D.M._____

	Nombre de la Empresa	1 Ferreteria El Fuente	2 Taller Mueble	3 Rigo Motors	4 Agroindustrial	5	6	7	8	9
Fecha (Junio)	1-Jun Lun									
	2-Jun Mar	3m3								
	3-Jun Mie									
	4-Jun Jue	2m3	3m3	2m3						
	5-Jun Vie				6m3					
	6-Jun Sab		2m3							
	7-Jun Dom									
	8-Jun Lun	2m3								
	9-Jun Mar	2m3			5m3					
	10-Jun Mie		2m3							
	11-Jun Jue		2m3	3m3						
	12-Jun Vie				5m3					
	13-Jun Sab									
	14-Jun Dom									
	15-Jun Lun									
	16-Jun Mar	2m3								
	17-Jun Mie									
	18-Jun Jue	2m3	2m3	5m3						
	19-Jun Vie				4m3					
	20-Jun Sab	2m3	2m3							
	21-Jun Dom									
	22-Jun Lun		2m3							
	23-Jun Mar	2m3								
	24-Jun Mie			4m3						
	25-Jun Jue	2m3	2m3							
	26-Jun Vie				5m3					
	27-Jun Sab		2m3							
	28-Jun Dom									
	29-Jun Lun	2m3								
	30-Jun Mar									
	Total Volume m3	21m3	19m3	14m3	25m3					

Part 3:
At the end of each month, the number of trips made by each company or other municipality will be added separately, and the total will be placed in the last cell of their respective columns.

Here the number of trips per column will be added. The total will be recorded in the last cell of each of these columns.

6.3.3 Calculation of the amount of solid waste [STEP 3]

Step 3, calculate the **amount of solid waste**, in the Database System this is calculated directly based on the data recorded by the ***Number of Solid Waste Collection Trips Table*** created in **Step 2.**

The implementation tasks are managed by the provincial office.

Calculation of the Number of Solid Waste in Ton.

Existen dos diferentes métodos de calcular la cantidad de residuos sólidos.

- If you have the weight in tons of the equipment:

The amount of solid waste can be calculated using the following formula:

Where:

$$Amount\ \ of\ \ Solid\ \ Waste\ \left(\frac{Ton}{Day}\right) = N\ \times L\ \times c$$

N = **Number of Solid Waste Collection trips** where waste was taken to the final disposal site in one day [Trip number/day].

L = Loading capacity of the collection vehicle [Ton/car]

Notes:

- The load capacity [m3/car or ton/car] varies depending on the collection vehicle. The municipal staff must check the load capacity before calculating the amount of waste.
- This method is not an accurate measurement, as the load capacity of waste can vary, there are trucks that are full above their load capacity.

Formula of Calculation of the amount of Solid Waste in M³ of the equipment:

La cantidad de residuos sólidos puede ser calculada utilizando la siguiente fórmula:

Amount of Solid Waste (ton/day) = N (trip/day) x L (m3/car) x C (ton/m3)

Where:

- $Amount\ of\ Solid\ Waste\ \left(\frac{Ton}{Day}\right) = N\ \times L\ \times c$

N = Number of Solid Waste collection trips where waste was taken to the final disposal site per day. [Trip number/day].

1) Public Collection

Finally, the total amount of tons is calculated and multiplied by both the **"Capacity in Tons"** cell of each truck and by the **"Total number of trips cell",** then the results obtained are added up.

Public Collection of Solid Waste = Capacity in tons x Total number of trips

2) Direct

Finally, at the end of each month, all totals in **M³** collected by each Company or other municipalities will be added up, then this total will be converted to tons through the following formula:

Ton= (m^3) x (ton/m^3)

Table 13 Calculate the amount of Solid Waste [Public]

Tipo de camion		Compactador	Compactador	Volteo	Volteo	
Ficha/ ID del Camion		F1 o IuzuO1	F2 o IuzuO2	F3 o DaihatsuO3	F4 o Mack4	
Capacidad Ton		3	3.1	2.5	2.2	
Fecha (Junio)	1-Jun Lun	3	4	3		
	2-Jun Mar	2	3	2	2	
	3-Jun Mie	2	2	2		
	4-Jun Jue	2	2	2	2	
	5-Jun Vie	1	2	2		
	6-Jun Sab		1	1	2	
	7-Jun Dom					
	8-Jun Lun	2	4	4		
	9-Jun Mar	3	3	2	2	
	10-Jun Mie	3	2	2		
	11-Jun Jue	2	2	2	2	
	12-Jun Vie	2	2	2		
	13-Jun Sab	1	2	1	2	
	14-Jun Dom					
	15-Jun Lun	3	4	2		
	16-Jun Mar	2	3	2	2	
	17-Jun Mie	2	2	3		
	18-Jun Jue	2	2	2	2	
	19-Jun Vie	1	2	2		
	20-Jun Sab	1	2	1	2	
	21-Jun Dom					
	22-Jun Lun	3	4	2		
	23-Jun Mar	2	2	1	2	
	24-Jun Mie	2	3	2		
	25-Jun Jue	2	2	2	2	
	26-Jun Vie	1	2	3		
	27-Jun Sab	1	2	1	2	
	28-Jun Dom					
	29-Jun Lun					
	30-Jun Ma					
Numero Total de Viajes		45	59	48	24	0

Finally, the total is calculated in Tons by multiplying the cell 'Capacity Ton' of each truck by the 'Total number of trips' cell, then add up all the totals obtained.

3.0x45=135 t + 3.1x59=182.9 t + 2.5x48=120 t + 2.2x24=52.8 t → **490.7 tons**

Table 14 Calculate the amount of waste [Direct]

Fecha (Junio)								
7-Jun	Dom							
8-Jun	Lun	2m3						
9-Jun	Mar	2m3			5m3			
10-Jun	Mie		2m3					
11-Jun	Jue		2m3	3m3				
12-Jun	Vie				5m3			
13-Jun	Sab							
14-Jun	Dom							
15-Jun	Lun							
16-Jun	Mar	2m3						
17-Jun	Mie							
18-Jun	Jue	2m3	2m3	5m3				
19-Jun	Vie				4m3			
20-Jun	Sab	2m3	2m3					
21-Jun	Dom							
22-Jun	Lun		2m3					
23-Jun	Mar	2m3						
24-Jun	Mie			4m3				
25-Jun	Jue	2m3	2m3					
26-Jun	Vie				5m3			
27-Jun	Sab		2m3					
28-Jun	Dom							
29-Jun	Lun	2m3						
30-Jun	Mar							
Total Volume m3		21m3	19m3	14m3	25m3			

Step 4:

Finally, at the end of each month, the totals of m^3 collected by each company or other municipalities will be added, after which this total will be converted to tons.

Total = 79 m^3

All the totals will be added here.

79 m^3 x 0.3 ton/m^3=23.7 tons

6.4 Responsible of filling out and handling the data of these tables

1) Municipality

The responsibility of recording the data and managing the tables is up to the personnel or the Solid Waste department or the Beautification and Cleanliness department.

Municipality must organize its personnel and allocate a person at the entrance of the municipal dumping site, this person will be in charge of receiving and registering the trucks, this person will be in charge of collection the desired information. But, it is hard to organize the personnel at the final disposal site, especially in the case of the municipalities and the smaller DM's, where direct collection does not exist, in that case the collected data can be used by the manager of solid waste at the Municipality.

It is also important to document the data on broken equipment, this must be reported by the department of solid waste collection equipment.

The data on the daily number of trips for Solid Waste Collection must be reported at the beginning of each month by the Provincial Offices of MARENA.

Municipality must record the number of total solid waste collection trips before handing in The Solid Waste Collection trips table.

Figure 12 Person in charge of controlling of vehicles at Moca's Dumping Site

2) Provincial Office

The Provincial Office is the main responsible for the collection and delivery of the ***number of collection trips*** and ***equipment*** **tables** within its jurisdiction. On top of that, they must explain to the personnel of the Municipality how to fill out the tables.

The provincial directions must collect the ***number of collection trips tables*** at the beginning of each month. The equipment tables are done only once or whenever the Municipality obtain new equipment. The data collected will be sent to MARENA through a link on Marena's website.

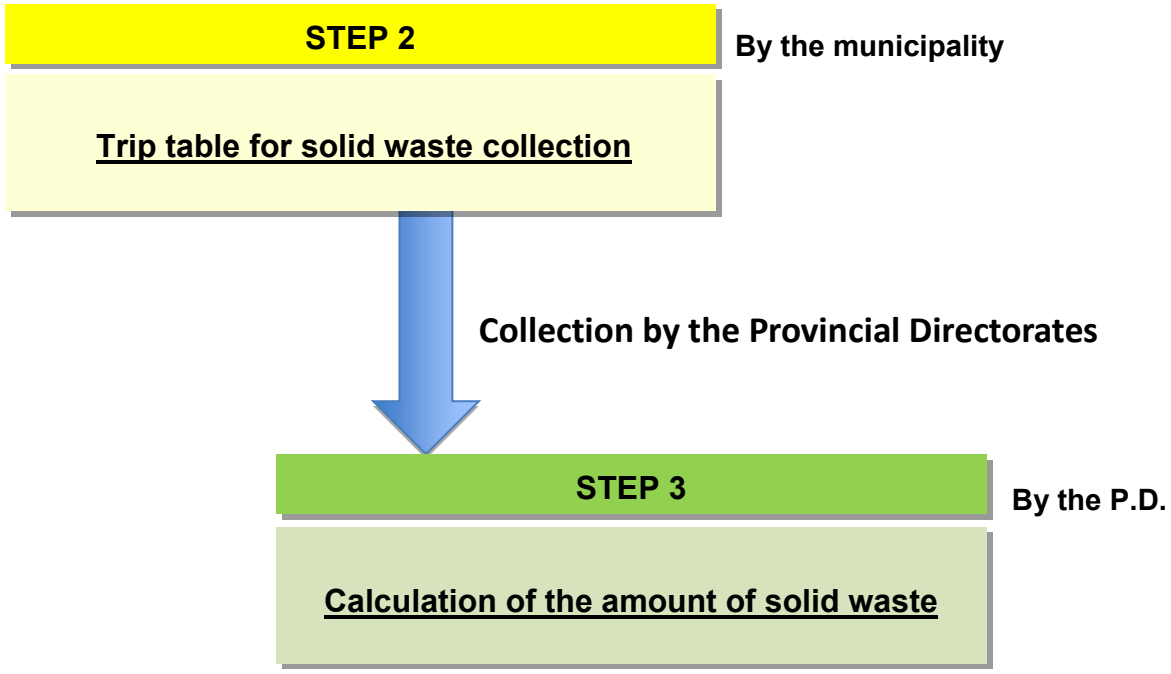


Figure 13 Calculation of the amount of waste

7 INTRODUCTION OF DATA THROUGH WEBSITE

The information collected in the **number of solid waste collection trips tables** and **solid waste collection equipment tables** prepared in **Step 2** must be introduced to the System by the Provincial Direction, based on the **number of solid waste collection trips tables** recorded by the municipality at the end of each month. Once this data is introduced, the amount of waste is calculated automatically by the database system.

Note: The Database will calculate the amount of solid waste through the summation of the monthly amount of solid waste per individual solid waste collection trip per solid waste collection truck.

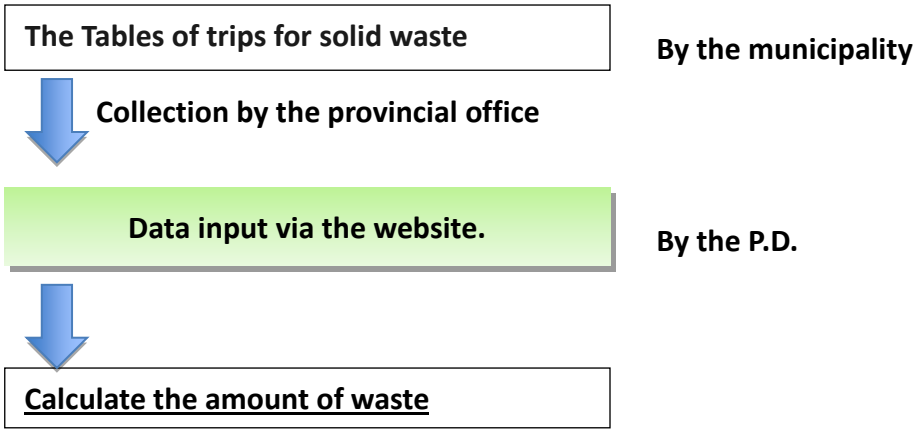


Figure 14 Data introduced through the website

For data input method, see ANNEX 4.

Photo 5 Input data to the Database system via website in provincial office de Azua

8 HOW TO USE THE DATA

The data on the current situation of the solid waste management in the country, will be stored within The Ministry of Environment and Environmental Resources' Database. This information will be used and projected to fulfill the purpose previously stated. The results obtained can be used or harnessed to create effective measures when it comes to solid waste management. On top of that, it will be useful for creating reports on the Environmental situation, specifically when it comes to Solid Waste Management and the general population

8.1 Projection and Data Dissemination

The projection and dissemination of data by MARENA and the general population can be represented as charts, tables, reports, created based on the needs of the users. On top of that, all the data and information of the Database System can be downloaded as an Excel or PDF file. Therefore, it is also possible to create a graphic interface through Excel.

Following this, some projections and charts with the information obtained by the three pilot municipalities of **Azua, Moca and Sánchez** are presented**.** These pictures are a reflection of the current and future situation of the behavior of the data generated at the municipal pilots.

As input for the creation of this data, using the different topics of the **Database Questionnaire** as a data collection tool.

9 RECOMMENDATIONS

The creation of a solid waste database within the Ministry of the Environment is a new and innovative process, but in order to be successful and functional, it is necessary to identify the most important points to ensure the sustainability of the system and the constant flow of information between the parties that comprise it.

It is necessary that public institutions become aware of the great importance of building a database, since historical records allow us to advance as citizens, because it presents statistics on the behavior of the population, and as a country, because it allows all levels of the state to evaluate its performance and correct the failures in its operations. Therefore, the following is recommend:

- A well-meaning agreement or agreement between the parties is required: Ministry of Environment (Directorate of Technology), Provincial Directorates, and Municipality, where each counterpart member assumes their responsibilities and roles in order to guarantee the success of the project.
- The Ministry of the Environment / Provincial Directorates Maintain constant monitoring and follow-up of the process and establish an updated record of changes taking place in municipalities.
- Training should be promoted and guaranteed through the active participation of governmental and local actors, taking into account the characteristics of each municipality and the power of the technicians designated in the decision-making process to generate municipal plans.
- MARENA's Commitment to analyze the data collected, to encourage the creation of new policies, ordinances, and strategies in the different municipalities.
- **The Department of Technology:** The Ministry of the Environment through this Directorate, it is recommended to appoint or permanently fix a technician / programmer who is in charge of monitoring and maintaining the database.
- **The Provincial Directorates:** As a liaison between the Ministry of the Environment and the Municipalities, take greater responsibility for their role, sending the information and inputs in time to feed the Database.
- **Municipalities:** Designate a fixed person to ensure the collection of information each period of time and be responsible for this information to arrive on time to the Provincial Directorates.

- **The FOCIMIRS / JICA Project:** The commitment to the monitoring of the international cooperation to the projects executed in the different municipalities to guarantee its sustainability throughout time.

10 ANNEXES

10.1 ANNEXES I: Database questionnaire

General information of the Municipality or Municipal District

Province _____ Municipality/ DM_____ Date _____

Mayor _____ Phone _____
Email_____
UGAM's Chief _____ Phone _____
Email_____
Ornamental and cleaning chief_____ Phone _____
Email_____
Provincial Director (MARENA)._____ Phone _____
Email_____
Personnel in charge of DB at PD _____ Phone _____
Email_____

Please indicate "**Y**", if the answer is "YES", "**N**" if the answer is "NO", and **enclose the answer** in case the options are listed.

Information Required Based on Indicators

I- Solid waste collection

Question	Answer
1. What is the size of the population in the Municipality/DM? 1-1.The number of households?	_____ Hab. _____ Households.
2. Are there improvised / informal dumping sites?	Y/N _____
3. What is the total coverage rate of the MSW collection in the Municipality / DM?	_____ %
4. What is the total number of habitants using the MSW collection service in the municipality / DM? 4-1.The number of households?	_____ Hab. _____ Households.
5. Does the muicipality collects hazardous / biomedical waste from Hospitals and / or health centers?	Y/N _____
> If the answer is "YES", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____
6. Does the municipality collect or receive solid waste from businesses, stores and markets?	Y/N _____
> If the answer is "YES", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____
7. Are there industries in the Municipality/DM?	Y/N _____
7-1 If the answer is "NO", they are directly deposited in the landfill by the industry?	Y/N _____
8. Does the municipality collect industrial solid waste?	Y/N _____
> If the answer is "yes", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____
9. Is waste from institutions collected?	Y/N _____

* (E.g., Public and private schools, Police Stations, etc.)	
>If the answer is "yes", how is it collected?	1) With domestic waste 2) Upon request 3) Regularly collected separately 4) Other: Please specify: _____

II. Recycling and Intermediate treatment

Question	Answer
1. Does a formal recycling/recovery activity organized by the Municipality exist in the municipality or that said Municipality receives income from?	Y/N _____

> If the answer is "Yes", this activity is

2.Segregation at the source (as formal activity)	Y/N _____
> If the answer is "Yes", this activity is 2-a) segregated at the source (as formal activity)	1) The whole city (municipality) 2) Parts of the city (i.e., community or zone)
What types of materials are segregated at the source?	2-1. Organics Y/N ___ , _____ kg/month
	2-2. Plastics Y/N ___ , _____ kg/ month
	2-3. Paper & cardboard Y/N ___ , _____ kg/ month
	2-4. Metal Y/N ___ , _____ kg/ month
	2-5. Glass Y/N ___ , _____ kg/ month
	2-6. Others(_____) Y/N ___ , _____ kg/ month

3. Intermediate treatment (As a formal activity)	Y/N _____
> If the answer is ''Yes'', What types of materials are recycled by intermediate treatment?	3-1. Compost Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-2. Plastic Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-3. Paper & cardboard Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-4. Metal Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-5. Glass Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)
	3-6. Others(_____) Y/N _____ , _____ kg/ month Where: 1) At the FDS 2) Another place (_____)

III- Final disposal

Question	Answer
1. How many dumping sites exist in the municipality/Municipal District?	Amount _____
1-1.If answer is "yes", please note the name of municipality	_____
1-2 if answer is 1 or more, Name and location of the dumping site/ sanitary landfill?	_____
2. If municipality have dumping site, please answer next question.	
2-1.Are the solid waste at the dumping site currently being covered at the dumping site/ sanitary landfill?	Y/N _____
>If the answer is "Yes", How often is the coverage done?	1) Daily 2) Every other day 3) Weekly 4) Biweekly 5) Monthly 6) Others

2-2.Is there a leachate collection network at the dumping site?	Y/N _____
2-3.Is there a leachate collection pond?	Y/N _____
2-4.Is there a gas collection network in the dumping site?	Y/N _____
2-5.In the area where the dumping site is located waterproofed?	Y/N _____
2-6.Are the subterranean waters of the landfill/dumping site being monitored?	Y/N _____
2-6-1.If the answer is "YES", How often are they monitored?	1) Daily 2) Every other day 3) Weekly 4) Biweekly 5) Monthly 6) Others

IV- Tariff system

Question	Answer
1. Does the municipality charge the users for the Solid Waste collection service?	Y/N _____
> If the answer is "YES",	
1-1.What is the Tariff systems for the households?	1) Fixed tariff 2) Depends on the generation 3) Others, specify_____
1-2.How often is the fee collected?	1) Weekly 2) Biweekly 3) Monthly
1-3.Payment method:	1) Together with water invoice 2) Together with electricity invoice 3) At the City Hall 4) Internet 5) Home delivery 6) Others, Specify_____
1-4.Amount of households that pay for the service:	%_____, Nº_____
2. Does the municipality charge the businesses for Solid the Waste collection service?	Y/N _____
➢ >If the answer is "YES",	
2-1.What is the Tariff system for businesses?	1) Fixed tariff 2) Depends on the generation 3) Others, specify_____
2-2. How often is the fee collected?	1) Weekly, 2) Biweekly, 3) Monthly
2-3.Payment method:	1) With the water invoice 2) With the electricity invoice. 3) At the City Hall 4) Through the internet 5) Home Delivery 6) Others, specify_____
2-4.Amount of businesses that pay for the service:	%_____, Nº_____
3. Does the municipality charge the industries for Solid the Waste collection service?	Y/N _____
➢ >If the answer is "YES",	

3-1.What is the Tariff for the industries?	1) Fixed tariff 2) Depends on the generation 3) Others, specify_____
3-2. How often is the fee collected?	1) Weekly 2)Biweekly 3)Monthly
3-3.Payment method:	1) With the water invoice 2) With the electricity invoice. 3) At the City Hall 4) Through the internet 5) Home Delivery 6) Others, specify_____
3-4.Amount of industries that pay for the service:	%_____, Nº_____

V- Outsourcing (Subcontract)

Question	Answer
1. Is the solid waste collection service being outsourced?	Y/N_____
>If the answer is "YES", 1-1.please select the option that applies:	1) The whole city 2) Some parts of the city 3) Others, Specify:_____
2. Is the recycling and intermediate treatment service being outsourced?	Y/N_____
>If the answer is "YES", 2-1.please select the option that applies:	1) Only for operations 2) Operations and construction
3. Is there outsourcing at the landfill/dumping site?	Y/N_____
>If the answer is "YES", 3-1.please select the option that applies:	1) Only operation 2) Operations and construction

*Se refiere a contratación de una compañía. No Aplica si solo alquilan los equipos.

VI- Amount of personnel for Solid Waste

Question	Answer
1. How many people work in the administration?	_____ people
2. How many people work in the street sweeping?	_____ people
3. How many people work in the collection and transportation of waste?	_____ people
4. How many people work in the intermediate treatment of solid waste?	_____ people
5. How many people work in the final disposal site?	_____ people

VII- Amount of Solid Waste

Question	Answer
1.Amount of Solid Waste disposed at the dumping site/landfill by the municipality/D.M. (tons/month)	_____ ton/month
2.Amount of solid waste disposed in the dumping site/landfill by businesses or industries, taken directly to the dumping site (ton/month)	_____ ton/month
3. Amount of Solid Waste disposed by other Municipalities/DMs in their Dumping Site/Landfill.	_____ ton/month

**If you do not have the data of point VII confirmed, please use the following table.

[CALCULATION FORMAT TABLE] (Within Data base system)

Please use "Table I" for the capacity of the vehicle in tonnes.

In order to be able to fill "Tables I", it must keep a record in "Tables II and III".

Name of landfill

_____

Name of responsible person

_____

Period (Month / Year) Month _____ Year _____

Table I: the capacity (TONS) of the vehicles

Vehicle ID	Type of Waste *Collecion *Direct	Type of Vehicle	Capacity (Ton) *1	Trip Number Trip / month *2	Amount of waste (ton / month) (=*1 x *2)
	Collection	Automatic	Automatic		Automatic
	Collection	Automatic	Automatic		Automatic
	Collection	Automatic	Automatic		Automatic
	Colletcion	Automatic	Automatic		Automatic
-	D.P	Automatic	Automatic		Automatic
-	D.O.M	Automatic	Automatic		Automatic
					Automatic

D.P = Private Direct

D.O.M = Direct another municipality

10.2 ANNEXES II: Equipment table

Table II: Equipment

Name of municipality / D.M._____

	Type of equipments (1)	ID (2)	Description	Measure L x W x H	Capacity		
					M^3 (3)	t/m^3	Ton
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

(1): Type of collection equipment (Vehicle)
- **Dump trucks** (transfer stations)
- **Compactor** (side, front and rear load, with mechanical arm)
- **Flat bed** (large and small)
- **Truck** (fixed bed)
- **Tractor** (with its Cart)
- **Cart**
- **Special trucks.**

(2): Equipment tab / ID (Plate, Chassis, Manufacturer, Color, etc.).
(3): Volume Capacity (m3) = L (m) x W (m) x H (m)
(4): Weight capacity = Volume (m^3) x t / m^3

10.3 ANNEXES III: Table for trip

Table III-1: Collection (public): Number of Trip

Name of municipality / D.M._____

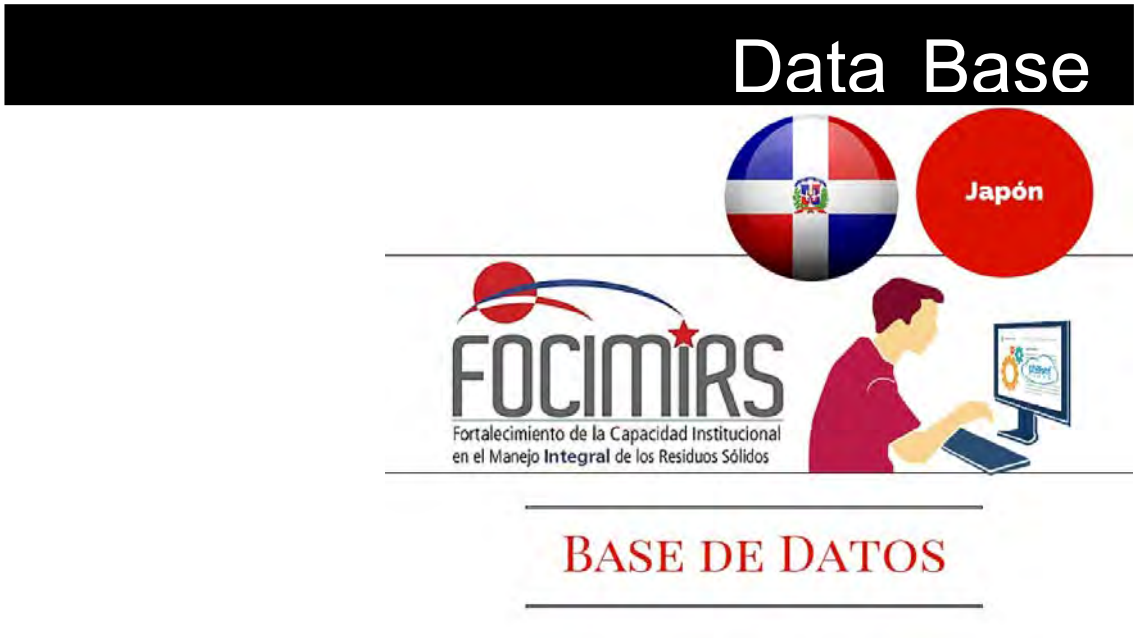
		1	2	3	4	5	6	7	8	9	10
Type of equipment											
ID of Equipment											
Capacity ton											
Months( )	1-										
	2-										
	3-										
	4-										
	5-										
	6-										
	7-										
	8-										
	9-										
	10-										
	11-										
	12-										
	13-										
	14-										
	15-										
	16-										
	17-										
	18-										
	19-										
	20-										
	21-										
	22-										
	23-										
	24-										
	25-										
	26-										
	27-										
	28-										
	29-										
	30-										
	31-										
Total trip number											

Table III-2: Direct: Number of Trip

Name of municipality / D.M._____

		1	2	3	4	5	6	7	8	9	10
Name of Company											
Months( )	1-										
	2-										
	3-										
	4-										
	5-										
	6-										
	7-										
	8-										
	9-										
	10-										
	11-										
	12-										
	13-										
	14-										
	15-										
	16-										
	17-										
	18-										
	19-										
	20-										
	21-										
	22-										
	23-										
	24-										
	25-										
	26-										
	27-										
	28-										
	29-										
	30-										
	31-										
Total Volume M^3											

10.4 ANNEXES IV: Introduction of data input via internet



1. Database User Guide

1-1 Introduction to the Database System User's Manual

The **Operational User Manual of Database** is an important tool that complements and strengthens the Database Manual. The purpose of this technical manual is to provide users of the Provincial Directorates with a technical / practical guide on the steps to be taken once the BDD system is installed at the provincial level.

This information system has as main purpose to improve the activities related to the capture and entry of data to the system by the Provincial Directorates, with the aim of providing and guaranteeing a better understanding and quality of the data provided by the different users of the Provincial Offices.

This guide aims to provide users with a tool that will allow them to provide a better service, as well as provide solutions in case of extra queries about the functionality and operation of the system.

The manual is structured in the form of a sequence of steps ordered logically (step by step). This guide includes image capture, explanatory boxes, reports, information analysis in a clear and orderly manner as different users progress through the system.

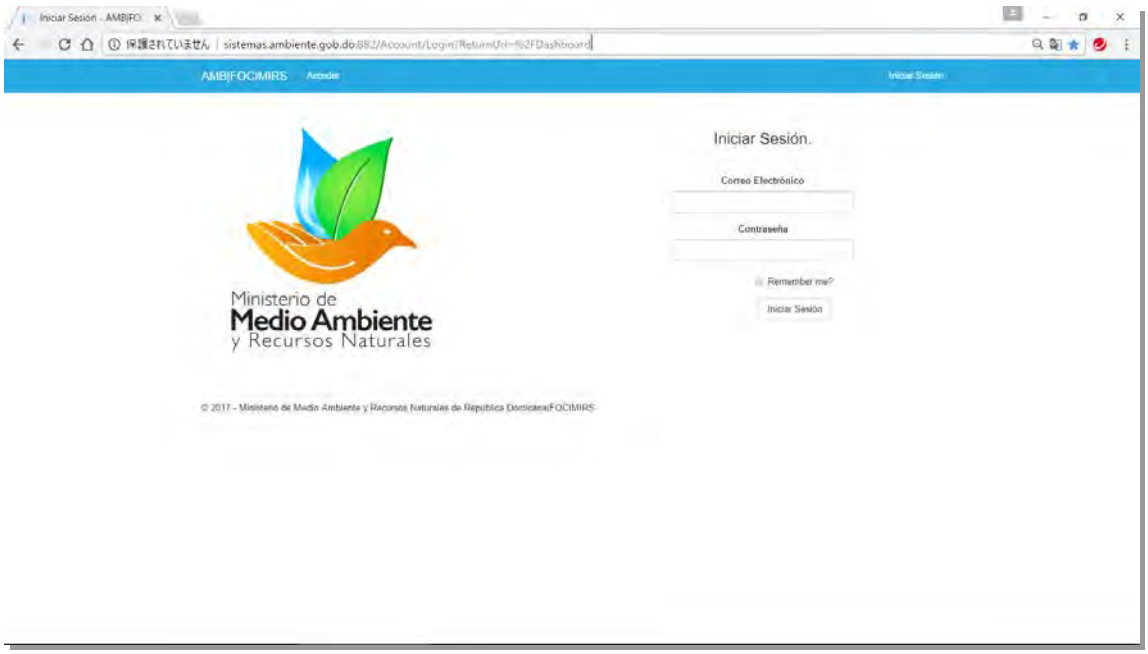
This guide or operation manual is not intended to be a specialized course of learning in the use and management of the database system, but rather seeks to document step by step and in detail each component of the database.

URL:

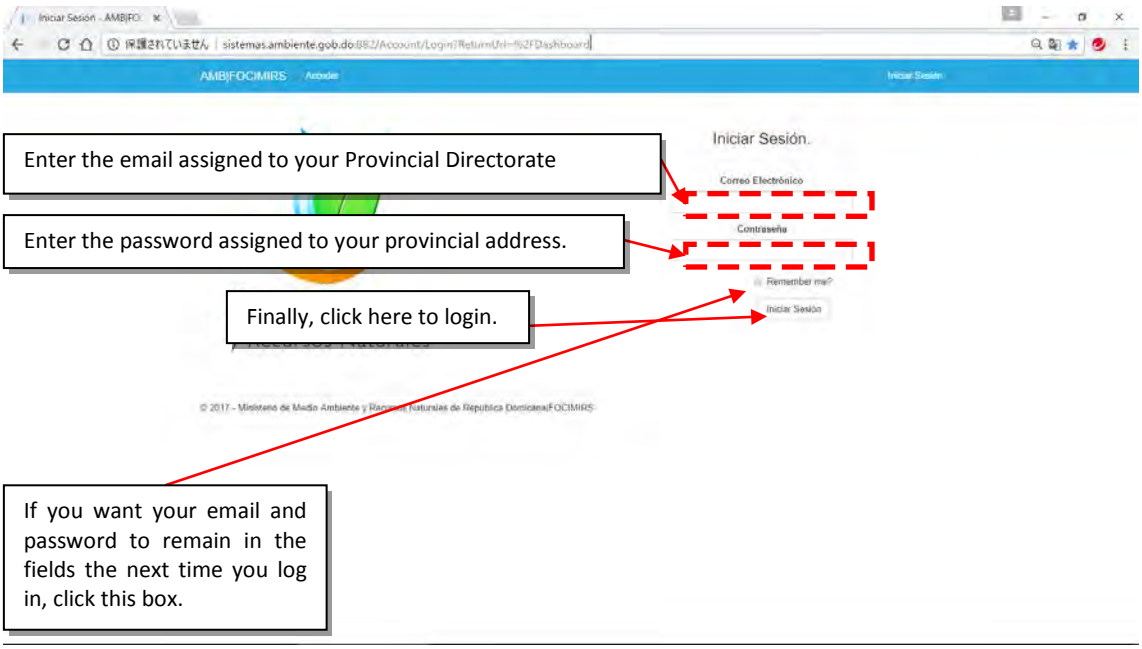
http://sistemas.ambiente.gob.do:882/

2. Logging into the Database system

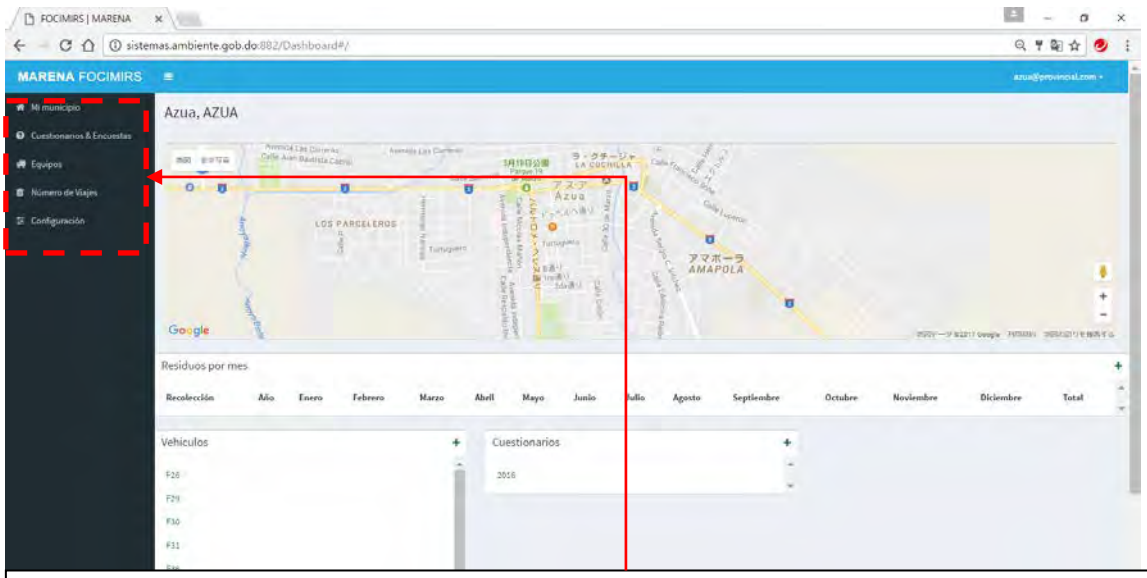
Access to web site of data base-> **http://sistemas.ambiente.gob.do:882**



2-1 Log in screen



2-2 Starting screen

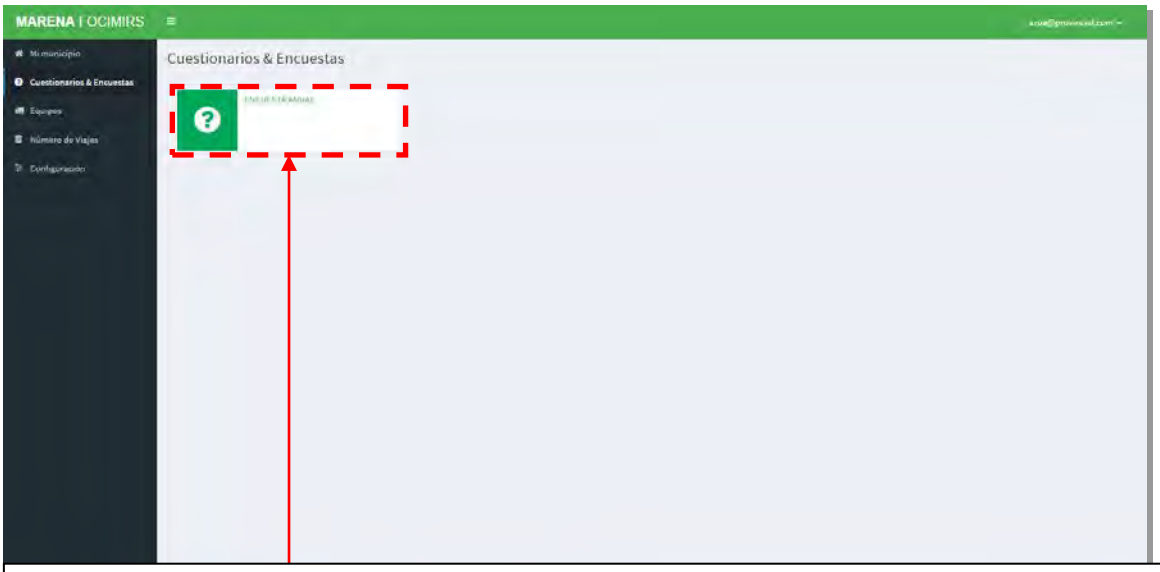


1. To the left of this screen you can see the different sections of the database.
2. If you wish, you can hide them by clicking on the 3 lines to the right of '' MARENA FOCIMIRS ''.

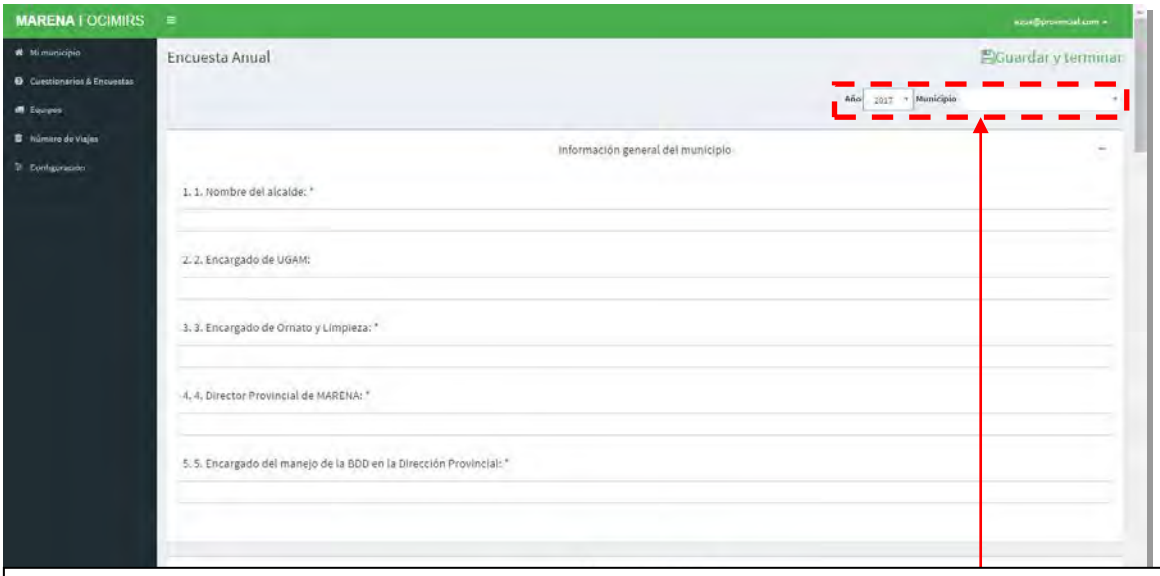
3. Input data

There are 3 types of input data. 1. Questionnaire (each year), 2. Equipment (First time and when new equipment is obtained), 3. Number of trips (each month) (but if there is a scale, only once every year, using a section of the questionnaire, is enough)

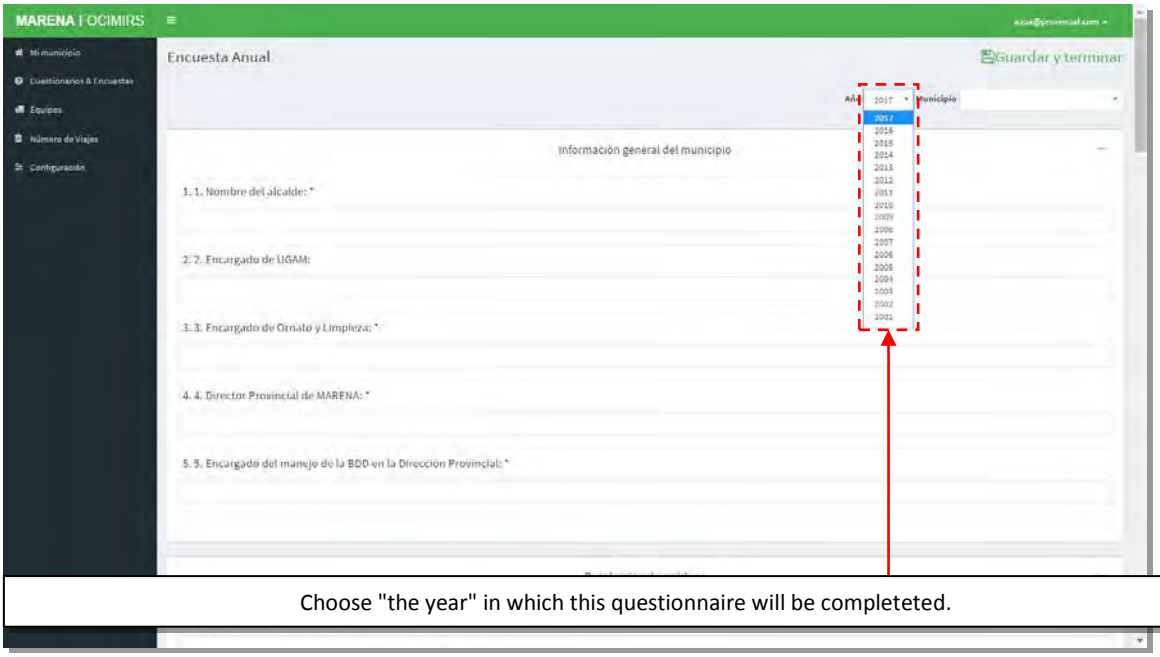
3-1 Input data of “Cuestionarios y encuestas”



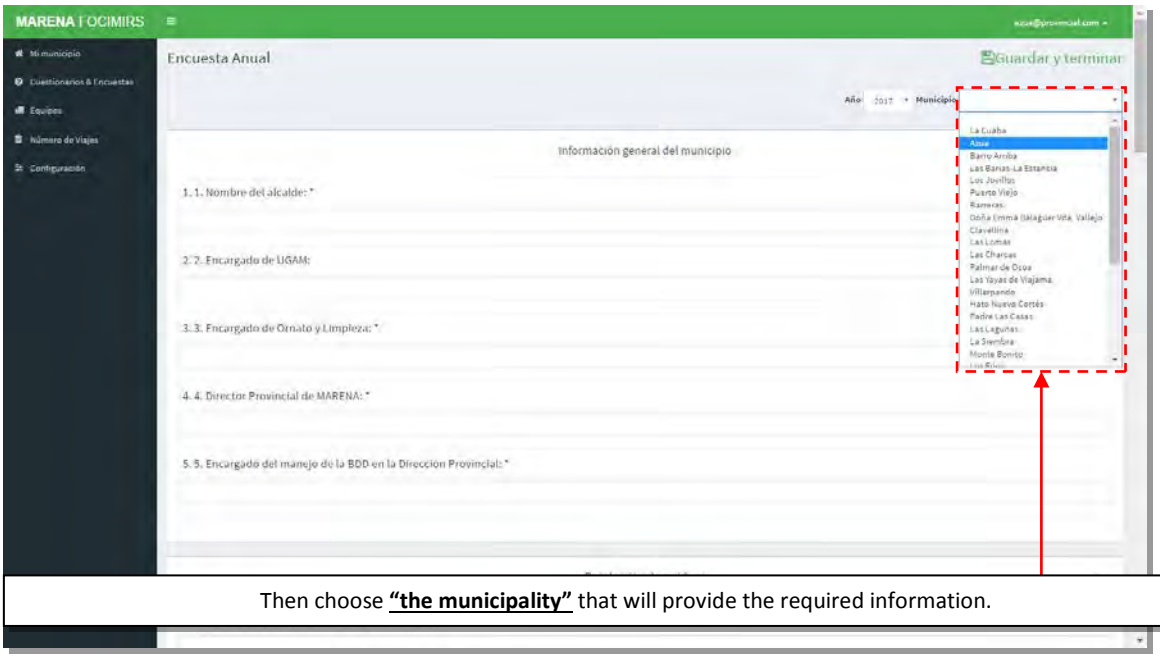
1. Click on '' Questionnaires and Surveys '' to be directed to this section.
2. Then click on '' Annual Survey '' to see the questionnaire.



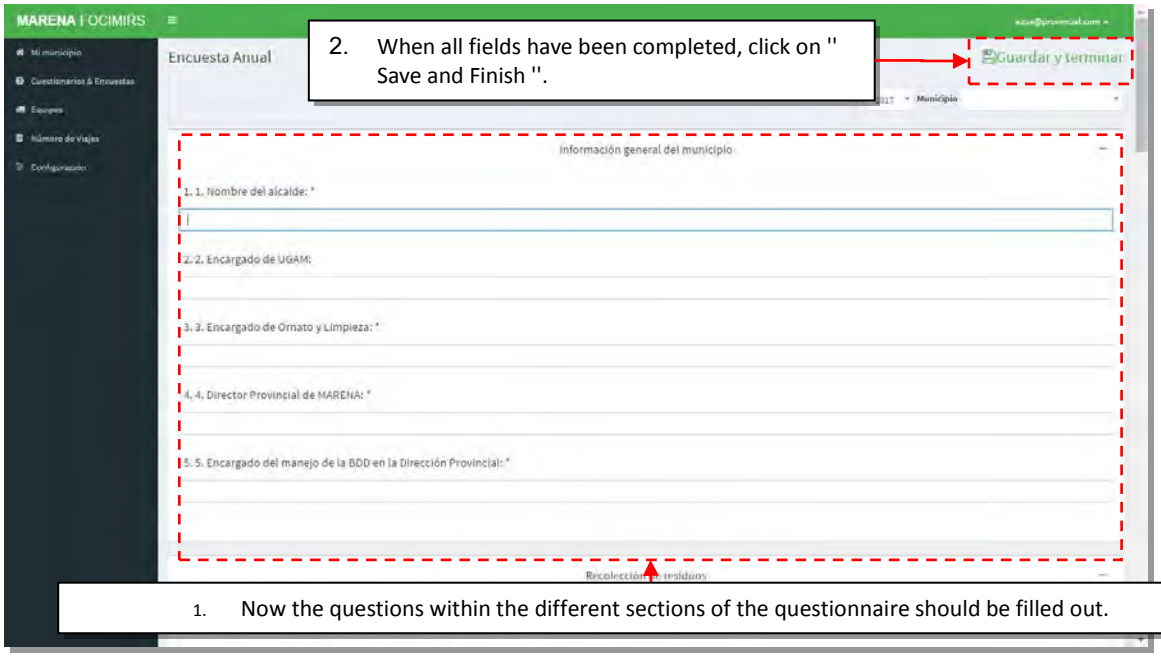
1. This is the questionnaire that must be completed once a year.
2. One for each of the municipalities in the jurisdiction of their province.



Choose "the year" in which this questionnaire will be completeted.

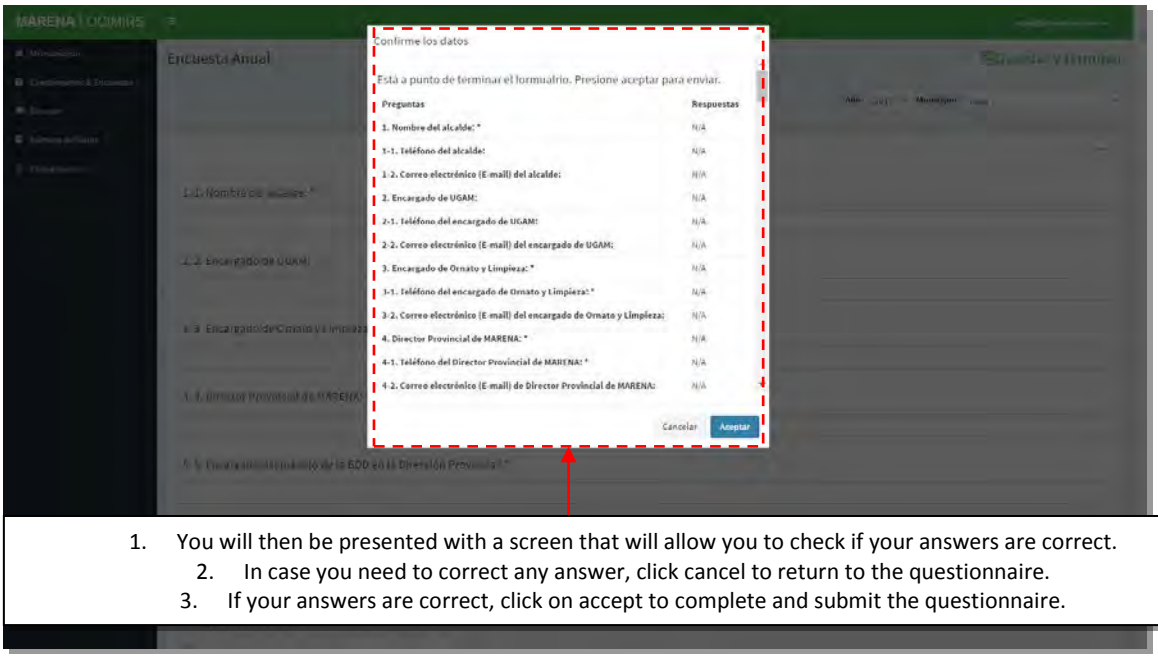


Then choose **"the municipality"** that will provide the required information.



2. When all fields have been completed, click on '' Save and Finish ''.

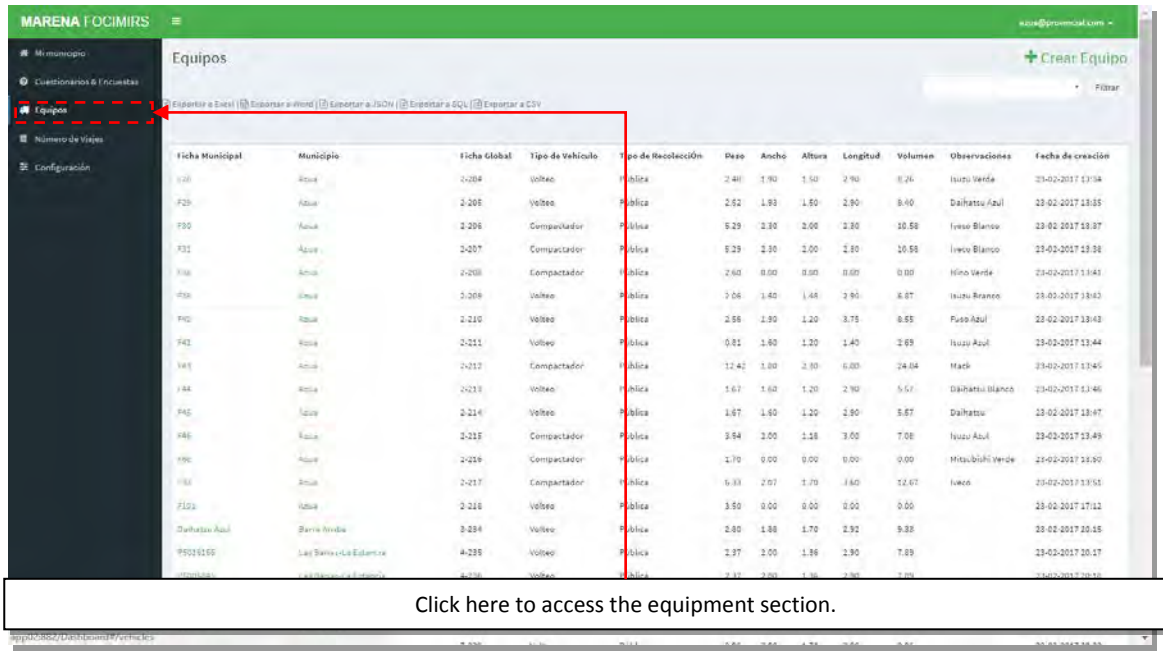
1. Now the questions within the different sections of the questionnaire should be filled out.



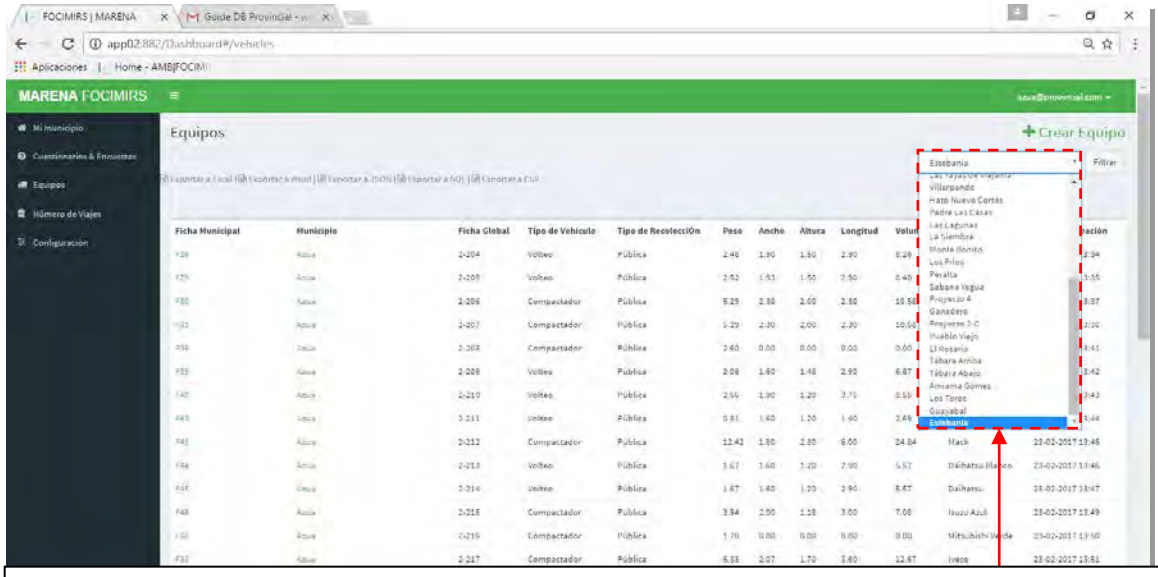
1. You will then be presented with a screen that will allow you to check if your answers are correct.
2. In case you need to correct any answer, click cancel to return to the questionnaire.
3. If your answers are correct, click on accept to complete and submit the questionnaire.

3-2 Input data of “Equipos”

If municipality has a weighing machine and the amount of waste. Inputting data of Equipment is not needed.

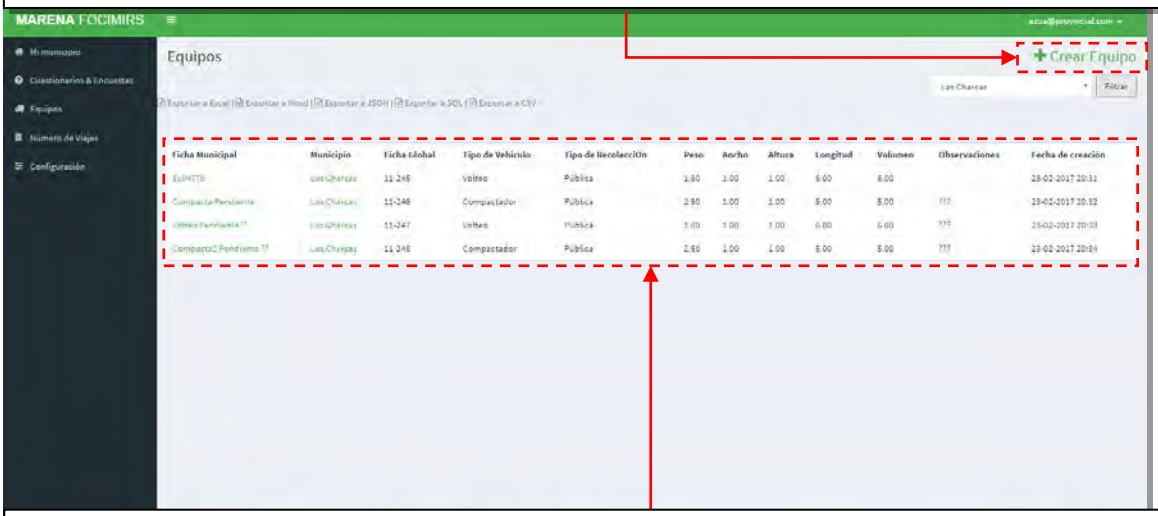


Click here to access the equipment section.



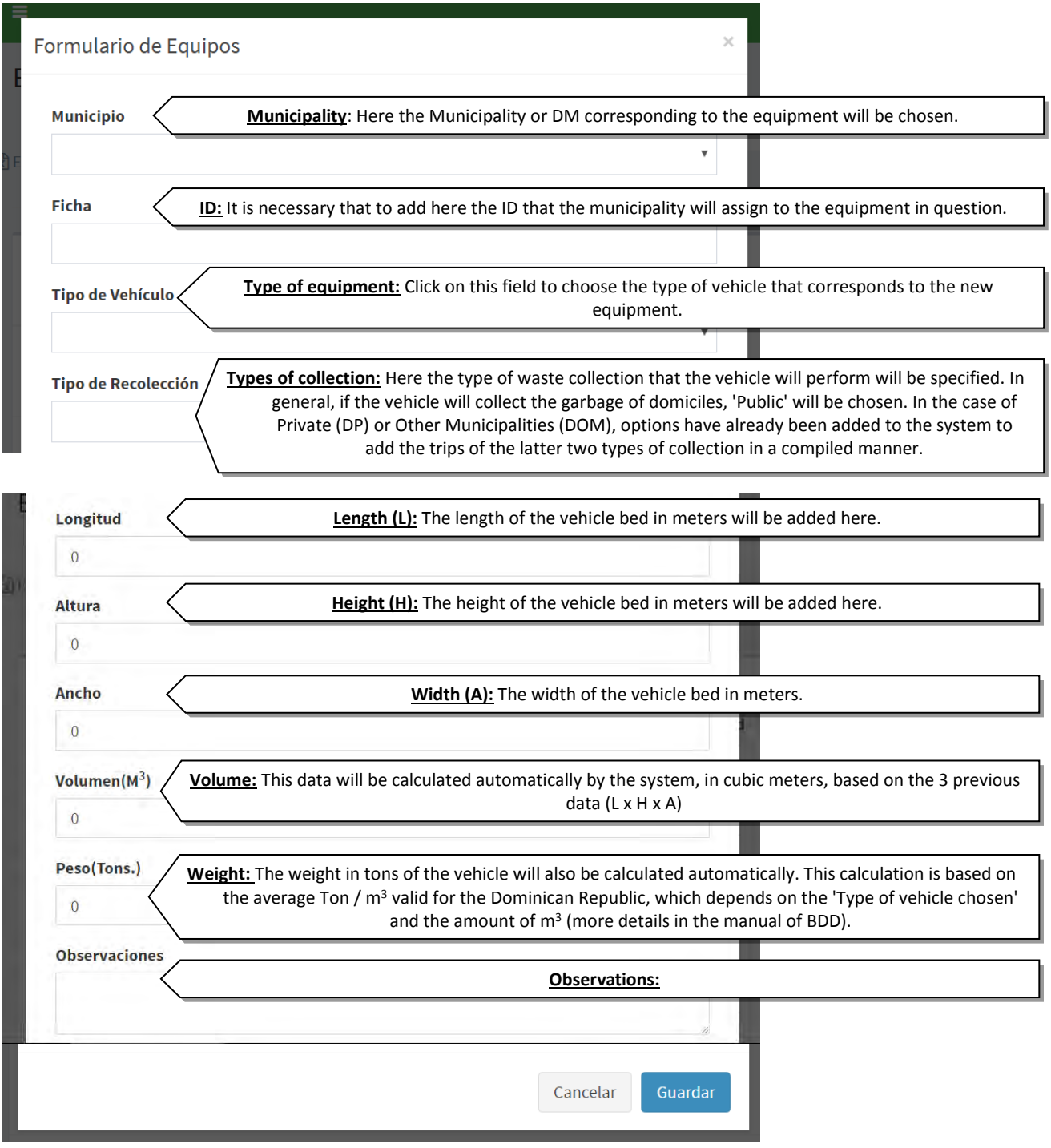
1. To see the equipment of the different Municipalities and D.M., the first thing to do is to choose the desired location.
2. Then click on '' filter ''.

In the event that a Municipality or D.M. acquire a new equipment, after selecting the location and click on filter, then click on create equipment to add this equipment to the list of the Municipality or DM that acquired it.



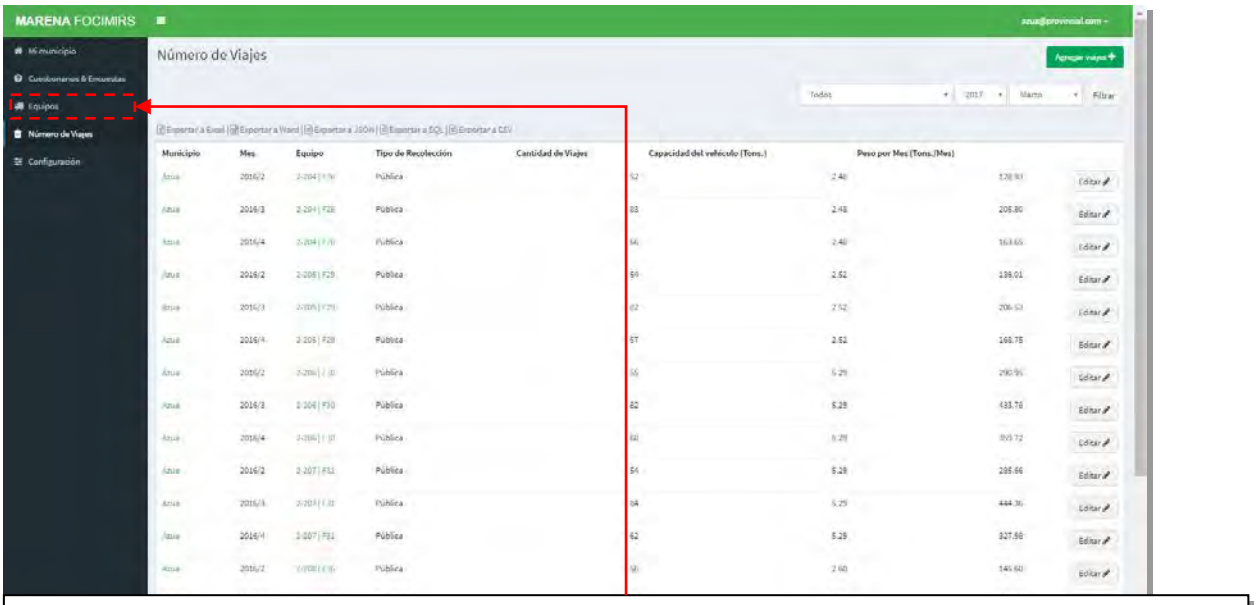
Below you can see the existing equipment in the inventory of '' Las Charcas '', location that we take as an example.

This list of features will appear, fill it, and then click save to finish adding the new equipment:

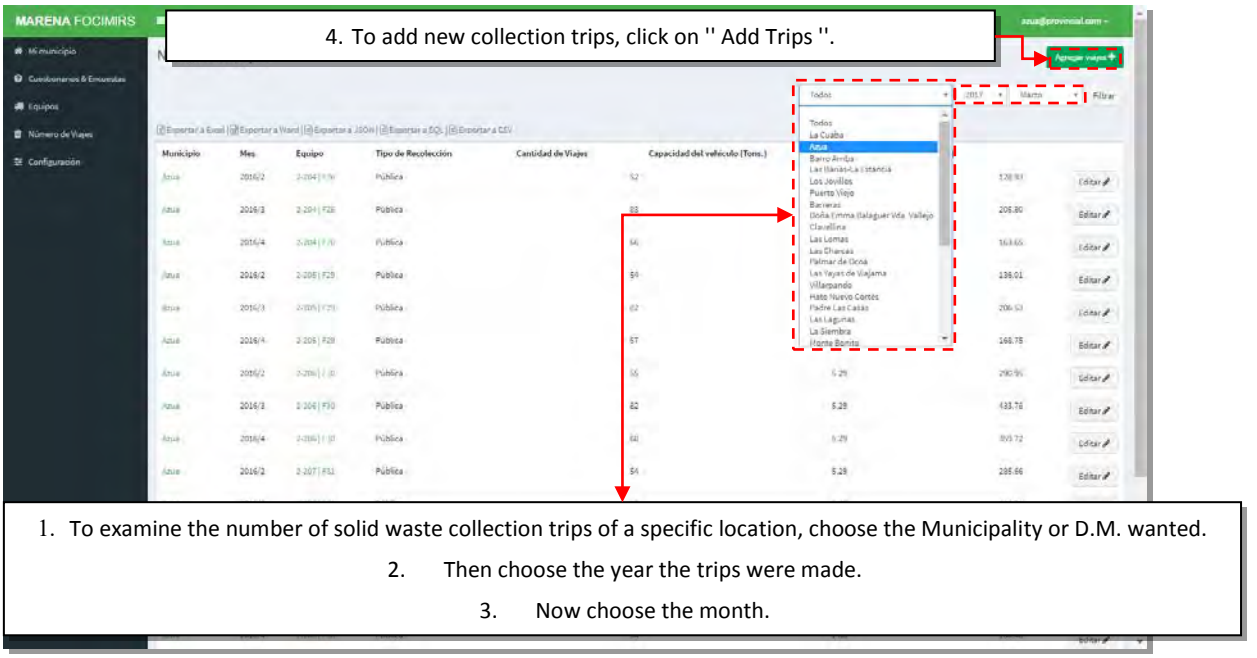


3-3 Input data of “Número de Viajes”

In the case of the municipality having a weighing machine and the amount of waste, inputting this data is not needed.

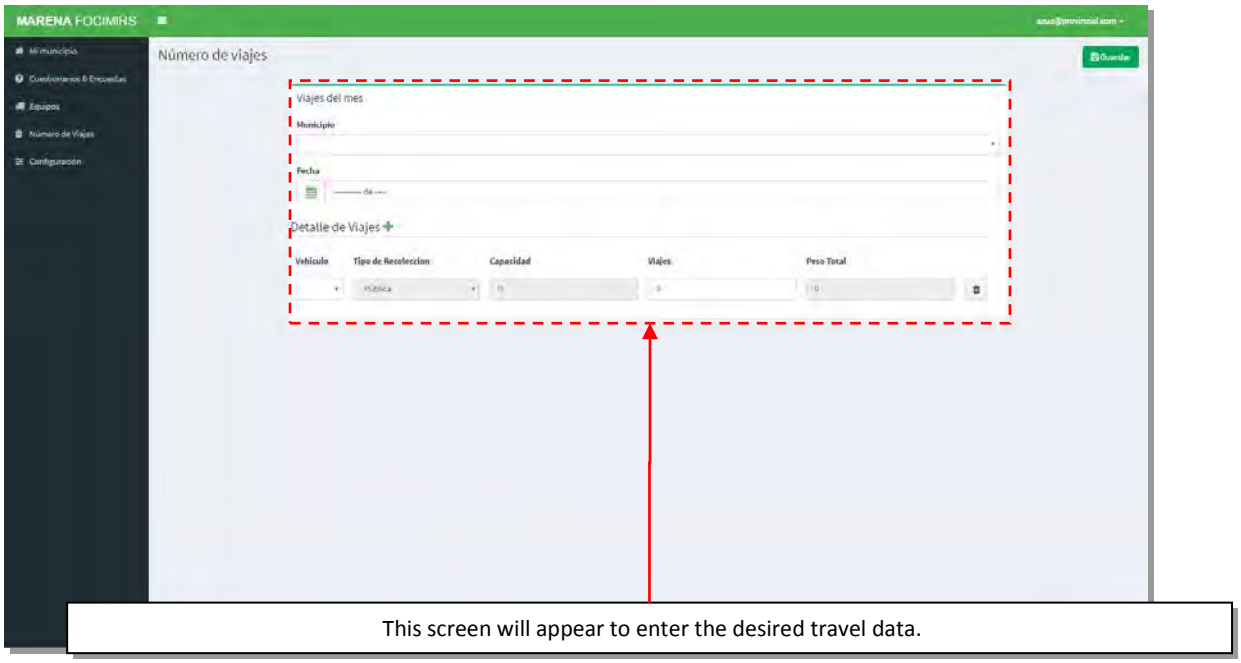


Click here to access the "Number of Trips" section.

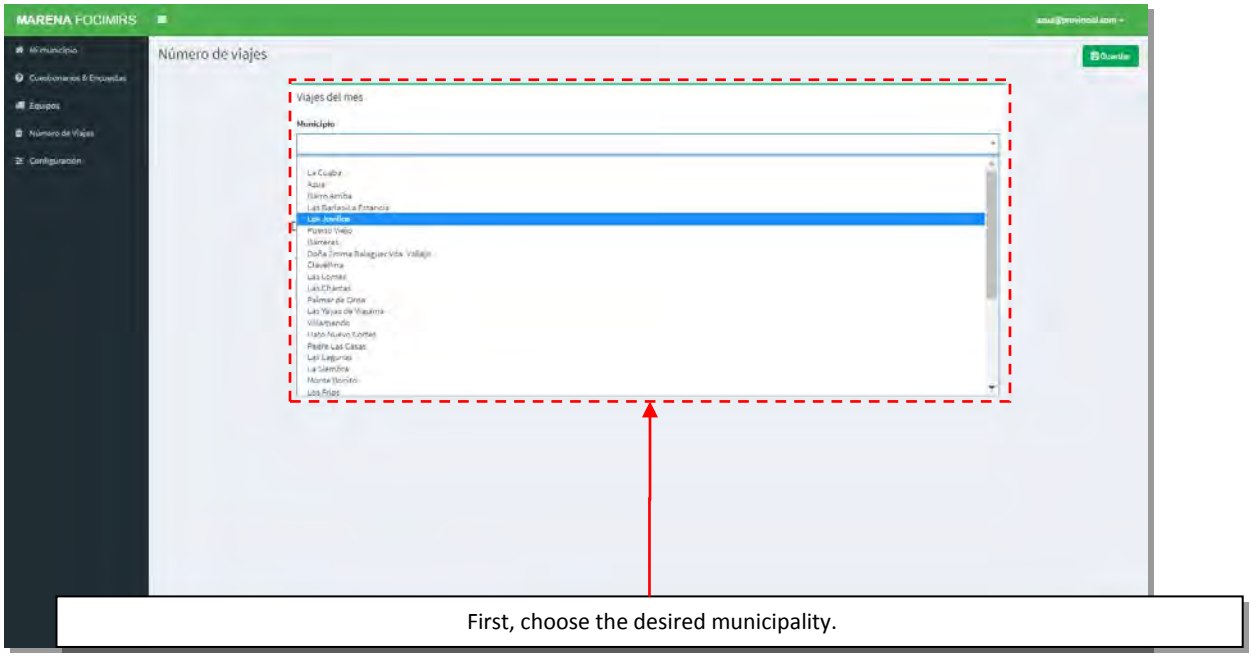


4. To add new collection trips, click on '' Add Trips ''.

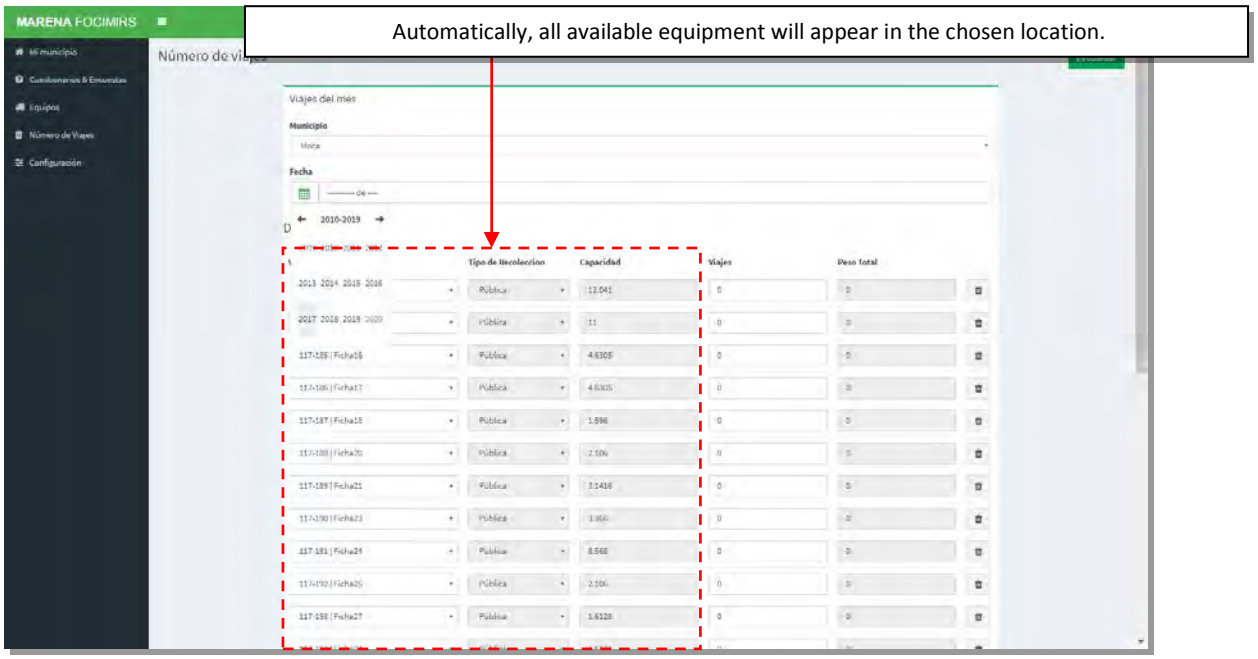
1. To examine the number of solid waste collection trips of a specific location, choose the Municipality or D.M. wanted.
2. Then choose the year the trips were made.
3. Now choose the month.

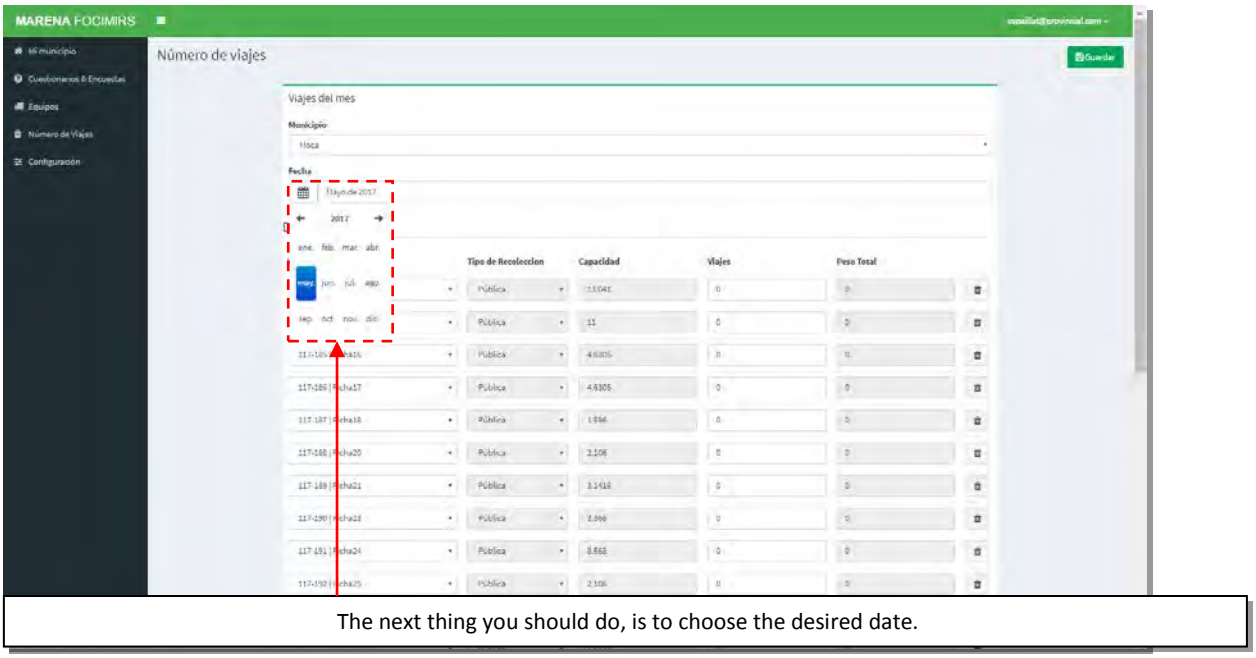


This screen will appear to enter the desired travel data.

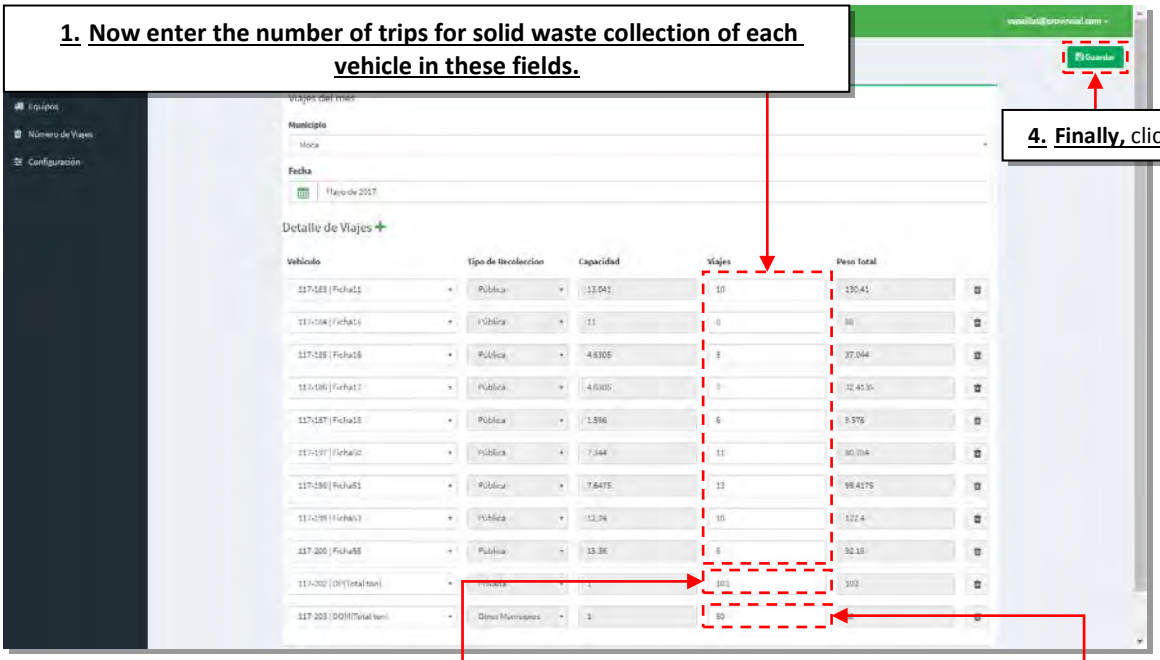


First, choose the desired municipality.


MARENA FOCIMRS
Número de viajes
Viajes del mes
Municipio
Moca
Fecha
Tipo de Recoleccion
Capacidad
Viajes
Peso Total
Automatically, all available equipment will appear in the chosen location.


MARENA FOCIMRS
Número de viajes
Guardar
Viajes del mes
Municipio
Moca
Fecha
Tipo de Recoleccion
Capacidad
Viajes
Peso Total
The next thing you should do, is to choose the desired date.

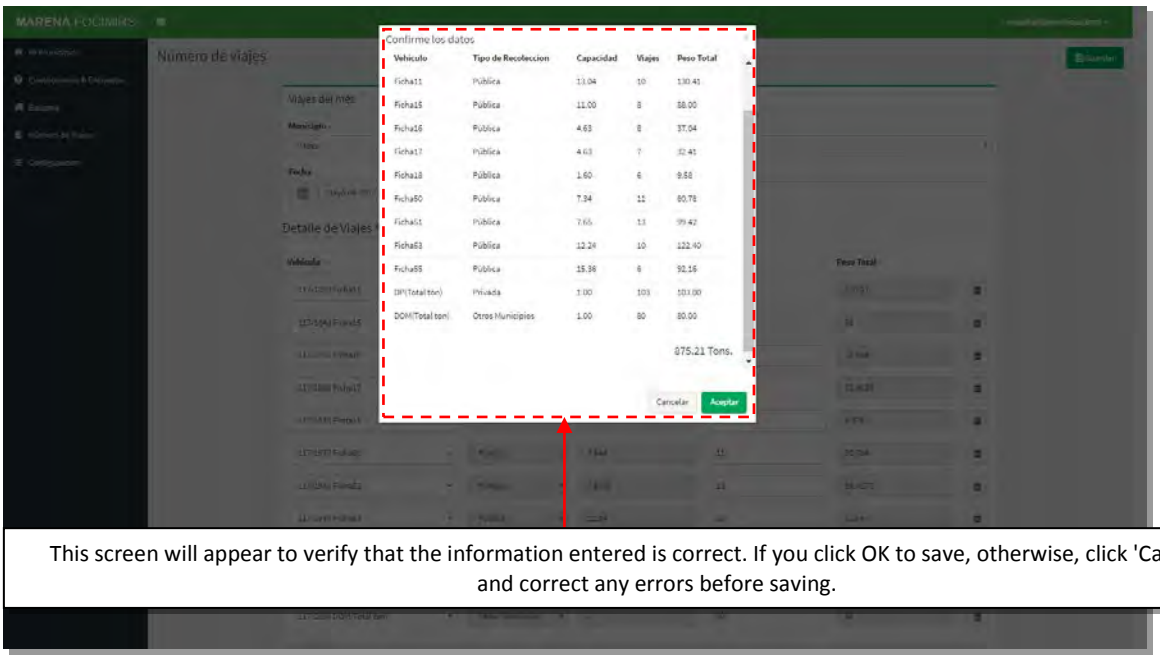
1. Now enter the number of trips for solid waste collection of each vehicle in these fields.



4. Finally, click save.

2. DP (Total ton) Does not represent a single vehicle, because in its field of '' Travels '' will be added the total amount of tons that sum all trips made for Direct or Private (DP) collection.

3.DOM (Total Ton) Does not represent a single vehicle, because in its field of '' Travel '' will be added the total amount of tons that sum all the trips made for Direct Collection of Other Municipalities (DOM).



This screen will appear to verify that the information entered is correct. If you click OK to save, otherwise, click 'Cancel' and correct any errors before saving.

4. When a mistake is made while adding input data

Please ask modification to MARENA.

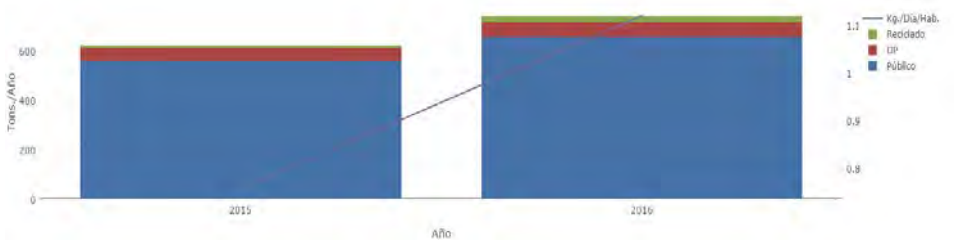
Person in charge: María de Leon

Tel: (809) 977-6352

E-mail: maria.deleonalvarez@ambiente.gob.do

10.5 ANNEXES V: OUTPUT data

Waste amount

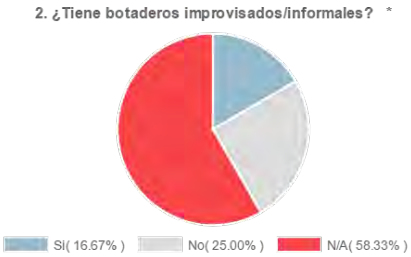


AÑO	PÚBLICO	DP	RECICLADO	HABITANTES	KG./DÍA/HAB.	MUNICIPIOS
2015	560	52	11	750,969	0.755	20
2016	654	62	25	728,385	1.119	17

Collection

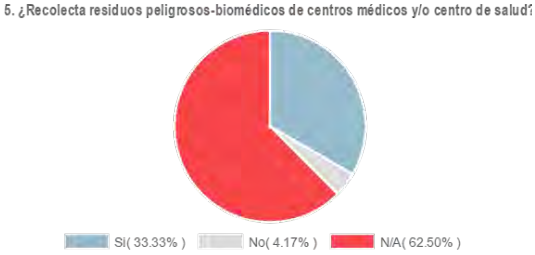
2. Are there improvised / informal dumping sites?

24/24 Questionnaires



5. Does the municipality collects hazardous / biomedical waste from Hospitals and / or health centers?

24/24 Questionnaires

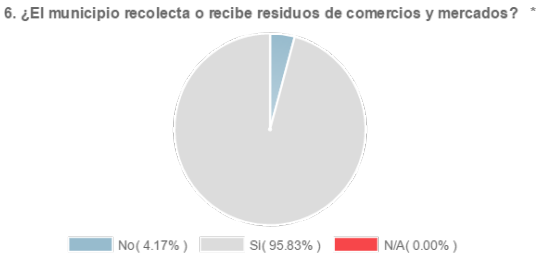


5-1. how is it collected?

24/24 Questionnaires

6. Does the municipality collect or receive solid waste from businesses, stores and markets?

24/24 Questionnaires

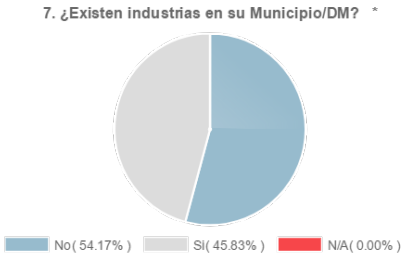


6-1. how is it collected?

23/24 Questionnaires

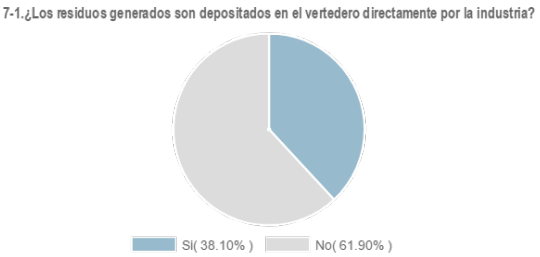
7. Are there industries in the Municipality/DM?

24/24 Questionnaires



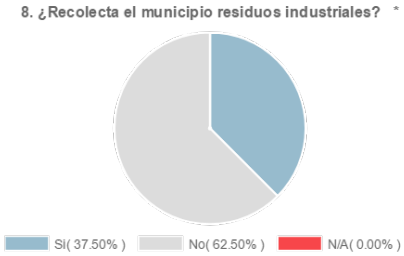
7-1. they are directly deposited in the landfill by the industry?

21/24 Questionnaires



8. Does the municipality collect industrial solid waste?

24/24 Questionnaires

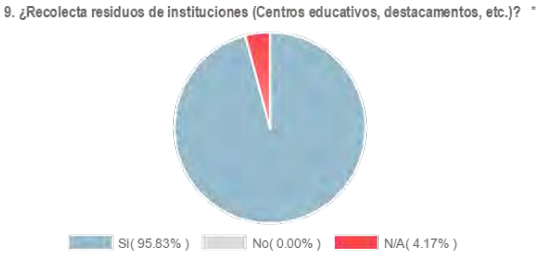


8-1. how is it collected?

10/24Questionnaires

9. Is waste from institutions collected? (Public and private schools, Police Stations,, etc.)?:

24/24 Questionnaires



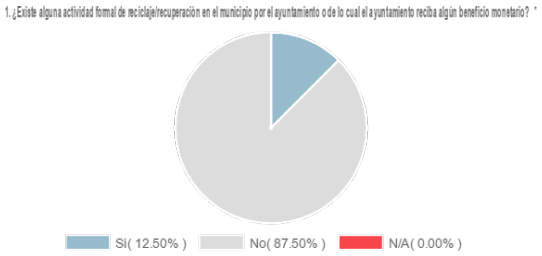
9-1. how is it collected?

24/24 Questionnaires

Recycling and intermediate treatment

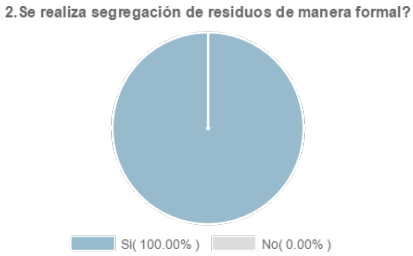
1. Does a formal recycling/recovery activity organized by the Municipality exist in the municipality or that said Municipality receives income from?

24/24 Questionnaires



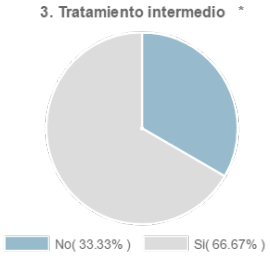
2. Segregation at the source (as formal activity)

3/24 Questionnaires



3. Intermediate treatment (As a formal activity)

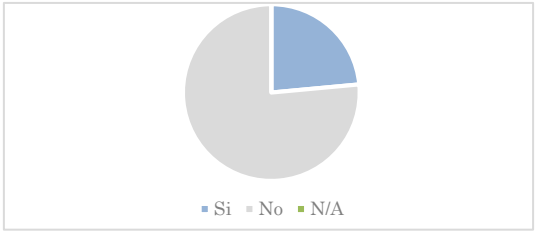
3/24 Questionnaires



Final Disposal

2-1.Are the solid waste at the dumping site currently being covered at the dumping site/ sanitary landfill?

18 Questionnaires



How often is the coverage done?

6/24 Questionnaires

2-2.¿Is there a leachate collection network at the dumping site?

18 Questionnaires

2-3.¿Is there a leachate collection pond?

18 Questionnaires

2-4.¿Is there a gas collection network in the dumping site?

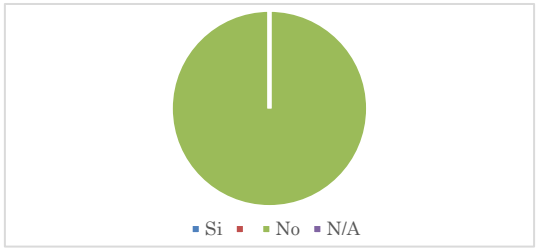
18 Questionnaires

2-5.¿In the area where the dumping site is located waterproofed?

18 Questionnaires

2-6.Are the subterranean waters of the landfill/dumping site being monitored?

18 Questionnaires



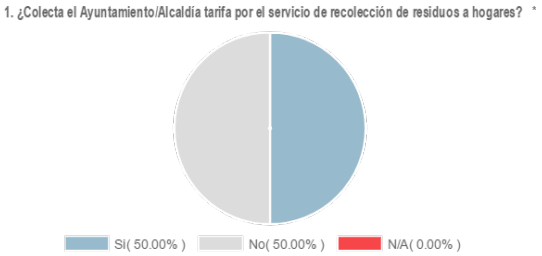
2-6-1.If the answer is "YES", ¿How often are they monitored?

0/24 Questionnaires

Tariff system

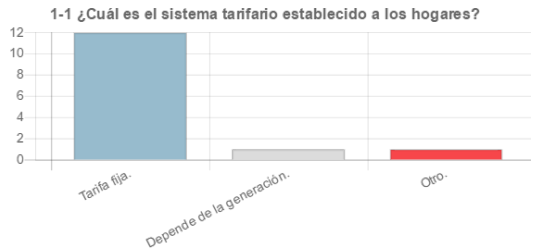
1. Does the municipality charge the users for the Solid Waste collection service?

24/24 Questionnaires



1-1 What is the Tariff systems for the households?

14/24 Questionnaires



1-2 How often is the fee collected?

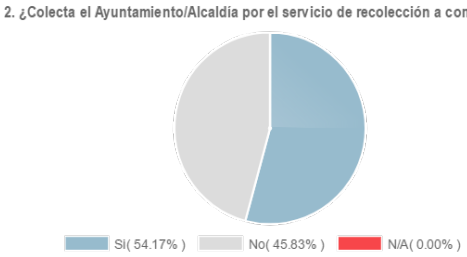
12/24 Questionnaires

1-3 Payment method

17/24 Questionnaires

2. Does the municipality charge the businesses for Solid the Waste collection service?

24/24 Questionnaires



2-1 What is the Tariff systems for the businesses?

13/24 Questionnaires

2-2 How often is the fee collected?

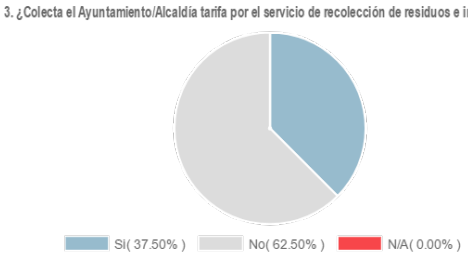
13/24 Questionnaires

2-3 Payment method

17/24 Questionnaires

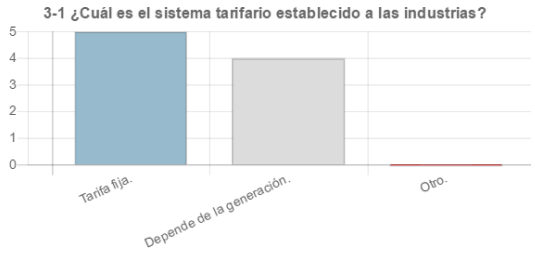
3. Does the municipality charge the industries for Solid the Waste collection service?

24/24 Questionnaires



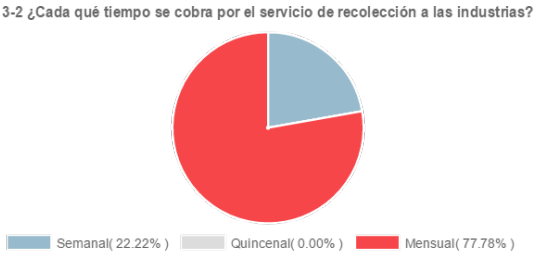
3-1 What is the Tariff systems for the industries?

9/24 Questionnaires



3-2 How often is the fee collected?

9/24 Questionnaires



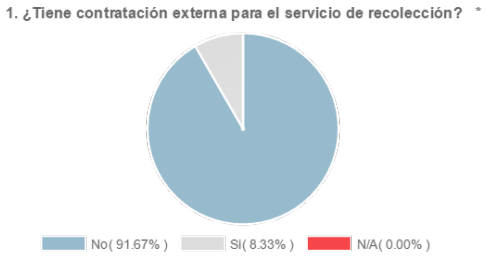
3-3 Payment method

13/24 Questionnaires

Outsourcing (Subcontract):

1. Is the solid waste collection service being outsourced?

24/24 Questionnaires



1-1. Type of outsourced

2/24 Questionnaires

2. Is the recycling and intermediate treatment service being outsourced?

24/24 Questionnaires

2-1. Type of outsourced

2/24 Questionnaires

3. Is there outsourcing at the landfill/dumping site?

24/24 Questionnaires

3-1. Type of outsourced

1/24 Questionnaires

Project For Institutional Capacity Development On Nation-Wide Solid Waste Management In Dominican Republic

Manual for the Conformation of Municipal Association for Solid Waste Management

Mayo 2017

NIPPON KOEI LAC

NIPPON KOEI

ABBREVIATIONS

PPP	Public-Private Partnership
FOCIMiRS	Project to Strengthen Institutional Capacity for Solid Waste Management
ISWM	Integrated Solid Waste Management
MANCOM	Municipal Association of Compostela
SWM	Solid Waste Management
SW	Solid Waste
MSW	Municipal Solid Waste
FDS	Final Disposal Site

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LIST OF FIGURES

INTRODUCTION

The interest in creating a municipal association can be traced back to the experience of countries that have been able to significantly improve their management of solid waste through the formation of municipal associations. This legal instrument, allows the mayors to share the expenses that imminently entails the correct management of solid waste.

In countries like Japan, the formation of municipal associations is of obligatory character to access financing, special funds, among others. A municipality that does not have the financial capacity will not present a plan for the final disposal of its waste unilaterally, since they could be subject to sanctions by the Central Government in case of non-compliance with minimum management conditions.

Although in Latin America the concept of municipal association is already well known, and in developing countries such as El Salvador, Guatemala and Honduras, they already use this legal instrument as a response to rising costs in all components of an integrated solid waste management, especially regarding the final disposal. The Dominican Republic has not achieved a consensus on the part of the mayors to formulate their municipal associations as a response to the growing problem.

Given that for years the reality has been lived that the costs of proper management are very high, and that hardly a municipality on its own can assume them, it is time for the mayors of the Dominican Republic to adopt the tendency to join as a viable solution to the reality of these times. Organize and form municipal associations.

Objective

The purpose of this manual is to provide a consultation tool for the formation of municipal associations in order to establish a system of integrated management of solid waste at a national level.

PART I

1 GENERALITIES

1.1 Formulation of Municipal Associations in the Dominican Republic

In the Dominican Republic, several Municipal Associations have been created, and in some cases legally constituted, although none of them with the specific purpose of working together with their solid waste.

In compliance with its regulatory function and in order to promote and implement the "National Solid Waste Management Policy", the Ministry of the Environment and Natural Resources has been promoting, through the FOCIMiRS project, the formation of Municipal Associations with a focus on Final Disposition in the main provinces / regions of the country. This, in the knowledge of the worldwide tendency to reduce the operational costs of waste management, and the success achieved by Municipal Associations that have been born for the same purpose in neighboring countries.

At the moment, it is a priority of the Ministry of the Environment to influence the existing associations to include the final joint disposal as one of its axes of work.

1.2 Legal framework

The legal basis of the Municipal Associations is supported fundamentally in the provisions contained in the following legal systems:

- Law 176-07, on the National District and Municipalities,
- Law No. 122-05, on Regulation and Promotion of Non-Profit Associations in the Dominican Republic,
- Decree No. 40-08, which establishes the Regulations for the Application of Law No. 122-05

Law No. 176-07, on the National District and Municipalities, in its article No. 72 "recognizes the municipalities' right to associate with others in associations for the joint execution of works and services determined within their competence".

In its articles no. 73 et seq., this law establishes the procedure for the creation, integration and separation of its members, statutes and governing bodies of the municipal associations, establishing its creation "by virtue of law 122-05 for the regulation and promotion of non-profit associations, and the approval of procedures established by it ".

Law no. 122-05, regarding regulation and promotion of non-profit associations in the Dominican Republic, in its article no. 2 considers as such "the agreement between five or more individuals or corporations, in order to develop or carry out activities of social welfare or public interest for lawful purposes and that do not have as purpose or object obtaining pecuniary or appreciable benefits in money to distribute between its associates".

In articles 3 to 9, Law 122-05 establishes the procedure and requirements for the incorporation of non-profit associations, through which they acquire legal personality.

Decree No. 40-08, which establishes the regulations for the application of Law 122-05, is intended to establish the necessary provisions for its application, "in order to specify juridical, organizational and procedural principles and norms that facilitate its implementation by public bodies and institutions and their compliance by interested natural and legal persons."

1.3 Municipal Association: Basic concepts

A Municipal Association is defined as an association of municipalities that has its own legal personality for the fulfillment of its purposes. It can exist without time limit, or be created only for a certain time and for the accomplishment of one or more concrete activities.

In most cases, it is understood that the formation of a municipal association obeys the need to facilitate the administrative and economic burden of some activities that must necessarily be carried out by the municipalities, therefore, the results must always be favorable to its members Provided that the conditions under which the activity is carried out are maintained or improved. For example, if a joint landfill is to be built, if the construction and operation of the landfill exceeds the conditions of the previous installation with a municipality, then the cost per ton will be higher for that municipality because the new

Infrastructure exceeds in quality and compliance to the previous one. Probably, this municipality on its own, could not match the new infrastructure available to it.

1.3.1 Process of creation of a Municipal Association

To achieve the formation of a Municipal Association, several steps are necessary, among them:

- A Record of related meetings
- Draft statutes
- Final statutes approved by all members
- Municipal Resolution of each member municipality
- Constitutive Act of the Municipal Association

The activities necessary for the creation of a municipal association cannot always be carried out in accordance with a pre-established schedule of short time, because activities depend on others and require decisions taken by plural bodies gathered in assemblies.

The following diagram shows a summary of the standard steps that must be taken to form a Municipal Associaton in the Dominican Republic:

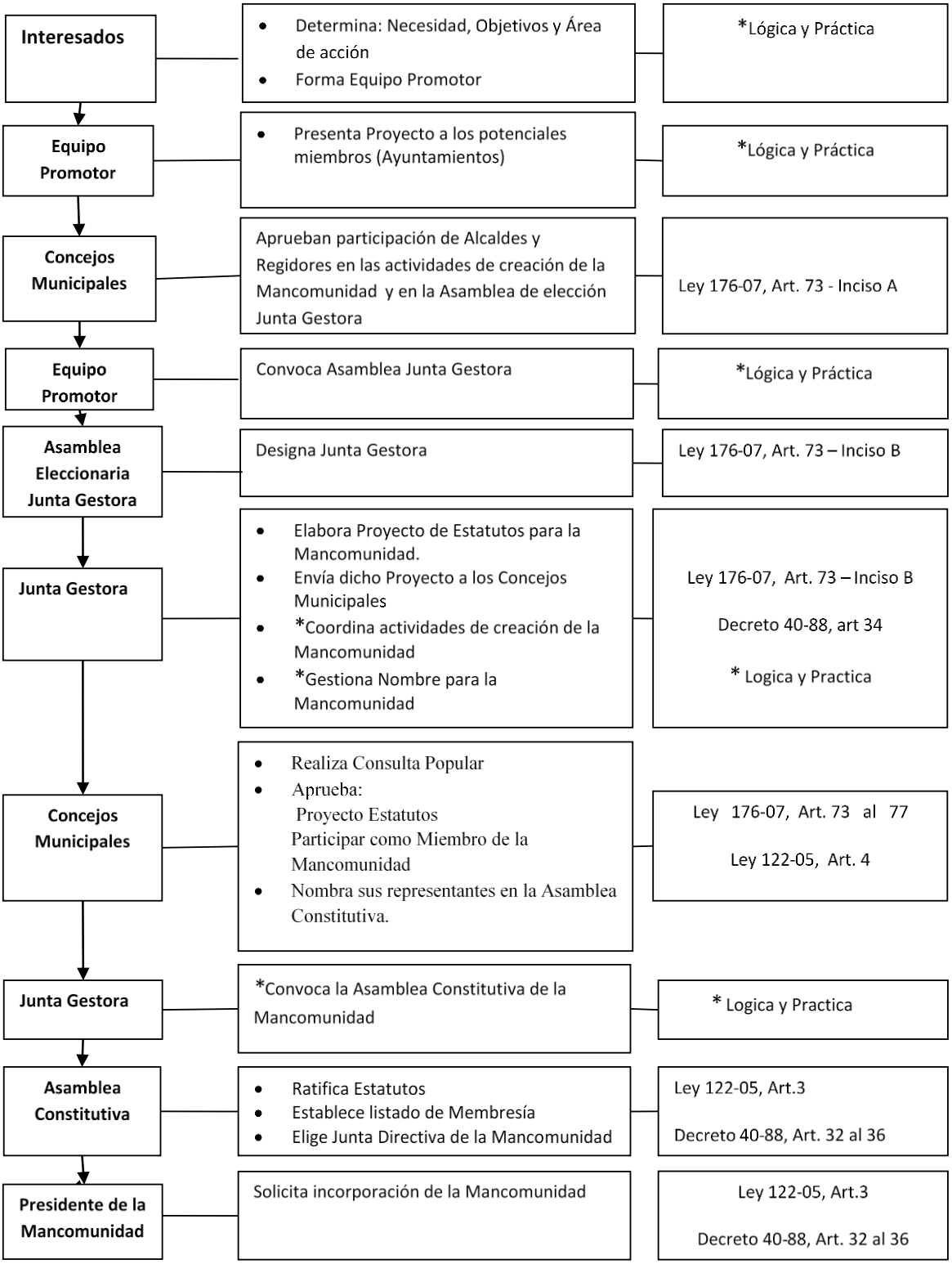


Figure 1 Diagram of standard steps for creating a Municipal Association

Once the creation of the municipal association has been approved, the name must be registered in the National Office of Intellectual Property:

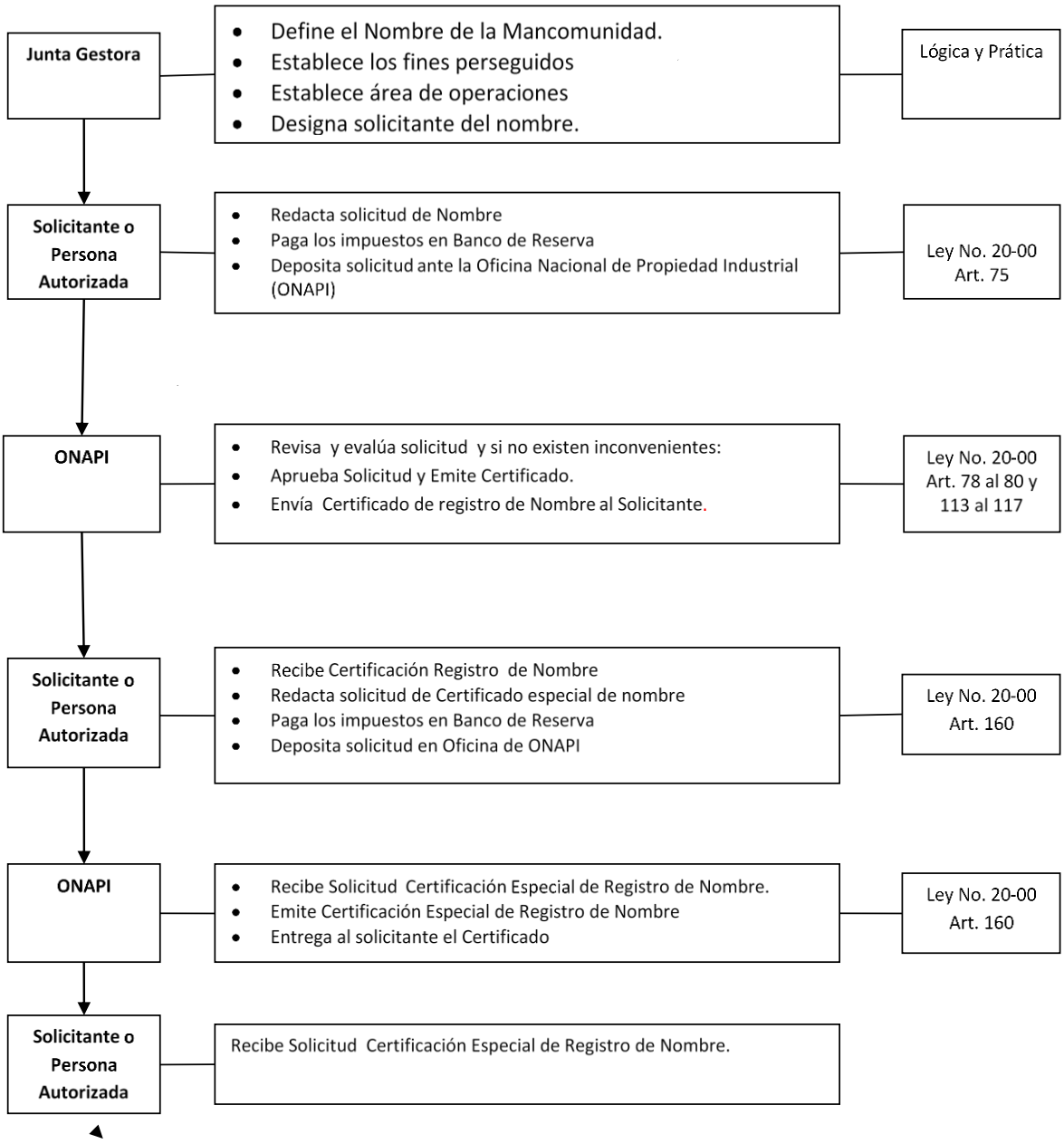


Figure 2 Standard Steps Diagram for name registration of a Municipal Association

Finally, once the steps shown in the two (2) previous diagrams have been exhausted, the process of incorporating the new association must begin with the competent authorities, which is the same for any non-profit institution:

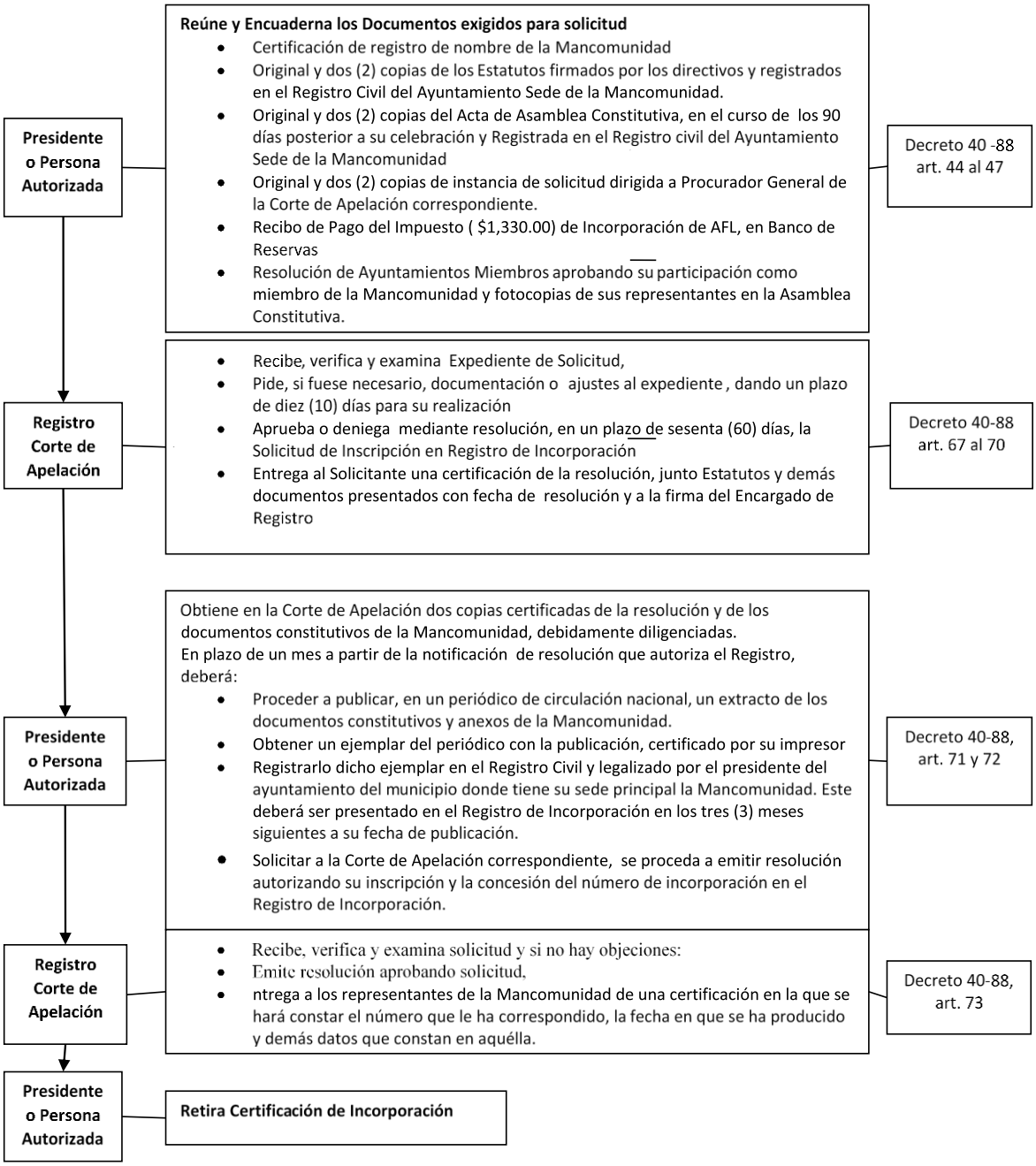


Figure 3 Standard Steps Diagram for the Incorporation of a Nonprofit Association

1.3.2 Advantages of a Municipal Association

The formation of an association, brings with it a series of benefits for its members in different aspects:

- **Environmental / Health**
  - Extends the possibilities of compliance of environmental standards in the services of competence of the municipalities.
  - Increase the chances of decreasing the adverse impact on the environment and health.
- **Economic**
  - They can benefit from the facilities and advantages offered to the associaton for the financing of projects by international cooperation agencies.
  - Possibility of receiving economic support from the Central Government.
  - Achieving greater efficiency in the use of resources in the face of the reality of economies of scale.
  - Investment in a single final disposal site instead of one for each member, increasing the chances of valorization of the rehabilitated land and its surroundings at the time of closure.
- **Politic**
  - Easier decision making on key issues for ISWM, establishing user fees for solid waste collection service and FDS / Achieving consensus on final disposal (Developing synergies facing ISWM).
  - To be a SW management model and reference nationally and internationally, which increases the credibility in the administrative management of the city halls.
  - Better political positioning of who presides the City Hall (Mayor) by the projected image.
- **Sociopolitical**
  - Decreases the opposition of the citizens, as there is only one FDS.
  - Facilitates consensus building with association and to support their needs.
- **Sustainability**

- **Politic:** Sustainability of FDS in time / not vulnerable to change of political administration.
- **Financial:** Financial efficiency, own resources for management and economies of scale.
- **Technique:** Permanence and requirement of less specialized technical personnel, therefore, financial benefit.

1.3.3 Case of Municipal Association of Compostela -MANCOM-

In order to establish a joint final disposal site, through the FOCIMiRS Project, the creation of the Compostela Municipal Association - MANCOM - was promoted in the Municipality of Azua.

In the particular case of the creation of MANCOM, made up of six members, it was necessary to carry out: Twelve (12) sessions of Municipal Councils, Six (6) Popular Consultations (Open Councils), One (1) Municipal Association Assembly, in addition to coordination meetings of the Management Board.

Although the legal framework does not literally establish a chronological order of activities, as an atypical data, MANCOM presents the realization of the Popular Consultations (Cabildo Abierto) at a date subsequent to the resolutions of the Municipal Councils where they decide to join a Municipal Association. Logic suggests the holding of the People's Consultations prior to the decision to work jointly, as described in the Standard Steps Diagram for Building a Municipal Association. However, the validation of the decision taken by the Municipal Councils in the Popular Consultations carried out and the subsequent ratification of the bylaws and the decision to join the representatives of the municipalities in the Constituent Assembly remove legal importance from the fact.

On December 23, 2015, the Resolution of the Office of the Attorney General of the Court of San Cristóbal was granted granting the incorporation benefit to MANCOM and the required publication was made according to said resolution in local media on January 11, 2016 announcing the creation of this entity with the power to act legally, demanding rights and contracting obligations.

After completing the corresponding legal procedure, the members of the Municipal Association were instructed to:

- To promote the integration as members of the Municipal Association, of the municipalities of the province of Azua not yet added to it.
- Establish the administrative and technical structure of the Municipal Association as it is the inter-municipal Technical Administrative Office -OTAI.
- Specify and manage sources of institutional financing.
- Define a Plan containing institutional priorities for the current management period.
- Manage environmental economic feasibility studies for municipal solid waste management activities, particularly on their final disposal.

1) Lessons learned through the creation of MANCOM

Among the lessons learned during the process of creation of this municipal association, we can mention:

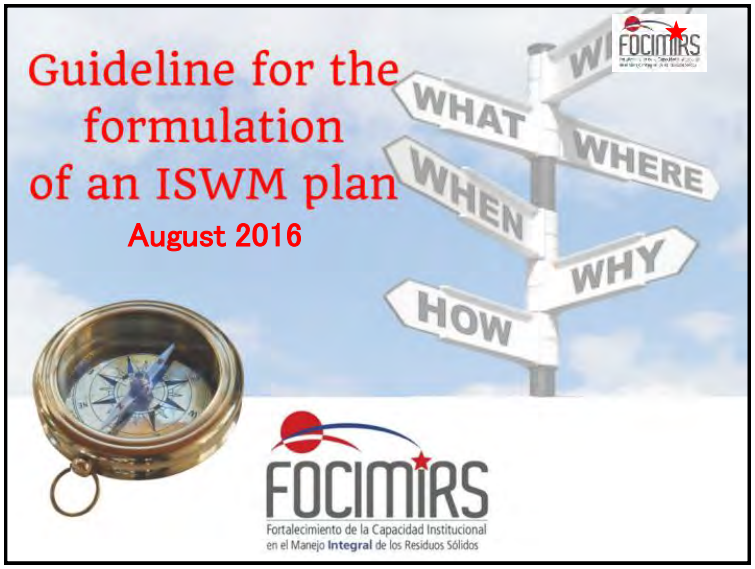
- Legal assistance plays an important role, but not as much as the involvement of the staff of the municipalities, who are the ones who will finally achieve compliance with the schedule required for legal incorporation. It should be noted that in the case of MANCOM, the collaboration of MARENA's team was decisive in order to comply with the schedule of activities required for the incorporation of this body.
- That it is very important that the representatives of the member municipality be informed and involved about the plans and objectives of this association to ensure success in future activities.
- That the figure of the Mayor is preponderant in the achievement of the objectives of this association, since we could verify that he/she is the one that impels the other members to collaborate.
- That the benefits and difficulties of integration to the municipal association should be discussed in advance for each candidate municipality, thus avoiding future nonconformities.

Goals reached until January 2017

Figure 4 Before and after, Azua

REFFERENCE

- Recycling: Opportunities to Reduce the Generation of Solid Waste and Reintegrate Recoverable Materials in the Economic Circle.



Content

→ **The content of Part III is the structure of a ISWMP**

PRESENTATION

In January 2014, the Ministry of Environment and Natural Resources initiated the "Project for Strengthening Institutional Capacity in Solid Waste Management at a National Level (FOCIMIRS)", with the support of the Japanese people through Japan International Cooperation Agency (JICA), which will run for three years.

The guide describes the elements that should be considered for the elaboration of the Integrated Management Plan for Solid Waste (ISWMP) in each component of the Plan.

The ISWMP is a fundamental and indispensable instrument to improve in a sustainable way, in the short, medium and long term, all aspects (legal, institutional, organizational, technical, operational, social, environmental, financial) involved in each of the stages of Adequate management of solid waste.

Objectives of the Guide

1. Provide a theoretical–practical work tool for the technical staff of municipalities and other institutions related to the management of solid waste; serving as an instrument of consultation for the formulation of the "Comprehensive Management Plans for Municipal Solid Waste".
2. Establish the minimum requirements that a ISWM Plan must meet for D.R.

GENERALITIES

PART I

What is an ISWMP?

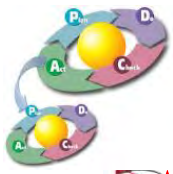
- It is an instrument whose objective is to minimize the generation and maximization of solid waste valorization, under criteria of environmental, technological, economic and social efficiency, based on the basic diagnosis for integral waste management. (Draft General Law on Solid Waste)
- It is a document that includes the objectives, lines of action and activities required to achieve a comprehensive management of solid waste.

Stages for the development of the ISWMP in the Municipalities

The process of implementing a comprehensive waste management system essentially covers four stages:

- Conceptualization
- Planning
- Implementation / Monitoring and evaluation
- Closing

Monitoring and evaluation allows monitoring the achievement of the proposed objectives, while improving the performance of the activities of the plan.



Minimum Level Required in the ISWM

Part II

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Generation and Temporary Storage

- The municipality must know the generation and composition of its waste.
- The population will separate the waste in the source of generation, in at least two fractions: recyclable materials and the rest.
- The population must store the waste inside their house properly and deposit them in rigid containers and in the location designated by the municipality, according to the schedule of collection established by the municipality.

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

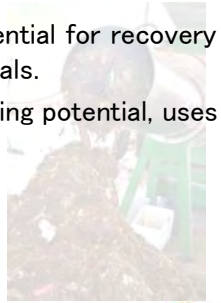
Collection and transportation

- Minimum coverage (routes and frequency) 90% of the population.
- 2 times/week

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Recovery and Intermediate Treatment (1/2)

- Do studies related to the potential for recovery and treatment of recyclable materials.
- Do studies related to composting potential, uses and marketing potential.



Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Recovery and Intermediate Treatment (2/2)

- Depending on the results of these studies, consider the installation of infrastructures for the recovery of materials.
- The municipality will incorporate the existing divers into the material recovery projects.
- In the case of private investment, the municipality will facilitate the installation of projects to recover recyclable materials and its subsequent treatment.

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Final Disposal (1/2)

1) Operational aspects

- The final disposal will be only in the site authorized for these ends. Improvised and illegal dumping sites are not allowed.
- Random daily inspections of the trucks deposited in the FDS will be carried out to verify incoming waste types.
- Coverage of waste: recommended daily, minimum 3 times/week).
- Monitoring of groundwater: 2 week / year

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Final Disposal (2/2)

2) Technical aspects

- Management of leachate (installation of catchment network and construction of a pond for storage)
- Management of gases (network of collection and ventilation to the atmosphere)
- Waterproofing of the base of the dump, according to the conditions of the place.

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Public Education, Public Consensus and 3R

- Provide information to the public on the integrated waste management (population in general, companies, businesses, institutions, etc.).
- Mobilize citizens to be responsible for their waste.
- The municipality will develop a process of public consensus for the installation of infrastructures related to ISWM.

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Financing Plan

- The municipality will establish charging systems for users of the service, based on pre-established rates.
- The municipality will prepare the income and expenditure budget related to ISWM.
- The municipality will keep records of the income and expenses related to the ISWM.

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Monitoring and control

- The municipality will define quality standards in the temporary storage and collection service and transport and will execute a system of monitoring its compliance.
- The municipality will establish a system for the recording and monitoring of complaints of inadequate service.

Minimum Requirements for the Comprehensive Management of Municipal Solid Waste

Sanctions

- The municipality will establish sanctions for faults that violate the fulfillment of the objectives and the achievement of the results of the ISWMP.

Guidelines for formulating an Integrated Management Plan for Municipal Solid Waste

Part III

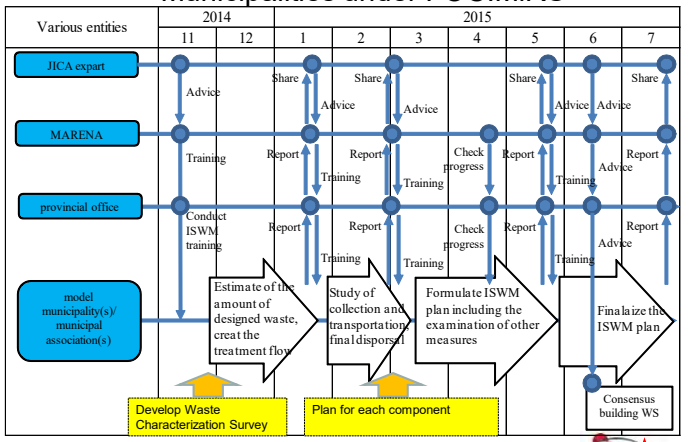
Contents of the ISWM Plan [1/2]

1. Diagnosis of the Current Situation of the SWM in the municipality or joint community
2. Evaluation Current Situation and Identification of critical problems
3. Definition of Planning Conditions
4. Definition of Policy and Objectives of ISWM
5. Roles and responsibilities in the planning and implementation of ISWMP
6. ISWM Component and Stages Plans

Contents of the ISWM plan [2/2]

6.1 Generation plan
6.2 Plan for temporary storage and delivery
6.3 Plan for Collection and Transportation
6.4 Plan for recovery and intermediate treatment
6.5 Final Disposal Plan
6.6 Education and Public Participation Plan
6.7 Financial Management Plan
6.8 Organizational Plan
6.9 Legal Plan
6.10 Plan on environmental and social aspects
6.11 Monitoring and follow-up plan

Formulation of the ISWM Plan by the Model Municipalities under FOCIMiRS



Relationship between the Guide and the Manuals [1/2]

1. Diagnosis of the Current Situation of SWM.

Manuals

2. Assessment of the Current Situation and identification of critical problems. — 1) Waste Characterization

3. Definition of planning conditions.

4. Definition of Policy and Objectives.

5. Roles and responsibilities in the Plan.

6. Plans for components and phases.

6.2 Temporary storage / delivery.
6.3 Collection and transportation. — 2) Collection and transportation

Relationship between the Guide and the Manuals [2/2]

Manuales

6.4 Recovery and Intermediate Treatment — 3) Reciclaje

6.5 Final disposal — 4) Disposición Final

6.6 Education and public participation — 5) Educación y participación

6.7 Financial Management — 6) Gestión Financiera y APP

6.8 Organization for the ISWM

6.9 Legislation

6.10 Environmental and social aspects

6.11 Monitoring and follow-up

7) Database

Target-Municipality
Target-Municipal Association

- The Municipality-goal or the Municipal Association-goal must be defined.
- Case of a Municipal Association: Discuss and Decide (the member municipalities) which components of the ISWM will be managed by the **Municipal Association**.
- Case of a Municipality: elaborate all components of the ISWM.

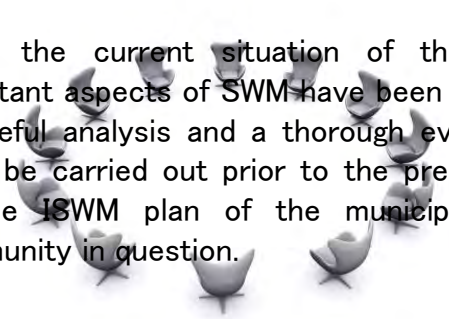
Diagnosis of the SWM in Target-Area

1. Socioeconomic Conditions
2. Meteorological conditionsSituación actual del SWM

- Generation and composition
- Sweeping, collecting and transport / transfer
- Recovery and intermediate treatment / 3Rs
- Final disposition
- Current SW flow
- Citizen awareness and participation
- Financial management
- Organizational / Institutional Aspects
- Social and environmental aspects
- Municipal legal base in force in relation to SWM

Assessment of the Current Situation and Identification of Critical Problems

- Once the current situation of the most important aspects of SWM have been studied, a careful analysis and a thorough evaluation must be carried out prior to the preparation of the ISWM plan of the municipality or community in question.



Assessment of the Current Situation and Identification of Critical Problems

- Identification and Analysis of problems in the SWM.
- Identification of critical problems.
- Prioritization of critical problems and proposed solutions.

Criteria for prioritizing problems

- Level / magnitude of the problem.
- Geographical scale of the problem.
- Urgency to solve the problem.
- Technical capacity to handle the problem.
- Financial capacity to handle the problem.
- Availability of human resources to carry out activities.
- Impact expected after the solution of the problem.
- Cost benefit relation.

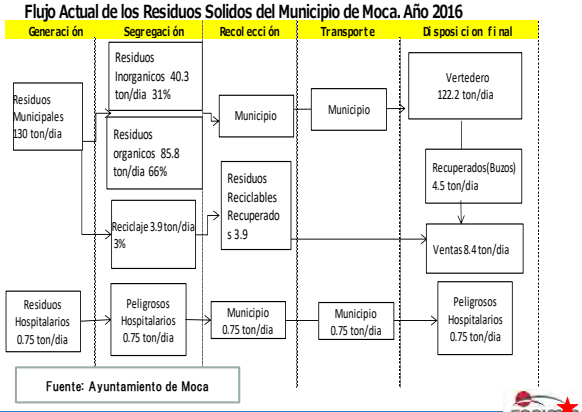
Plan Conditions

- ISWM framework (Where/What)
  - Target area: Jurisdiction of the municipality or of the association of municipalities.
  - Types of target waste: municipal solid waste.
- Project horizon: 10 – 20 years (when)? [More than 15 years recommended]
- Projection of the population to serve
- Projection of the economy
- Implementation structure (Who)

Solid Waste Flow Chart

- Illustrates the amount of waste to be handled at each stage of the ISWM in the target year (based on the present, visualizing the future).
- The solid waste flow in the target year is a basic and inevitable tool for ISWM planning.

Moca's current Solid Waste Flow Chart (2016)



APPENDIX 10-2

Policies and Objectives

Policy

- Overall goal or higher purpose of ISWM.
- Conditions in the SWM that the ISWM Plan must achieve.

Consider the vision of the "Policy for the Integrated Management of the SWM of the Ministry of Environment and Natural Resources".

Objectives: They are specific to each component and phase.

- Policy Examples:
  - Improve sanitary conditions
  - Embellishment of the environment
  - Conservation of the environment
  - Establish a society based on 3Rs

PLANS FOR COMPONENTS AND PHASES OF MISWM

MISWM component and phase plans Generation

Generation planning should consider, among others:

- Population growth.
- Future development of the municipality and region.
- Quantity of recyclable materials with commercial value.

MISWM component and phase plans

Temporary storage and delivery

Planning should consider an effective system, taking into account:

- Nature / type of waste.
- The existing or proposed collection system.
- Population density.
- Cultural aspects.
- Housing conditions.
- Technical requirements of current legislation.

MISWM Component and Phase Plans 1/2

Collection and Transportation / Transfer

- It is based on estimation or determination of the total amount of waste generated.
- Efficient and sanitary planning is required.
- The plan will cover its two basic components:
  - Collection
  - Transportation / transfer

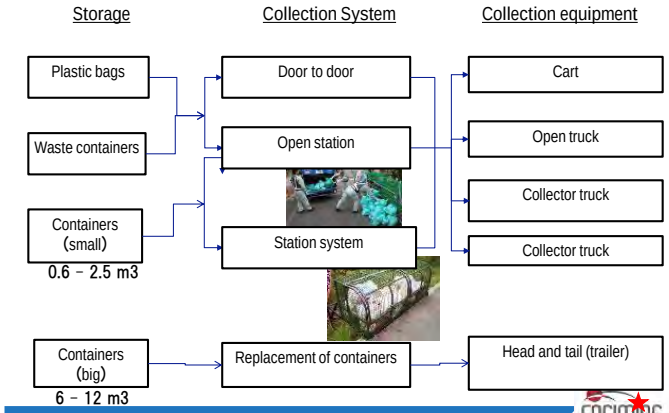
MISWM component and phase plans 2/2

Collection and Transportation/Transfer

The plan will consider aspects such as:

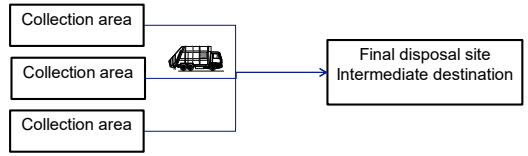
- Responsible for the operation
- Quality of Service Standards
- Method of collection
- Frequency (number of times / week)
- Days / hours
- Routes
- Transport method
- Applicability of a transfer station –ET
- Required Equipment
- Operation and Maintenance of equipment
- Equipment Acquisition / Replenishment

Storage-collection systems-Equipment

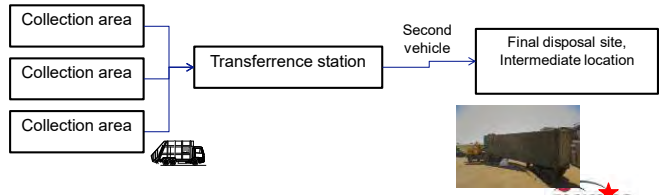


Transport method

Direct transport



Indirect / secondary transport



Plans by components and phases of MISWM 1/2

Recovery and Intermediate Treatment

Purpose of intermediate treatment:

- Reduce the volume of solid waste.
- Recovering materials / resources.
- Prevention of environmental pollution.

Plans by components and phases of MISWM 2/2

Recovery and Intermediate Treatment

- The plan will be formulated based on the amount and composition of the waste generated, specifically those destined for intermediate treatment.

Considerations:

- Potential of waste commercialization.
- Socioeconomic and financial conditions.
- Measures to take.

Intermediate Treatment Options (1/2)

Physical treatments	• Size reduction • Manual separation • Mechanical separation -By gravity. -By size. -Magnetic and by electric field. • Compaction
Biological treatments	• Compost • Vermicompost • Anaerobic Disgestion.
Chemical treatments	• Hydrolysis • Oxidation • Vitrification • Mineralization

Intermediate Treatment Options (2/2)

Thermal treatments	• Incineration • Pyrolysis • Microwaves • Sterilization • Gasification • Plasma
Final Disposal Tecnology	• Conventional Landfill • Methanogenic Landfill • Dry Landfill
Combined Tecnological schemes	• Mechanic Biological • Recovery plants • ArrowBio

Criteria for Selection of Intermediate Treatment Systems

- Stability and reliability of the treatment system (Commercial scale use experience / Time and No. of plants operating in similar countries).
- Initial costs, operation and maintenance costs.
- Simplicity of design / Ease of operation.
- Applicability of the waste to the proposed treatment technology.
- Acceptability of various types of waste.
- Quality of waste resulting from the process. Uses and applications.
- Level of volume reduction of treated waste.
- Environmental impact .
- Economic Feasibility.

Intermediate treatment: Possible options in municipalities

- Recovery of materials for recycling
- Composting
- (Taking into account the economic situation of the different municipalities, it is recommended to consider composting as an option).

Plans by components and phases of MISWM 1/2

Final Disposal

A FDS (landfill / controlled dumping site):

- It must be located, designed, constructed and operated in a way that prevents any environmental and social impact.
- It must be a facility isolated from the natural environment.
- Consider your infrastructure and operation from a community.

Plans by components and phases of MISWM Final Disposal 2/2

- Volume capacity for the target year and life cycle
- Site Selection
- Selection of the type of landfill (anaerobic, semi-aerobi and method of operation (cell, trench or mixed)
- Detailed design plan, installation and construction
- Operation and maintenance plan
- Equipment acquisition plan
- Risk control plan
- Closing / closure and post-closure management plan
- End-use post-closure plan

CONTENT

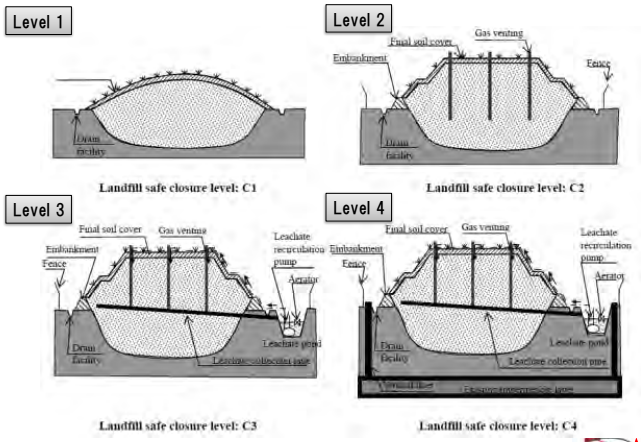
Closure of Existing Landfills

- Apply mitigation measures for a safe closure.
- Plan and methodology of the facilities
- Maintenance plan

Technical requirements for the closure of open dumps

- Prevent the effects of open-air disposal (bad odors, pests, scattered garbage)
- Prevent fire or explosions from the landfill gases.
- Provide drains and gutters to facilities
- Minimize environmental pollution due to leachate.
- Prevent contamination of groundwater
- Take measures for the stabilization of waste.

Landfill Safe Closure Levels



Plans by components and phases of MISWM

Education and public participation

Measures to consider :

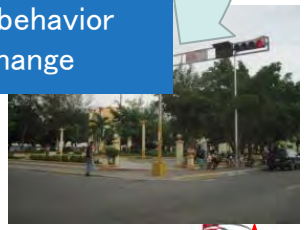
- Create / structure mechanisms for citizen participation and accountability in the ISWM.
- Raise the capacities in ISWM (Awareness raising/training) of key stakeholders
- Encourage and facilitate inter-institutional coordination in the ISWM
- Promote the search for public consensus for the NIMBY.
- Inform the population.
- Transparency management.

Importance of Public Awareness

- Solid waste is generated and manipulated by the population.
- The performance in ISWM will depend on the behavior of the citizens, in terms of compliance with their rules.
- The recovery of the cost of solid waste management will depend on the payment of the citizens.
- Continuous approval of the ISWM by citizens is necessary.

Objective of the Environmental Education and Public Consensus:

Ensure an attitude and behavior change

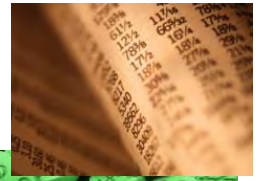


Benefits of the Environmental Education

1. **Rising awareness**: to elevate the sensitivity and concern to the environmental problems, acknowledging the commitment for its solution.
2. **Knowledge**: to understand why the necessity of the sanitation and the deterioration of the environment and natural resources.
3. **Attitudes**: Conscience and knowledge must conduct a change in the attitude or behavior.
4. **Abilities**: To solve the specific problems, reach concrete objectives or foment changes of behaviors.
5. **Capacity of monitoring/evaluating:** Capacity to monitor and evaluate the activities/programs and plans of ISWM.
6. **Participation**: Active and conscious of the citizenship for a sustainable ISWM plan.

Financial Plan

- It is a key component for the implementation of an Integrated Solid Waste Management Plan.
- To cover:
  - Investment cost for infrastructure and equipment.
  - Operation and maintenance cost.



Plans by components and phases of MISWM 2/2

Financial Management

- The financial plan will define the financing system of the ISWM, covering at least the following two aspects:
- **Financial requirements=** Investment and service costs for the defined quality level.
- **Financial sources**

Financial Sources

- Income of the municipality from municipal service rates and others.
- Financial allocation from the Central Government (transfer from the 10% of the national Budget).
- Bank, domestic and international institutional loans, in accordance with the Public Credit Law.
- SNIP Funds
- Donations

Measures to Improve the Financial Conditions of ISWM

a. Allocation of resources in the budget of the municipality depending on the needs.
   - Cost estimation
   - Expense record
   - Collection of fees, based on costs, for ISWM services

   (The costs of the ISWM are supported by the payment of citizenship, which would increase as the municipality maintains an adequate service.)

b. Improve the efficiency of SWM.

Plans by components and phases of MISWM 1/2

Organizational plan

- The implementation of an effective and sustainable ISWMP requires the establishment of appropriate bodies for this purpose.
- The organizational operation plan must be formulated so that the considered instances can function successfully, achieving the objective to be achieved.

Plans by components and phases of MISWM 2/2

Organizational plan

It should cover the following aspects :

- Organizational structure
- Defining functions and job descriptions
- Recruitment
- Human resources development

Plans by components and phases of MISWM 1/3

Legal Plan

- The ISWM should be planned taking into account the current legal framework.
- The measures / strategies that can be contemplated cover :

➢ Adapt the municipal legal framework to the new requirements of the ISWM: creation and / or updating of new ordinances and resolutions.

Plans by components and phases of MISWM 2/3

Legal Plan

➢ Regulate the temporary storage for delivery to the collection service.

➢ Regulate the collection of tariffs

➢ Establish infractions / Sanction practices contrary to the implementation of ISWM.

➢ Establish monitoring and control mechanisms to ensure compliance with the new regulations.

Plans by components and phases of MISWM 3/3

Plan legal

- Municipal Associations must be legally constituted.
- The responsibilities of a Municipal Association relating to the ISWM must be defined clearly and precisely in a formal document approved by its members.
- The scope of the services, functions, powers, obligations of the Municipal Association for ISWM, as well as the penalties for infraction must be defined.

Plans by components and phases of MISWM 1/2

Environmental and Social Considerations

1. An EIA is a requirement for the development of certain facilities. Infrastructure projects must follow the required procedures.
2. Environmental monitoring and data dissemination must be continuous for the population to accept the operation of the facility and assess its importance.

Plans by components and phases of MISWM 2/2

Environmental and Social Considerations

3. The process of developing public consensus seeks to win the trust of the community through transparent and honest communication
4. Any project will face serious conflicts if it starts without public consent.
5. Existing waste pickers should be considered in the planning of the ISWM (inclusive recycling).

Plans by components and phases of MISWM

Monitoring and follow-up of the ISWMP

- It is necessary to monitor compliance with the provisions of the ISWMP.
- The plan will cover:
  - Time: It is recommended once a year
  - Responsible: Mayor and council of regidores.
  - Methodology: Review of indicators, dates of commitment and registration of complaints.

Thanks!

Legal Framework [1]

- Constitution of the Dominican Republic.
- Legal code of 1867, Cap. II, Art. 471 establishes the fines for the ones that deposit waste in public places.
- Law 4984, law of the police, of 1911, Arts. 29, 43 and 44 provides among others, the prohibition of burning waste inside the cities.
- Law 675 of 1944 on Urbanization, sanitation and constructions, Arts. 32 and 35, prohibits placing debris on public roads.
- Law 241 of 1968, on the legal regimen of vehicle's transit, Art. 130 that prohibits the placing on public roads of different types of waste.
- Law 218 of 1984, that prohibits the introduction to the country of basically any type of waste.
- Law 83 of 1989 that prohibits the placing of construction waste, debris and discharge on the streets, sidewalks, avenues, among others..
- Law 120-99, that prohibits throwing solid waste of any nature on the streets, sidewalks, parks, paths, beaches, rivers, oceans and other public places.

FOCIMIRS 2

Legal Framework[2]

- General Law on the Environment and Natural Resources, Law 64-00
- General Law on Public Health and Social Assistance, Law 42-01
- Law on Municipal Districts and Municipalities, Law 176-07
- National Development Strategies –END, Law 1-12
- General Law on Education, Law 66-97
- Law 163-03 on the Cooperation and Financial Assistance Regimen from the Executive Power to City halls
- The Regulation for the Environmental Management of Non-Hazardous Solid Waste along with the resolution No. 15/2009

FOCIMIRS 3

NATIONAL POLICY FOR THE INTEGRATED MANAGEMENT OF MUNICIPAL SOLID WASTE– MSW

MINISTERIO DE MEDIO AMBIENTE Y RECURSOS NATURALES

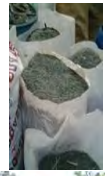
FOCIMIRS 4

APPENDIX 10-2

New Vision on the Integrated Management of Municipal Solid Waste

Open Dumping Sites

Where are we going?



Valorization Projects Sanitary Landfills/ Regional and/or Provincial Controlled Landfills

FOCIMIRS

5

MINISTERIO DE MEDIO AMBIENTE Y RECURSOS NATURALES

Basis

- The generation and composition of the municipal waste is inherent to the development model, which currently implies a progressive and hedged increase in both components, respectively.
- The prevention and minimization in the generation of the municipal solid waste is framed within the sustainable management of the environment.
- The management of municipal solid wastes MSW is closely linked with the civic participation.

FOCIMIRS

6

MINISTERIO DE MEDIO AMBIENTE Y RECURSOS NATURALES

Basis

- The proper management of the municipal solid waste is technically feasible, economically viable and environmentally sustainable.
- The seek of solutions in accordance to the general reality of the country and particular reality of the municipalities.
- Shared Institutional Responsibility.
- Formalization of the solid waste informal recyclers, popularly known as “waste pickers”.

FOCIMIRS

7

MINISTERIO DE MEDIO AMBIENTE Y RECURSOS NATURALES

Principles

- Integrated Management
- Precautionary
- Environmental sustainability
- Hierarchy in Waste Management
- Prevention or Reduction at Source
- Financial Sustainability
- Responsibility "From Cradle to Tomb" / "From Cradle to Cradle"
- Producer's Extended Responsibility
- Principle of Use of the Best Possible Technology
- "The One Who Pollutes, Pays"

FOCIMIRS

8

Goals

General:

Achieving a comprehensive management of municipal solid waste, while avoiding and / or minimizing negative impacts on the health of the population; ends up being environmentally sustainable and socio-economically viable.

Specifics:

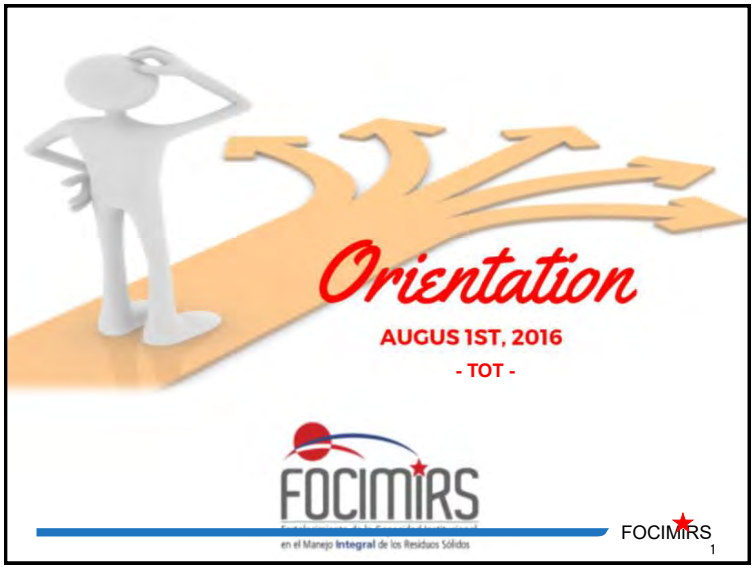
- Encourage the creation of a Municipal Solid Waste Management System, based on the improvement of economic, technological and environmental conditions.
- Foster citizen participation and public commitment to the actions implemented, in order to optimize the management and management of MSW.
- To reaffirm, clarify and / or strengthen the institutional framework for the integrated management of MSW.
- Encourage training of human resources at all levels with a focus on participation.
- Encourage the incorporation of scientific research aimed at solving the problems of national, regional or provincial reality.

The Challenge

TURN THE "WASTE" INTO AN OPPORTUNITY FOR THE EDUCATION, ECONOMY AND THE PROTECTION OF THE ENVIRONMENT.

- SUSTAINABLE USE OF RESOURCES
- SUSTAINABLE WASTE MANAGEMENT
  - 3 Rs and BASURA CERO AS NATIONAL PRIORITY
  - PROPER LEGAL FRAMEWORK
  - EVERYBODY ASSUMES ITS ROLE
  - APPROPRIATE INFRASTRUCTURES
- BETTER LIFE QUALITY

Thank You!



Project: FOCIMiRS

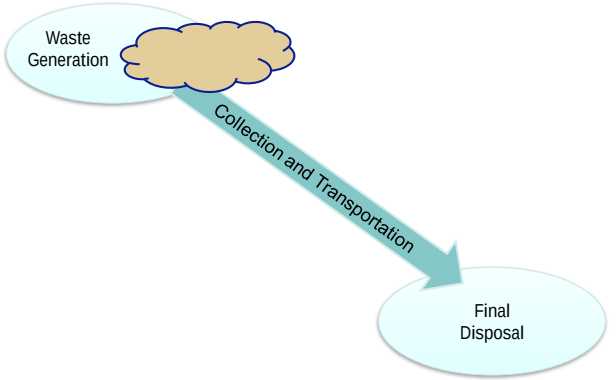
The Project for Institutional Capacity Development on Nation-wide Solid Waste Management in Dominican Republic.

What is ISWM?

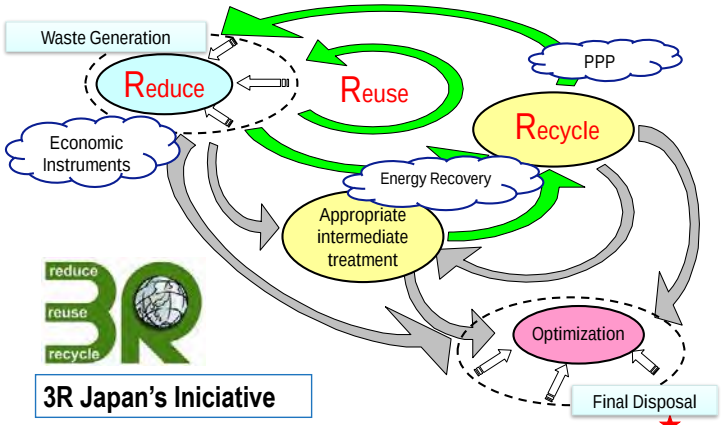
It refers to the Integrated Solid Waste Management, considering the following aspects:

- Minimization of the solid waste generation, from the amount to be stored and collected, as well as the amount that will go to treatment and final disposal.
- Minimization of the Environmental Impacts, including the impact generated by the activity as is.
- Sustainability from the financial, technical and environmental point of view.

Primitive Flow of the Solid Waste Management



Integrated Solid Waste Management with 3Rs Concept and other Measures



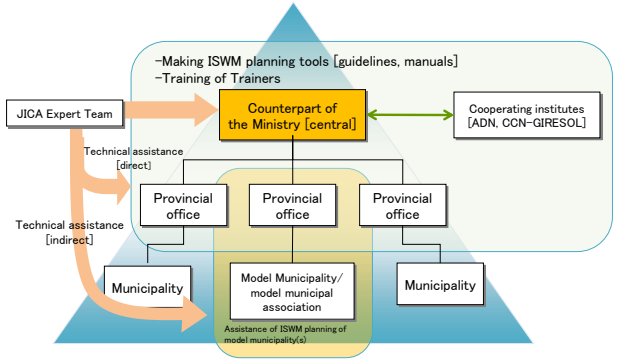
Project: FOCIMiRS

The Project for Institutional Capacity Development on Nation-wide Solid Waste Management in Dominican Republic.

Goal:

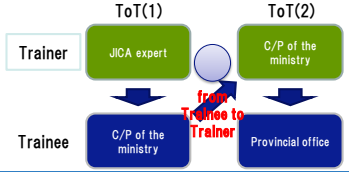
- To establish nation-wide mechanism to improve capacity of municipalities for ISWM planning
- To give ToT to all Provincial Offices of MARENA in 3 years
- Support model municipalities and/or municipal association for preparation of ISMW planning
- To support model municipalities and/or municipal association to conduct a pilot project to implement some component of ISWM plan prepared

Structure of the capacity development under FOCIMiRS



Two levels of Training of Trainers (ToT)

- ToT(1)
  - The JICA experts teach C/P members (through the elaboration of supporting tools)
- ToT(2)
  - C/P members who received ToT(1) and others shall teach the provincial staffs



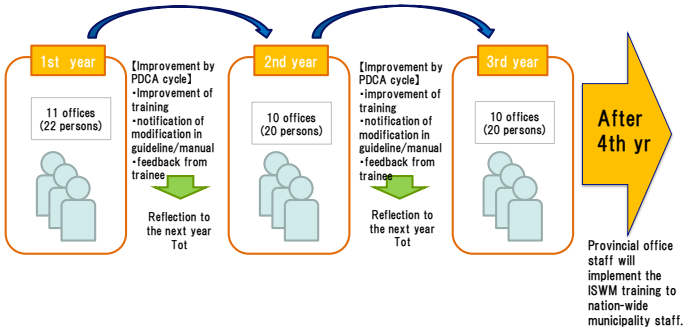
Role of the MARENA [Central]

- Survey and selection of model municipality and municipal association.
- Preparation of principle, guideline and manuals for ISWM planning.
- Training of trainers [to Provincial Offices].
- Supports to model municipality and municipal association through the provincial offices.
  - Preparation of ISWM plan.
  - Implementation of the pilot project.
- Coordination with collaborating institutes in D.R. and neighboring countries

Roles of the staff of Provincial Offices

- Participation to the ToT and obtaining knowledge to lead municipalities for ISMW planning
- Understanding of principle, guidelines and manual for ISWM planning
- Conduct ISWM training to municipalities in the province
- Supports to model municipality and municipal association
  - Preparation of ISWM plan
  - Implementation of the pilot project
- Supports to municipalities in the province

Improvements of ToT and Manuals



Provincial Offices to participate in the ToT (2)

		Provincial Offices
1st year [2014]	12	1. Espaillat (Moca), 2.San Francisco de Macorís, 3.Azua, 4.Puerto Plata, 5.Samaná, 6.Higuey, 7.San Juan, 8.La Romana, 9.Peravia (Baní), 10. Santiago, 11. Sánchez Ramírez (Cotui)
2nd year [2015]	11+2	1. Valverde (Mao), 2. Santiago Rodríguez, 3. Monseñor Nouel (Bonao), 4.San Cristóbal, 5.Barahona, 6. La Vega, 7.San Pedro de Macorís, 8.Santo Domingo Province, 9.Hato Mayor, 10.Monte Plata, 11. National District, 12. Villa Altagracia and 13. Constanza
3rd year [2016]	9	1.Monte Cristi, 2. Dajabón, 3.Elias Piña, 4. Independencia, 5.Pedernales, 6. Bahoruco, 7. Hermanas Mirabal, 8. Maria Trinidad Sanchez 9. San José de Ocoa, 10.El Seíbo

* Municipalities in RED, were included in MARENA's SW Policy.

ISWM Training

- Training for the Integrated Management of Solid Wastes [ISWM Training]

-Tentative

November	Monday 23	Tuesday 24	Wednesday 25	Thursday 26	Friday 27
ISWM Training	●	●	●		
International Workshop			●	●	●

Policy, Guideline and Manuals

- **Policy:** MARENA policy for solid waste management published in February 2014

Policy, Guideline and Manuals

- **Guideline**
  - Illustrates the structure of the ISWM plan
- **Manuals**
  - Solid waste characterization
  - Solid waste collection and transportation
  - Recycling and intermediate treatment
  - Final disposal
  - Education and public consensus
  - Financial Management
  - Database of solid waste management
  - Public-Private Partnership [PPP]

Objective of the ToT (2)

- Understanding of the structure of the development of the training by MARENA.
- Acquire necessary knowledge on ISWM planning through the guideline and manuals.
- Preparation to become trainers of the municipalities.

Thank you!

Content of the Manual

- Chapter 1: Introduction
- Chapter 2: Objectives
- Chapter 3: Generation and classification of domestic solid waste
- Chapter 4: Base line information
- Chapter 5: Methodology
- Chapter 6:Physical characterization survey of Non-domestic solid waste
- Chapter 7: Projection of the generation of solid waste
- Chapter 8: Points to make the waste flow for the future

INTRODUCTION

CHAPTER 1

The FOCIMIRS project contemplates the elaboration of ″principles, guides and manuals for the elaboration of MIRS plans by the municipalities. They will be used in the training workshops for the training of multipliers directed to the staff of the Ministry of Environment and Natural Resources (central level) and its staff at the level of Provincial Directorates, municipalities, as well as collaborating institutions.

This manual analyzes the units for the generation of waste, characteristics and projection of solid waste, in order to generate the basic instruments for obtaining information, to provide an application methodology and analysis of results, for decision-making and verification Of feasibility of projects.

OBJECTIVE

CHAPTER 2

Generate the basic instruments for obtaining information on the characteristics and qualitative and quantitative projection of municipal solid waste.

What is the study of solid waste characterization?

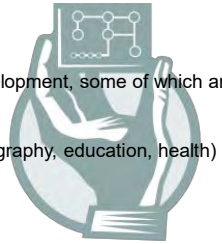
It is a tool that allows us to obtain primary information related to the characteristics of municipal solid waste, consisting of household and commercial waste, specifically in: the amount of waste, density, composition and humidity in a given geographical area.

Base line information

CHAPTER 4

Stages for the development of a characterization study

Base line



A characterization requires certain aspects for its development, some of which are:

- Municipality location
- Environmental aspects (weather, geography, hydrography, education, health)
- Habitability and citizen cohabitation.
- Seasons of the year.
- Habits of the population.
- Socio-economic conditions.
- Predominant activities (Economic activities of importance such as tourism, agriculture, etc.)
- Special occurrences (the occurrence of natural disasters, patron saint festivities).

These factors can alter the type and volume of characterized waste at a certain time.

METHODOLOGY

CHAPTER 5

Necessary elements to start a amount and composition survey

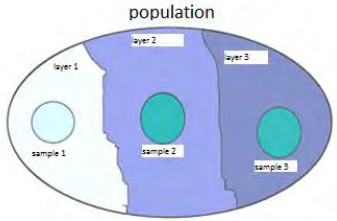
- **Preparatory work includes three types of activities:**

1) Development of formats, which should be used during practice and developing a program of study
2) Field and recognition work; source confirmation and planning of an optimum collection route; adjustment and collection program
3) Preparation of the materials to be used in the study.

It will be necessary to begin a process of information collection before performing a municipal solid waste **Characterization Study** in the municipality.

Factors to take into account:

- Municipal zoning.
- Determine current population.
- Survey distribution by zone.
- Determine sample quantity.
- Determine representative zones.
- Awareness and training of the population.
- Determine the amount of samples.

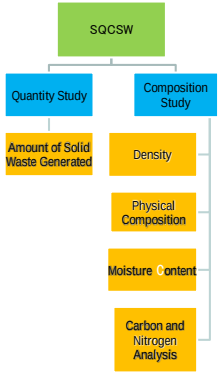


Work Methodology
(design)

This stage comprises the design of the characterization study itself, for this it must start with the determination of the sample, determination of the resources and the formation of the technical equipment.

- Surveys elaboration.
- Determine per capita generation (**PCG**) or per capita production (**PCP**).
- Determine the apparent density.
- Determine physical composition of solid waste.
- Determine moisture content.
- Determine calorific value.

Conceptualization of the Characterization Study
(Study of the Quantity and Composition of Solid Waste – SQCSW)



Determination of the Per Capita Production (PCP)

The **per capita production** of the waste will be determined using the following formula:

$$PPC = \frac{V_c}{N_h}$$

PPC : The per capita production of waste (kg / inhab / day)

V_c : Collected (kg / day)

N_h : Number of inhabitants

Amount of waste to be collected

$$V_c = \sum_i \left(r_i \times V_{gi} \right)$$

V_c : Amount of waste to be collected (ton / day)

r_i : Collection Coverage (Rate)

V_{gi} : Waste generation (ton / day)

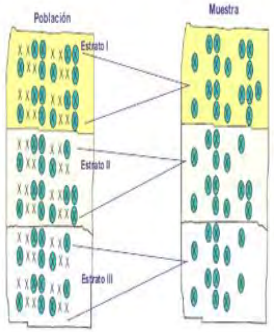
i : Type of waste generator
(Domiciliary, business, commerce, institution)

Determination of the sample number

•There are several ways to determine the number of samples to be analyzed in a characterization study.

•In the simplified method for the calculation of the number of samples, its required to count on a map of the city and make a field visit to pre-select the households that will participate in the study.

•It's necessary to set a minimum number of samples so that the results to be obtained reflect, with a certain degree of trust and reduced percentage of error, the prevailing conditions in the population universe.



Samples Quantity, Empirical method

$$n = \frac{Z^2_{1-\alpha/2} N \sigma^2}{(N-1)E^2 + Z^2_{1-\alpha/2} \sigma^2}$$

Where:

n = households sampling
N = household total
Z = level of trust. 95%=1.96
σ= standard deviation
E= permissible error

To apply the formula, the estimation of all the aforementioned variables is required. In this manner, E = permissible error, and it's a 10% of the national gross product and the σ = standard deviation is of 0.20 a 0.25 Kg./ inhab./ day.

Example:

For a sector of 1,382 households, calculate the number of samples needed to perform a characterization study. Consider a permissible error of 10% of the GDP and a standard deviation from 0.20 to 0.25 kg/inhab./day. Consider a GDP of 0.85 kg/inhab./day.

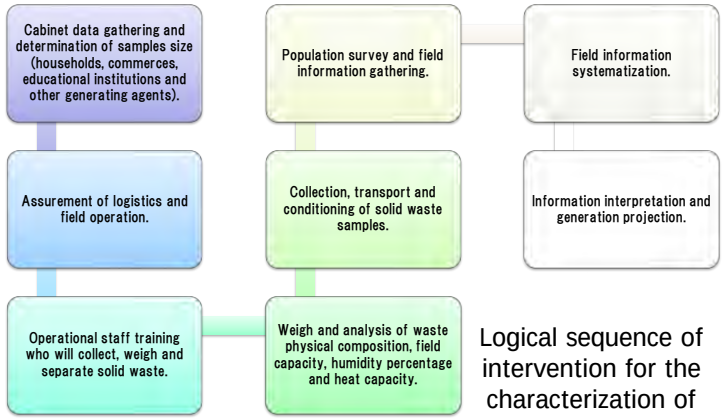
N= 1 382 households
Z=1.96
Ɣ= 0.20 to 0.25 kg/inhab./day
E= 0.085 kg/inhab./day

$$n = \frac{(1.96)^2(1382)(0.25)^2}{(1382-1)(0.085)^2 + (1.96)^2(0.25)^2}$$

n= 32.47, meaning 32 households

Execution Stage

The execution stage for its better understanding and application is divided in two moments: field phase and cabinet phase.
Once the field and cabinet activities have been identified, the technical work team is organized, the materials are prepared, the houses are identified and selected, the sample is collected and studied, the results processed and analyzed.



Logical sequence of intervention for the characterization of SW

Generation and Classification of Non-domestic Solid Wastes

CHAPTER 7

Classification of Solid Waste

There are various solid waste classification categories:

- By its chemical composition: organic and inorganic.
- By its potential risks: hazardous and non–hazardous.
- By its generation source: domestic, construction activities, industrial, agricultural, by cleaning of public spaces, health centers, commercial businesses, among others.

By its physical composition:
Classification in 10 components:

- Kitchen waste
- Paper
- Textile
- Herbs, wood, bamboo
- Plastics
- Rubber and Leather
- Metal
- Glass and Bottles
- Stone, Soil, ceramic
- Others

Types of waste generation

Types of generation of non-household solid waste

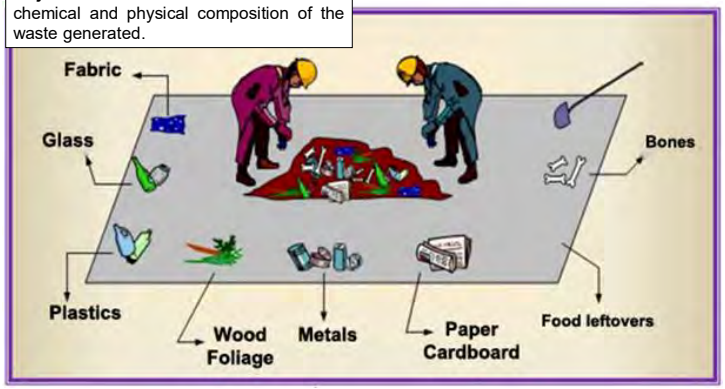
- Waste from commerce
- Construction waste
- Waste from hotels and restaurants
- Waste from markets
- Electronic waste
- Waste from education institutions
- Waste from health centers
- Waste from the sweeping service
- Others

Characteristics of solid waste

- Density
- Humidity
- Calorific power

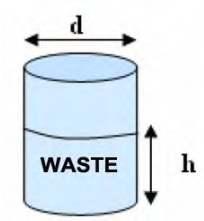
Solid Waste Composition

Objective: To obtain data related to the chemical and physical composition of the waste generated.



Source: CEPIS (Pan-American Center of Sanitary Engineering and Environmental sciences)

Solid Waste Density

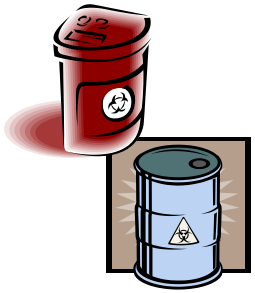


$$\text{Density} = \frac{\text{Net Weight of the Waste}}{\text{Volume of the Waste}}$$

Generation and classification of solid household residues

CHAPTER 7

Non-domestic solid waste

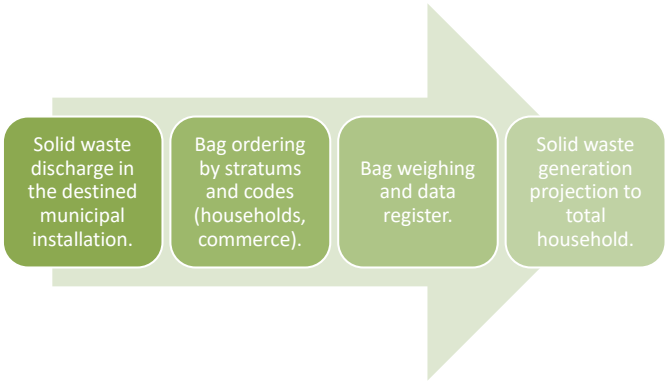


- The management of the non-domestic solid waste such as those from the industries, biomedical and construction, among others, are the responsibility of the generators, who must have an environmental manager licenced by the Ministry of Environment and Natural Resources.

Projection of Solid Waste

CHAPTER 8

Logical Sequence of Determination of Domestic Solid Waste Generation



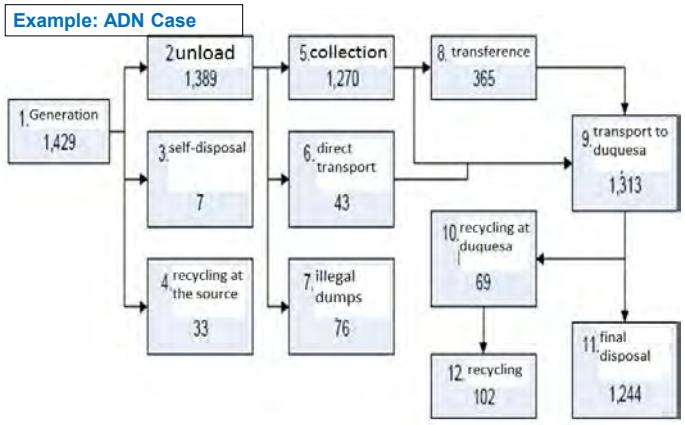
Projection of solid waste

It serves to have a baseline to project the same in the long term, to predict the behavior of solid waste generation and the viability of any project.

It will be necessary to ESTABLISH:

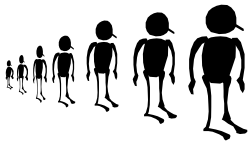
- Period of Project.
- Municipality's Population Growth Estimation

Analysis of the Solid Waste Flow



Projection: Population Growth Estimation

$$P^{t+n} = P^{t}(1+tca)^{n}$$



Where:

- Pt = Population year
- n= Number of projected years
- tca= Annual growth rate (in decimals)
- From the result of the projection, the total number of households in the municipality is calculated and taken as an average of 5 people per household.

Thank you!

Contents of Manual

FIRST PART: GENERALITIES

Context: Current situation of SWM collection and transport in DR.

Collection and Transportation / Transfer: Fundamental concepts.

SECOND PART: PLANNING

Plan of collection

Transportation plan

PART THREE: OPERATION (in preparation)

2

Objective of the manual

- **Provide a document that covers the basic criteria for the establishment of an adequate collection and transportation system that allows municipalities to comply with the following aspects:**
  - Evaluate the current situation of the collection and transportation service and analyze the problems to be solved.
  - Formulate a plan to improve the collection and transportation service.

3

What is the problem of collecting and transporting solid waste in the Dominican Republic?

- It has not been possible to establish an efficient system, since the service is not due to a study or detailed planning of all the elements that take part in the system.
- It is understood that the purpose is that the garbage that is generated is not in sight of the citizen, regardless of how and when it is removed.

4

APPENDIX 10-2

Current situation of collection and transportation

According to the 2010 Regional Report on the Evaluation of the Comprehensive Management of Solid Waste for LAC, in the country the percentage of daily collection represents 55.2%; of 2–5 times per week, 37.1% and once a week, barely 7.7%.

Collecting and Transportation: Basic Concepts - Part I

Solid waste collection and transportation system

The collection and transportation stage comprises two clearly differentiated processes:

- **Collection:** Activity consisting of collecting the waste disposed in the indicated places and its load in the collecting vehicles.
- **Transportation:** Activity consisting of taking the waste to its final destination, once it has been collected. It includes the transfer of waste between the different sites included in the integral management (collection center, TS, material recovery plant, treatment plant, FDS).

Types of Collection

In general terms, by the mode of operation, the collection may be :

- Manual

- Mechanics

Taking into account other criteria:

- ***General***: The waste is collected mixed in the containers, without any separation and without discriminating the different types.
- ***Selective or Differentiated***: The solid waste is collected separately, according to its type, characteristics and properties; depending on its subsequent treatment and assessment.
  - It is based on the fact that the generators are the ones that make the selection of the recoverable products, placing them in independent containers.
  - It requires a high degree of citizen awareness and collaboration.
  - Works most successfully in developed countries.

Types of Collection

- **Door to door collection**
- **Point-to-point collection** (Containers)
- **Pneumatic pick up**: It uses a system of underground pneumatic pipes where trash is transported to the transfer stations where it is transported to the treatment plant.

Vs

- **Vehicle collection**: It is carried out using vehicles, some specially prepared for this purpose, such as trucks equipped with a hopper in which the waste is compacted or others in which they are deposited without compacting.
- **Informal Collection:** Performed by individual collectors (Waste Pickers).

Urban Waste Collection

The urban collection service should consider:

- **Municipal Collection** (Or conventional): it consists of the collection of solid waste from residences, commercial establishments and institutions, its volume does not exceed that provided for in the corresponding municipal legislation.
- **Collection** at markets, beaches, streets and other public places.
- **Special collection:** Contemplates waste not collected by regular collection, such as debris, dead animals and pruning of gardens and trees. It can be regular or programmed for where and when there is waste that need to be removed;

Urban Waste Collection

- **Selective Collection:** Its purpose is to collect waste separated at its point of origin. This type of collection is linked to recycling.
- **Collection of health care waste**, In which they include hospitals, outpatient clinics, health posts, laboratories, pharmacies, veterinary clinics, etc. → This type of Collection should not be included in the municipal collection of Solid Waste.

Types of transport

1. Direct transport by the waste collection vehicle.
2. Secondary transport, from the Transfer Station -ET
   - Transfer the collected waste from a small vehicle to a larger vehicle to improve efficiency, convenience, and economic reasons.
   - Applicable, in cases:
     - If the distance from the collection area to the final disposal site is very far: 30-50km (0.5 hours).
     - If the amount of waste [ton / day] is greater, such as that used by secondary transport vehicles.

Transfer Stations

A Solid Waste Transfer Station is the set of equipment and facilities where garbage is transshipped from a collecting vehicle to another with a much greater carrying capacity, which will transport the waste to its corresponding destination.

Santo Domingo, ADN

Katmandu, Nepal

Jakarta, Indonesia

Queretaro, Mexico

Santo Domingo, ADN

Type of Transfer Stations

Type	Characteristics
Direct Dumping Station	Waste is dumped directly from pickup vehicles to the standby transfer trailer.
Trench Station or Platform, without Compacting	The waste is discharged into a pit or a platform and then loaded onto the trailer using waste management equipment.
Compaction Hopper Station	The waste is discharged from the collection truck, through a hopper and then loaded onto a closed truck by a compactor.
Station of a Compactor Box	The waste is discharged from the collection vehicle to a compacting box, and then loaded onto a closed truck through a compactor.

Source: W. Pferdehirt, Universidad de Wisconsin–Madison Center for the Education of Hazardous Solid Waste, 1994

Environmental impacts of TS

1. Bad smells
2. Noise
3. Vectors
4. Powder (Particulate Matter)
5. leachate
6. Fire Risk

Santo Domingo, ADN

Planning
Part II

Evaluation of the current system of collection and transportation

Conditions to be confirmed in the collection area 1/4

The current collection and transportation system should be reviewed before planning.

The following must be taken into account :

- Number of inhabitants and households
- Conditions of tracks and verification of key points:
  - Streets where the pickup truck can not pass (due to narrow roads, electrical wiring, etc.)
  - One-way streets and avenues
  - Streets and Avenues with high traffic flow (peak traffic hours)
  - Streets and Avenues that change traffic direction
  - Streets and Avenues with outstanding grades (major and minor point)
  - Location of large generators
  - Identification of green areas
  - Location of the sector closest to the operations center
  - Location of the sector closest to Landfill / landfill.

Conditions to be confirmed in the collection area 2/4

In addition, the following must take place:

- **Study of Time and Movement**

It consists of directly monitoring in the field the times of the routes to be optimized. This information will allow to make the diagnosis of the current routes of collection and to generate the necessary information for the subsequent optimization.

With this study, it is diagnosed if the collection frequency is adequate, through a comparison between the value obtained for the indicator tons collected / time collection (Ton / hour) for the routes under study, with the optimum value indicated in The following table :

Tipo de recolección (Zona urbana)	Rango aceptable	Valor Optimo
Método puerta a puerta, o mixto, 3 ayudantes.	2.3 a 2.6 ton/hora	2.45 ton/hora
Método de punto a punto, (contenedores), 3 ayudantes,	2.8 a 3.2 ton/hora	3.0 ton/hora

Conditions to be confirmed in the collection area 3/4

- **Study of storage capacity**

The way the solid waste is stored is determined by:

- the amount
- the composition
- The transport (type of collection, frequency)

It is necessary to examine the storage capacity as follows:

- Check the condition of the waste containers located in the streets for continuity of 15 days at the same time of day.
- Container Condition: Full, overflow, not full (-> x% occupied), empty, damaged.

Conditions to be confirmed in the collection area 4/4

- **Analysis of Waste Collection Registers**

It will be necessary to verify any available history of the current collection system. The main points to register will be:

- Number of trips per collection vehicle.
- Person in charge.
- Working hours.
- Number and location of containers (if any).

Amount of Solid Waste to be collected

What are municipal solid waste?

They refer to the solid waste generated in:

- Homes
- Shops
- Business
- Institutions
- Sweeping public spaces and streets

Estimate of the amount of waste

- **The total generation of solid waste in the municipality should consider :**
  - Population
  - Generation / per capita production rate (PPP)
  - Waste generated in institutions, businesses and institutions.

Example of calculation of waste generation

Background

P: Population = 125,000 inhabitants

P.P.C.= 0.90 kg/inhab./day

PRODUCTION CALCULATIONS

Daily production = PPC * Population

= 0.90*125,000 = 112,500 kg/day = 112.5 ton/day

1 ton = 1,000 kg

Year production = (PPC * Population * 365) / 1000

= (0.90 * 125,500 *365)/1000 = 41,063 ton/years

Population month = Production year /12= 41,063/12 = 3,422 ton/month

Week production = Production year x 7= 112.5 x 7= 787.5 ton/week

Amount of Waste to be collected

$$V_c = \sum_i \left(r_i \times V_{gi} \right)$$

Where:

V_c = Amount of waste to be collected (Ton/day)

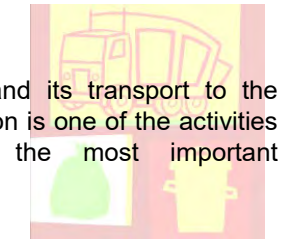
r_i = Collection Coverage (%)

V_{gi} = Waste generation (Ton/día)

i = Type of waste generator (population, business, commerce, institutions).

Plan of Collection and Transportation

Solid waste collection and transportation system 1/4



- The collection of solid waste and its transport to the treatment areas or final destination is one of the activities under the responsibility of the most important municipalities, since:
  - The accumulated waste in the streets affects the health of the population and the environmental quality.
  - If they are not collected, the waste become a vector that transmits diseases.
  - Their costs are the highest in the entire management system.

Solid waste collection and transportation system 2/4

- A collection system must take into account the characteristics of each municipality: geographical, demographic, economic conditions and its road structure, among others.
- Establishing a collection system requires a detailed and exhaustive study to ensure that the service will be performed efficiently and will not hinder the development of other day-to-day activities of both the municipality and the population served.

Solid waste collection and transportation system 3/4

Formulation of a collection and transportation plan should cover the following aspects :

- Proper storage and delivery
- Equipment for the transportation of waste.
- Collection routes, frequency and schedules.
- Applicability of a transfer station.
- Applicability of waste separation at the point of generation.

Definition of plan objectives and service characteristics for each component

The solid waste collection and transportation plan must have the following components:

- Temporary storage and delivery.
- Collection system.
- Transport system.
- Information management system or database.
- Plan of operation and maintenance of the collection vehicles.

Temporary storage and delivery of waste 1/2

Temporary storage systems determine the system of loading and collection of waste and vice versa, so that both are closely related.

Consider an effective system for the storage of waste, taking into account local conditions such as: existing and / or proposed systems for collection, types of waste, population density, housing conditions, culture of people, etc..

Temporary storage and delivery of waste 2/2

- **Necessary capacity for the use of containers**

Temporary storage systems should allow for easy cleaning and access.

Can be used:

- Mobile Containers.
- Fixed Containers.

Collection System

- For collection planning, it is necessary to consider many technical requirements.
- The solid waste collection system must be prepared in an efficient and sanitary manner, including :

- Frequency of collection.
- Days / hours of collection.
- Collection Routes.
- Methods of collection.
- Equipment.
- Seasonal and weekly fluctuation in waste generation.

Types of Collection Equipment

The main means of transporting solid waste is motor vehicles.

Some types of equipment for the collection of solid waste are:

- Animal-drawn carts.
- Flat or fixed bed trucks.
- Dump trucks (large and small).
- Compactor trucks with front, side or rear loading mechanical arm.
- Special vehicles (e.g., tractor with its cart).
- Dump trucks (transfer stations).

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Waste loading system

- Rear loading (manual – container lift).
- Side load (lift–container).
- Front load (lift–container).
- Hidraulic arm.

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APPENDIX 10-2

Manual Rear Loading

Rear load Raises container

Lateral Lifting Container

Front-loading lifted container

Other types of cargo

Collection System Design

The design of the collection system has to decide:

- Storage
- Type of truck
- Frequency
- Schedule
- Source segregation

Based on:

- The characteristics of solid waste (generation, trade, small industries)
- Characteristics of the municipality (slopes, roads and traffic conditions, etc.)
- Characteristics of the discharge site (transfer station or final disposal facility)
- Infrastructures for intermediate treatment.
- Human and economic resources.

Technical considerations in the design of collection routes

- Number and type of equipment selected
- Crew Size
- Frequency of collection
- Distance between stops and stations
- Distance to T.S. or FDS
- Maneuverability of containers
- Topography of the terrain
- Traffic on route
- Conditions of the roads

QUALITY

Collection Frequency

- It is defined as the number of times the waste is collected in a period of one week.
- Frequency depends on:
  - Type of waste (decomposition of residues, larvae appearance of the fly).
  - Combination of waste generation and storage capacity.
  - Economic, human and physical resources.

Not necessarily a high frequency means a quality service.

Example of calculation of waste generation

Background

P: Population = 125,000 inhabitants

P.P.C.= 0.90 kg/inhab./day

PRODUCTION CALCULATIONS

Daily production = PPC * Population

= 0.90*125,000 = 112,500 kg/day = 112.5 ton/day

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Year production = (PPC * Population * 365) / 1000

= (0.90 * 125,500 *365)/1000 = 41,063 ton/año

Month production = Production year /12= 41,063/12 = 3,422 ton/month

Week production = Production day x 7= 112.5 x 7= 787.5 ton/week

Calculation Daily Tonnage to Collect

The total of tons to be collected daily depends on the frequency of collection, which establishes the days of accumulation of the waste in the households.

Daily frequency: The collection is done every day of the week, therefore every day the daily production is collected, with exception of Monday that must be collected what is generated in two days, as shown in the following figure.

Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

Daily Tonnage

Daily Frequency (Monday to Saturday)

Days of normal accumulation 1

Days of maximum accumulation 2

ton/day normal = $\frac{\text{(ton/week)}}{7}$ x Days of normal accumulation

ton/week = 787.5

ton/day normal = 112.5 ton/day

ton/ día peak= $\frac{\text{(ton/week)}}{7}$ * Days of maximum accumulation

ton/day peak = 225 ton/day

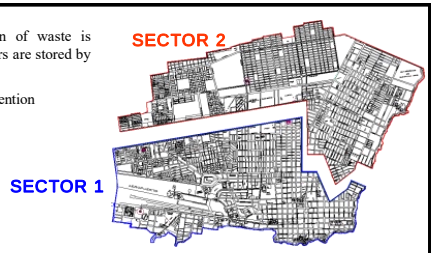
Frequency Three times per Week: The collection of waste is realized three days to the week, therefore the remainders are stored by more of a day in the house.

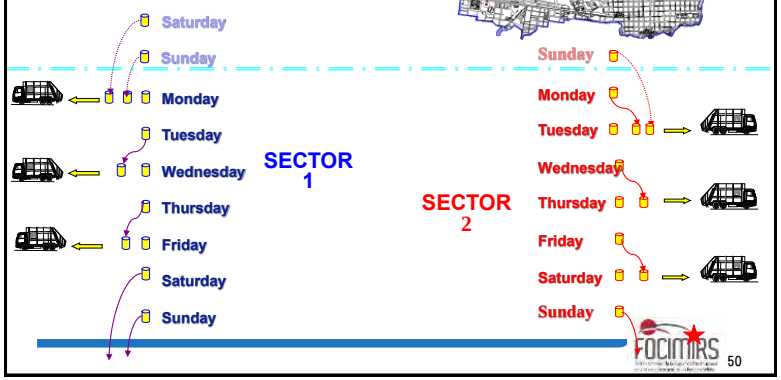
The collection is realized considering two sectors of attention

Sector 1 Attention: Monday - Wednesday - Friday

Sector 2 Attention: Tuesday - Thursday - Saturday

Then we divided it to the city in two sectors





Tonnage of Design

Frequency Three times per Week

Days of normal accumulation: 2

Days of maximum accumulation: 3

Number of Sectors: 2

Weekly tonnage by sector: Tonnage week/ #Sectors

Tonnage by sector = 787.5/2 = 393.8 ton/wk

Ton/Normal day = 393.8 * 2/7 = 112.5 ton/day

Ton/peak day = 393.8 * 3/7 = 168.8 ton/day

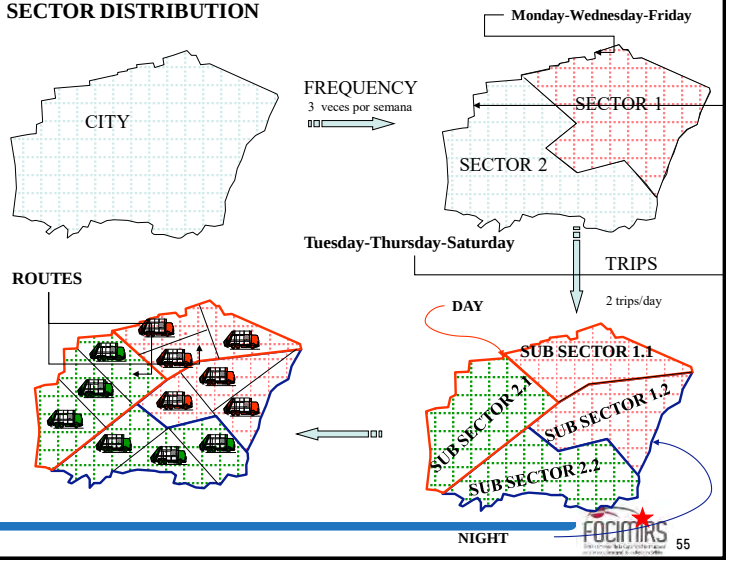
Tons of waste to collect based on the attention frequency

Frequency	Sector	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total Sector	Total
Daily		225,00	112,50	112,50	112,50	112,50	112,50	787,50	788
3 times per week	1	168,75		112,50		112,50		393,75	788
	2		168,75		112,50		112,50	393,75	
2 times per week	1	150,00			112,50			262,50	788
	2		150,00			112,50		262,50	
	3			150,00			112,50	262,50	

Daily number of operative trucks based on the attention frequency, supposing trucks of 10 tons

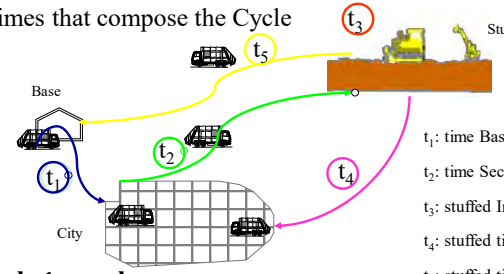
Frequency	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Daily	23	12	12	12	12	12
3 times per week	17	17	12	12	12	12
2 times per week	15	15	12	12	12	12

SECTOR DISTRIBUTION



Design of the Service
Calculation of the Number of Trucks

Times that compose the Cycle



t_1: time Base to Sector Collection

t_2: time Sector to Sanitary landfill

t_3: stuffed Inner time

t_4: stuffed time Sanitary Sector

t_5: stuffed time Sanitary Base

t_R: time of collection

Cycle 1 travels

Total time = $t_1 + t_R + t_2 + t_3 + t_5$

Cycle 2 travels

Total time = $t_1 + t_R + t_2 + t_3 + t_4 + t_R + t_2 + t_3 + t_5$

Cycle time must be equal or smaller to the duration of the work day

LAYOUT

The layout consists of developing the collection route so that each vehicle can carry out the service in the smaller time and route.

Necessary conditions

- •Location Bases
- •Final disposal site
- •Sense of circulation
- •Hour of greater flow of transit and situation of congestion
- •Topography
- •Useful and non-useful routes
- •Type of drawing up of route

Comb: Collection of both sides of the routes to the same hour, is crossed only once by via. It is recommended for zones of low density of population, and by the same extensive.

Double Comb: Collection of a side of the routes; it is crossed at least twice by each route. Of population and in commercial zones is recommended mainly for zones of HD.

COMMON RULES OF LAYOUT

a) It must avoid unnecessary duplications, repetitions and movements

b) It must respect the transit disposals

c) It must diminish the number of round returns left and, in order to avoid losses of time when loading, reducing dangers to the crew and to diminish the blocking of the traffic

d) The routes by far traffic do not have to be crossed in the hour of greater transit

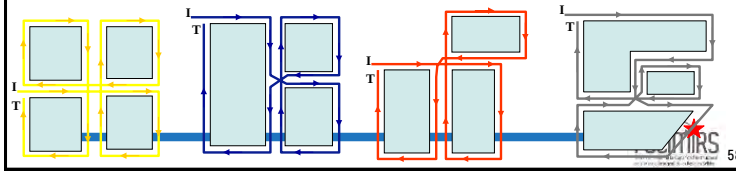
e) Whenever possible the routes must begin in the points nearest the base, and in agreement advances the day, it are approached the place of final disposition in order to diminish the time of transport.

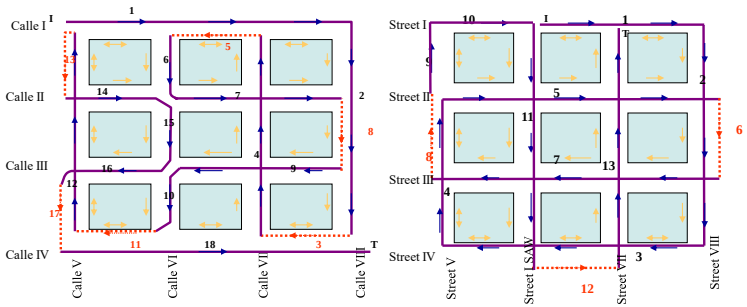
f) The elevated parts more must be crossed at the beginning of the route

g) Whenever possible the lofty routes must be crossed downhill, realizing the collection to both sides of the routes, with the purpose of to increase the security of work, to accelerate the collection, to diminish the wearing down of equipment and to reduce to the consumption of fuel and oil.

h) When it is used drawn up the Comb is generally preferable to develop the routes with long and straight routes before to give returns to the right.

i) When the drawn up one is of Double Comb is preferable to develop the routes with many returns in the sense of the clock, around apples, as it is in the figure





Legend:

Route in good condition

Route in transit

Direction of the traffic

	Esquema Original	Esquema Mejorado
Recorrido estimado	3 km	2.7 km
Recorrido en transporte	0.6	0.3
# vueltas derecha	9	9
# vueltas izquierda	7	2
#vueltas redondas	1	0

VERIFICATION, IMPLANTATION AND EVALUATION OF ROUTES

a) To quantify the length of travel for km on each route

b) To verify the road (traffic direction)

c) Check the drivability of streets at any time of year

d) Report if within the proposed route are uninhabited blocks and accordingly do not need cleaning

e) Note the circulation problems caused by narrow streets, obstruction by parked vehicles, steep streets, etc.

f) Describe the collection route and verified for the area.

INDICATORS

The indicators constitute an excellent tool of evaluation of the service, through constant management of them can:

- To improve the administration of the service
- To monitor and to control the activities
- To compare between similar activities (routes, sectors, etc.)

Indicators are prefixed to relate quantities (base information) obtained from continuous monitoring of the activity.

Possible indicators	unit
Number of effective helpers	No. helper/ month
Quantity of waste collected per month	ton /month
Number of trips per month	No. trip/ month
Number of hours worked per month Working	hours / month
Number of hours per month Hours collection	collection / month
Number of paid hours for driver	Hours/ month
Number of paid hours for helper	Hours/ month
Total number of paid hours per month	Paid hours / month
Effective working days	days / month
Total driving length for collection	km/month
Monthly fuel consumption	Gallon/ month
Population covered by service	No. of inhabitants served
Total urban population	No. of inhabitants
Number of vehicles scheduled	No. vehicles programmed

Indicators for an optimal operation

- Tons collected versus hours of collection
- Tons versus paid hours
  - -Tons per trip
  - -Tons/assistant/day

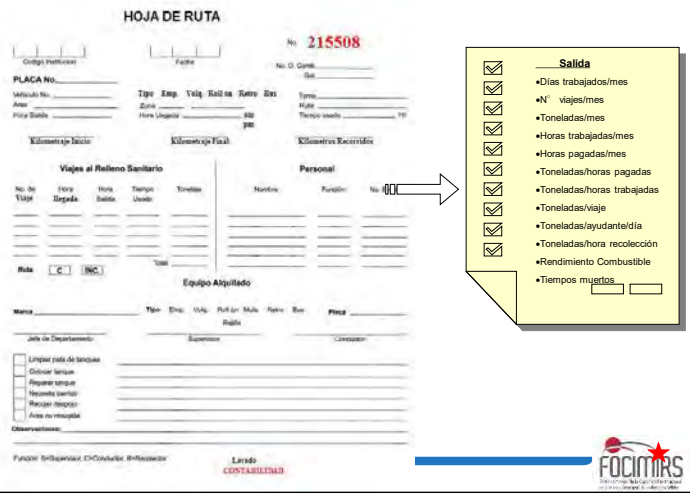
Considering the reality of most municipalities, they shoud start from:

- Record of collection work [trips, hours, collection area]
- Survey of the Capacity of the containers

Aplicabilidad de la Estación de Transferencia

- **Análisis de costos**
  - Costo inicial: estación de transferencia, vehículos de transporte, otros.
  - Costo de operación y mantenimiento: combustible y consumo del vehículo de recolección, así como del vehículo de transferencia, costos de operación de la E/T incluyendo la mano de obra necesaria, etc.
- **Consideración en el caso de mancomunidad:** el municipio principal en la provincia se puede permitir una distancia larga de transporte.

Order of Work/ Trip sheet



Maintenance of Collection System Vehicles

There are two main types of vehicle maintenance:

a) Corrective: It is done to correct a fault when it has happened.

b) Preventive: It is executed by means of a program designed to carry out a series of operations in order to reduce the number of failures.

Preventive Maintenance of Collection System Vehicles

It is not always possible to predict the moment when faults will occur during vehicle operation. Regular inspection periods should therefore be established as a means of discovering them before it is no longer possible to fix them

The established periods vary according to the number of hours worked by the vehicle, the type of vehicle and the working conditions (dust, dirt, atmospheres loaded with humidity, among others). In addition, some of the parties require more frequent inspection than others.

¡Thank you!

02 de Agosto del 2016

RECYCLING and INTERMEDIATE TREATMENT

FOCIMIRS

Content of the presentation

- 1. Introduction
- 2: Legislation on recycling.
- 3: Current recycling situation
- 4: Recycling Processes and Treatment
- 5: Recycling Benefits Strategy
- 6: Benefits of Recycling
- 7: Incentives for the reduction and reuse of solid waste
- 8: Mechanisms of diffusion to the citizenship

INTRODUCTION

Solid waste and its classification? According to its generation

- **Waste:** is any solid, liquid or gaseous material, whether isolated or mixed with others, resulting from a process of extraction of the nature, transformation, manufacture or consumption, that its holder decides to abandon. Solids are recognized as those that are neither liquid nor sludge.

Commercials: Generated in commercial establishments, such as warehouses, hotels, restaurants, cafeterias and marketplaces.

Domestics: By its nature, composition, amount and volume is generated in activities carried out in households or in any similar establishments.

Urbans: Originated from the human activities in public areas that belong to the state or to a specific municipality. E.g., Park waste and gardens, useless urban furniture, etc.

Industrial: Its origin is a product of the manufacture or process of transformation of raw material.

Hospitals: Result of the medical processes. E.g., syringes, gauzes, medicine. Generated in hospitals, clinics, health centers, diagnosis centers, etc.

Construction: Any substance or object generated while building structures or their demolishing them.

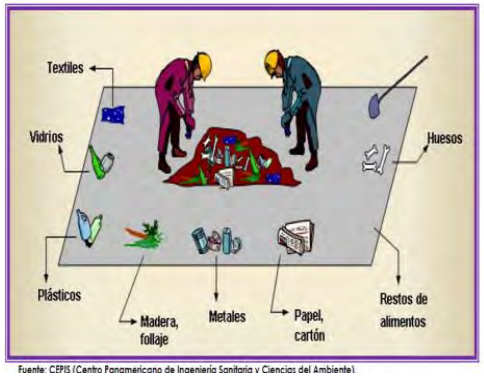
FOCIMIRS

Solid waste and its classification according to its composition

Organic Waste

Inorganic Waste

Infectious Dangerous Waste
Special Handling



Fuente: CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente).

Hierarchy of Integrated Solid Waste Management

- ***Hierarchy of waste management:*** *Establishes the classification or strategy to be followed in the treatment of waste and, in turn, designates the level of preference among the different options available for optimal waste management.*

Recycling

Recylcing of materials: *It is the transformation of solid waste, within a production process, for its initial purpose or for other purposes, including composting and biomethanization, but not incineration with energy recovery.*

Recycling is the activity of recovering solid wastes in order to reintegrate them into the economic cycle, reusing them or using them as raw material for new products, which can achieve several economic, ecological and social benefits.

The waste is recyclable in approximately 90%, according to the physical characteristics that contain and the quality of the materials.

Valorization: A set of associated actions with the objective of using resources contained in the waste, without endangering human health and without using methods that could cause harm to the environment.

Recycling Legislation

Recycling Legislation

- **Law 64-00**, General Law of Environment and Natural Resources.
- **Law 218-84** Which explains the prohibitions for industrial waste.
- 176-07 **of the National District and Municipalities.**

  Ordinances.
- **Solid Waste Bill.**

Standard for Environmental Management of Non-Hazardous Solid Waste: June 2003. NA-RS-001-03 Replaces RE-DM-01).

Policy for the Integrated Management of Municipal Solid Waste. Feb.2014.

Procedure for the Recovery of Multilateral Recyclables with commercial value.

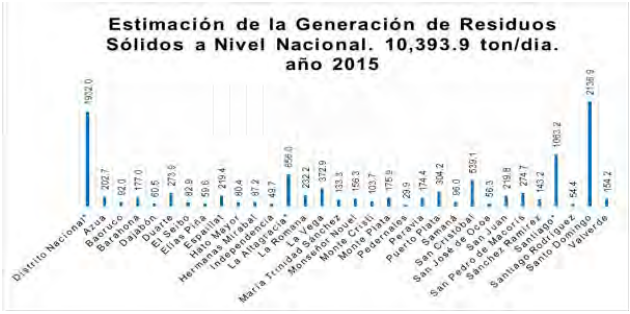
Standard for Environmental Management of Non-Hazardous Solid Waste. June 2003. NA-RS-001-03 Replaces RE-DM-01).

Objective. This Standard has the objective of protecting the human health and the quality of life of the population, as well as promoting the preservation and protection of the environment, establishing the guidelines for the management of non-hazardous municipal solid waste. It specifies the sanitary requirements to be met in storage, collection, transportation and final disposal, as well as the general provisions for the reduction, reuse and recycling.

Within the Principles. Programs and projects will be incorporated into management reduction in waste origin. The recovery and recycling will be taken as basic management measures in the final disposal process.

Chapter 5. Section 5.7. General Provisions for Reuse, Recovery and Recycling.

Background



- Population Rep. Dom. 9,445,281 people according to census 2010.
- More than 350 open dumps.

Background

In 2009, the Municipal District las Placetas initiated the first program of separation at the source of waste.

In 2011, CEDAF publishes the 3Rs guide, Reduce, Reuse and Recycle. Update 2015.

May 2013. Ministry of Environment, National Recycling Week begins.

2014 ECORED. Inclusive Recycling Project. 3 Municipality Pilot.

OBJECTIVES

Awareness-raising / Encourage citizens to carry out the separation of solid waste into the generation source, as key players in the integral management of solid waste.

Promote the culture of recycling, through the municipal plans as management tools, with the strategy of the 3Rs. Reduce, Reuse and Recycle.

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Current situation of recycling

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Current situation of recycling

In the Dominican Republic there are industries dedicated to the transformation of different materials and to their crushing and compaction for export to be used as raw material in other countries.

Who generates the waste	Who picks it up	Who recycles it
QUIÉN GENERA EL RESIDUO	QUIÉN LO RECOGGE	QUIÉN LO TRANSFORMA O RECICLA
• Comerciales • Domésticos • Urbanos • Industrial • Hospitalario • Construcción	• Gestores formales • Recolectores informales • Fundaciones de Saneamiento Ambiental	• Empresas recicladoras

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Current Situation of Recycling

Institutional

- Ministry of Environment. 3Rs Programs (February 2015),
- Ministry of the Environment / Atabey. Clean Point: Villa Francisca, Los R í os, El Espaillat and Prosecutor's Office.
- Industry and Commerce, Customs, IAD, National Lottery, Passports, Codia, Fiscal í a and Agriculture. 3Rs Programs.
- MOPC. 3Rs Programs.
- CEDAF. Promotion Programs 3Rs. Banreservas, Banco Popular, Ars Universal.
- CEDAF. Recycling Guides. THE 3Rs NETWORK.
- ECORED. Inclusive Recycling Project. 3 Municipality Pilot, 22 Educational centers.
- UASD. Sun Program
- Schools. Colegio Calasanz, Colegio Saint Michael's., Movearte. Don Bosco, The Clavellines,

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Current Recycling Status

- **Final Disposal.**
- **Duchess. Recycling plant and a biogas plant (out of service).**
- **Eco Park Rafey.** Waste separation plant. Baler Packing (out of service).
- **Punta Cana Group.** Recycling and Incineration Center. (Debris brought from aircraft arriving at the airport).
- **San Pedro Bio Energy.** Biomass plant. (Bagasse of the sugar cane Cristóbal Columbus).

Current Recycling Status

- **Informal Recyclers (Divers, recyclers). 5,000 approx.**
- **Formalized Recyclers. Samaná,**
- **Formal managers.**
- **ECO-Services, Resicla SRL, Green Love, AIDSA, Mirsa.**
- **Foundations of Environmental Sanitation.**
- **Company of Community Sanitation (ESCOBA)**
- **Community Foundation for Environmental Sanitation Los Guandúles, La Ciénega, Guachupita and 27 de Febrero (FUCOSAGUSCIGUA-27)**
- **Foundation Environmental Sanitation of the Zurza (FUNDSAZURZA)**
- **Foundation for Development and Environment La Puya (FUNDEMAPU)**
- **Foundation for Community Environmental Sanitation (FUNSACO).**
- **The Municipalities. Moca, Sánchez, La placetas, San José de la Mata, Sabana de la Mar, Juan de Herrera. Etc.**
- **Heroes of the Environment.**

Recycling companies

Industry	Location	Material received	Product manufactured
Moldeados Dominicanos S. A (MOLDOSA)	Santo Domingo	Periódico, Papel no satinado Cartón	Cartones para huevos, Portavasos Bandejas desechables
Recicladora del Cibao	Santiago de los Caballeros	Botellas plásticas, Galones desinfectantes y blanqueadores Huacales para botellas Cartón	Plástico triturado para exportación Compactado para exportación
RIERBA División de Reciclaje	Santo Domingo	Papel blanco de oficina y Cartón	Compactado para exportación
Papel SIDO	Santo Domingo	Papel en general incluyendo satinado, Revistas	Papel higiénico, Servilletas de mesa y de cocina, Papel craft
SOLTEX	San Pedro de Macorís	Botellas plásticas	Fibra para textiles
PLASTIFAR	Santo Domingo	Foam post-industrial, Foam residuo limpio	Vasos, Platos, Cubertería, Sorbetes, Envases
Capobianco Soluciones	Santo Domingo	Envases plásticos de aceite de vehículo	Mobiliario de interior (mesas, sillas), Recipientes, Mobiliario de exterior, Mobiliario urbano
Metales Antillanos	Santo Domingo Santiago de los Caballeros	Chatarra de hierro	Hierro para exportación
Exportadora M&F	San Cristóbal	Papel, plástico	Tubería plástica y materiales para exportación
Novoplast	Santo Domingo	Residuos de plástico, sillas, huacales, mesas, cubetas	Fabrican nuevos productos

Some of the materials currently recyclable in the Dominican Republic

Nº	Components
1	Paper
2	Cardboard
3	Food waste (organic)
4	Plastics
5	Glass
6	Metals
7	Tetra pack
8	Foam
9	Tires
10	Electronic waste
11	Textiles & Leather Products
12	Wood
13	Batteries
14	Pruning and gardening

Generation of potentially recyclable waste in the MGSD (Great Santo Domingo's Municipal Association)

Type of Solid Waste	General Average	Total Generation to 2012 (Ton/day) (1)
Carton	1.80%	86.2
Paper	6.20%	296.9
Tetrapack	0.90%	43.1
PET	1.50%	71.8
High Density Polyethylene (PEAD, Spanish accronym)	5.20%	249. 0
Other plastics	2.90%	138.9
Glass	5.10%	244.2
Ferrous Material	0.50%	23.9
Total of marketable wastes (inert)	24.10%	1,154
Total of biodegradable wastes	57.70%	2,763.30

Source: Characterization study 2011, Project SW MGSD Average of the 5 quintiles.
(1) Total generation average in 2012 is 4,789 t/day

As can be seen in the table above, 57.7% of waste are biodegradable moist organic.

Exports of recycled materials. 2013-2014

822,789.49 Tons **US $312,274,287.40**

- The main export countries are. United States, China and Hong Kong.

Source: CEI-RD 2105

Costs of recycled materials in the MGSD

MATERIAL	UNIT	COST-RD$	COST US$
Plastic	Pound	3. 00	0.08
Carton boxes	Unit (According to Size)	10.00-70.00	0.26-1.80
Iron	Kg	12 .00	0.31
Aluminum	Pound	24. 00	0.62
Bronze	Kg	75	1.92
Calamine	Kg	13. 00	0.33
Copper	Kg	110. 00	2.82
Glass	Unit	1. 00	0.026
Volumionous Waste			
Fan	Unit	50 to 300	1.28-7.69
Air Conditioner	Unit	500 to 600	12.82-15.39
Frige	Unit	200	5.12
Washing Machine	Unit	200 to 50	5.12-1.28
Vehicle and plants	Unit	410	10.51

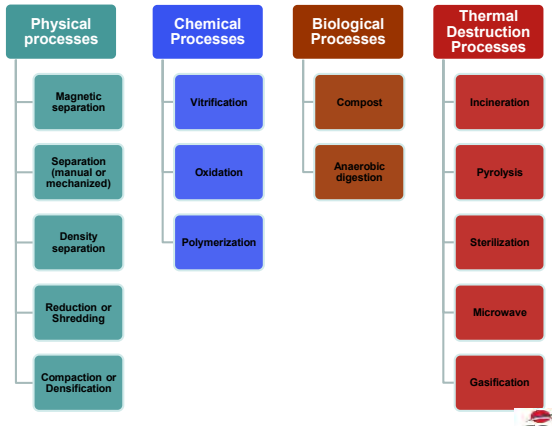
Source: Census, august 2011
Elaboration: Project SW MGSD. (1)Exchange rate RD$39 = 1 US$ (27/10/2012)
http://www.forexticket_pe.com/es/cambio/divisas_DOP

Recycling and Treatment Processes

TREATMENT

- Refers to any method, technique or process that has the purpose of changing the physical, chemical or biological characteristics or composition of any waste to neutralize it, recover energy or material resources thereof, or transform it into another that is safe to transport , store or dispose; or low volume.

Treatment of Urban SW



Recycling Processes

- The goal of any recycling process is the use or reuse of waste.
- As a commercial activity it is an element of high added value in any productive chain, since it is a strategy of cleaner production (P + L), coupled with payment for an environmental service (PSA).
- It leads to significant savings in production (especially in energy, water, and raw materials), and fosters development.

Recycling symbols

Colors of Containers for Recyclable Materials

- Each country sets its standards of separation.
- Generally the blue color corresponds to paper and cardboard, yellow to plastic, green to glass, gray to metals and brown to organic waste.

Generation site of the Wastes to be valorized

Examples of Generators

- Domestic or Residential and Offices
- Businesses and Service Establishments (Including Schools)
- Industrial, Agricultural, wood shops, Fishing Activities and others.

Segregation and Primary Storage

- The segregation consists in the separation in the solid waste generation point, placing them – according to their type– in the corresponding container (primary storage).

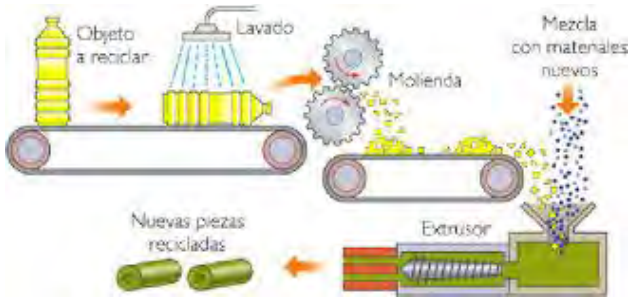
Plastic Recycling

Types of plastics

There are different types of plastic and to classify them an internationally approved coding system is used.

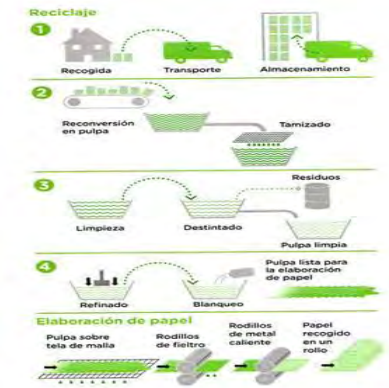
Plastic recycling

There are plastics that have more demand than others to be recycled in the Dominican Republic. For example the PET or No. 1 transparent, it has very high demand in the fiber industry to make textiles.



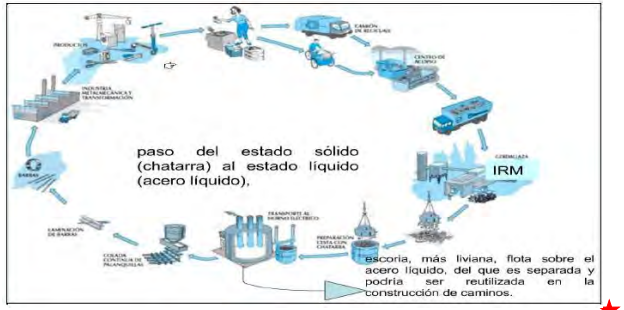
Recycling of paper and paperboard

Not all papers are recyclable in the Dominican Republic, most of them refer to bond paper, newsprint and satin paper (magazines).



Recycling of metals

The range of metal products is very wide. Metallurgical companies often recycle many of the metal scrap. These wastes should be delivered to a formal or informal recycler. The metals that are most in demand are copper, aluminum and iron. Many of these wastes are exported to be recycled in other countries.



Recycling of Glass

Glass has no limit on the number of times it can be recycled, without losing quality, something that happens for example in the recycling of paper. The ideal way to recycle glass is to store all kinds of jars, bottles or glass containers in our homes.

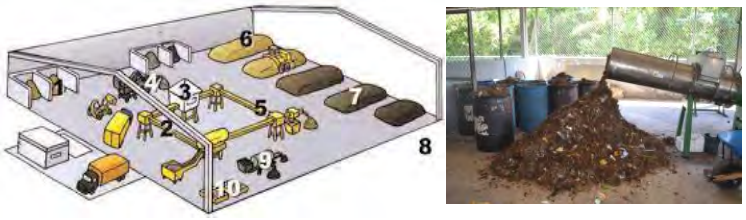
In the Dominican Republic there is not a potent recycling industry for glass, however, companies such as the Cervecería Nacional and Bepensa have a return protocol for their packaging.

Organic Waste

They are materials that decompose naturally and do not take long to degrade like plastic, glass, paper and metals. Organic waste, including food waste, is processed by removing the moisture by heating, then crushing and converting it into fertilizer for the plants.

Compost

Composting is the realization of compost from organic waste. It is produced through a process of reuse and recycling of decaying organic matter. It is obtained in a natural way by decomposition of organic residues like vegetal remains, animals, excrement, wood, among others. Its process can be manual or mechanized.



Proceso de Compostaje

Recycling Strategies

The 3Rs (Reduce, Reuse, Recycle)

REDUCE

Reducing is the most important action of all, since it is a preventive action.

It consists of reducing the consumption of those things that we do not really need.

Choose products with few wrappings, using returnable packaging, or buying only what you need.

It reduces the use of energy, water, raw material (wood, metal, minerals, etc.)

The 3Rs (Reduce, Reuse, Recycle)

Give new use to waste before discarding it.

The 3Rs (Reduce, Reuse, Recycle)

It is a physicochemical or mechanical process that consists in subjecting a matter or product already used to a cycle of total or partial treatment to obtain a raw material or a new product.

Valorisation of waste

Which waste recovery options are possible?

The recovery of waste can combine, as appropriate, options such as the following:

- Reuse
- Recovery and classification of recyclable materials
- Co processing
- Transformation of recyclable materials
- In new materials or products
- Composting of biodegradable organic waste
- Bio gasification
- Energy Recovery

What can we do?

Separate waste

Investigate about points of stock

Think before buying.

When going to the supermarket, carry bags from home.

Avoid buying products with a short lifespan.

Look for a 2nd use before disposing.

Benefits of recycling

Benefits of recycling

Economics	Social	Environmental

Saves space in landfills and dumping sites.

Reduces waste burning and incineration processes.

It promotes the reduction of greenhouse gases responsible for global warming.

It allows new alternatives for the generation of Jobs

It favors obtaining quality raw material at a lower cost.

Promotes significant energy savings.

Examples of benefits

We can save energy and resources:

Recycling 1 ton of paper equals:
Preserve 17 trees (From each tree They get 58.85 kg of paper).

Save 270,000.00 liters of water.

Reduce water consumption by 86% and the energy in 65%.

Save 7,000.00 Kw / Hour (Kilowatts / Hour) of energy.

To produce 1 ton of virgin cardboard, 14 tree trunks are required.

Examples of benefits

Recycling a single aluminum can saves enough power to run a TV for three hours.

For each folio that is recycled, the energy equivalent to the operation, for one hour, of two low-wattage 20-watt bulbs, which give the same light as two 100-watt incandescent bulbs, is saved.

1 recycled bottle saves energy to have a TV on for 3 hours.

1 kg of plastic is equivalent to saving 1 liter of oil.

(www.swissinfo.ch)
http://www.separadonoesbasura.org/calculaimpactoambiental.html y http://www.reciclame.info/sabias-que/

Incentives for the reduction and reuse of Solid Waste

Incentives for the reduction and reuse of Solid Waste

Some examples of incentives are:

- Modifications of rates of local disposal of waste, surtax or taxes on services of cleaning / recycling.
- High advertising taxes on disposable or junk products.
- Granting of loans, subsidies and guarantees on loans or purchase of reduction equipment at source (dishwasher or duplex copier).
- Financial incentives for the sale of waste or reduction activities at the place of business or commerce.
- Deposits, rebates and discounts for reduction of toxicity and other difficult wastes, such as tires and batteries.
- Bonds.

Mechanisms for dissemination to the public

Mechanisms for dissemination to the public

- For the implementation of municipal programs of reduction, separation, reuse and recycling of solid waste, promotion and education are essential components.

An axample of a ‘‘Basura Cero’’ model

Element	Responsibilities
Local government	Ensures organizing the actors; Assigns the resources required for the process; Establishes the norms for the management; Carries out control on fulfillment; Establishes the sanctions.
Community	Co-responsibility over the management of rights; Starts segregation of waste at home; Takes leadership over the process and the organization of the actors.
Service	Ensures the improvement and adaptation of the service to the changes of behavior in the population when it comes to the delivery of waste; Provides the differentiated collection between organic and inorganic waste; Carries out the final disposal of the waste in the dumping site through the conditioning of the segregation, gathering/storage and processing installations

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Referred References

Law 64-00. General Law of Environment and Natural Resources. 2000
Standard for the Management of Non-Hazardous Solid Waste. 2003.
Policy for the Integrated Management of Municipal Solid Waste.
Guide. CEDAF / 3Rs Program; The 3Rs (Reduce, Reuse, Recycle). Miscellaneous series. Santo Domingo Dominican Republic. CEDAW / Program 3Rs, 2015. 70p.

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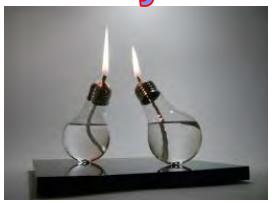
Thank you!



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APPENDIX 10-2

August 2nd 2016

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Fortalecimiento de la Capacidad Institucional en el Manejo **Integral** de los Residuos Sólidos

Final Disposal

Objective

- Provide a tool that allows municipalities to develop the capacity to execute all phases of a final disposal site project (landfill / controlled dumping site), from planning, construction, to operation and post-closure.

Content of the Manual

PART I: PLANNING

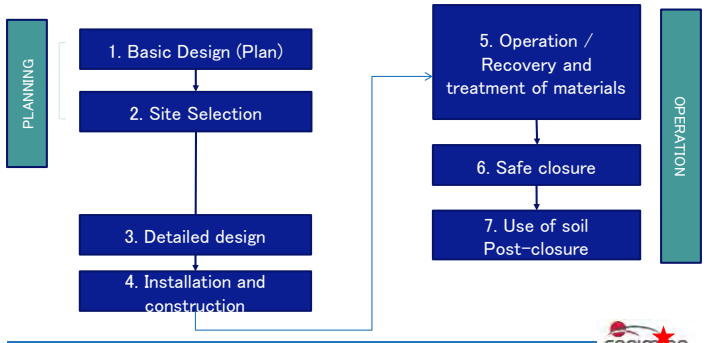
- Chapter 1: Current Situation and Legal Framework of final disposal in DR.
- Chapter 2: Final Disposition: Basic Concepts
- Capítulo 3: Development stages of a project FDS

PART II: OPERATION

Final Disposal: Basic Concepts

Flow of development of a landfill project controlled dumping site

The development flow of a landfill project and / or controlled dumping site is illustrated in the following figure:



Landfill capacity (1/2)

- In order to estimate the filling capacity, it is necessary to determine the period of operation and the annual volume of waste.
- The operating period should be 10 ~ 20 years (15 years or more is recommended).
  - ➢ The annual waste volume will be:

$$V = 365 \times \frac{T_d}{P_v}$$

Where

V : Annual volume in m³ (m3 / year)

365 : Number of days per year (days)

T_d : Tons collected daily (t/day) * from flow of waste

P_v : Volumetric Weight or density of compacted waste in the filling (t/m3)

Landfill capacity (2/2)

- The total waste deposited will be the sum of the annual volume for each year of operation.
- The filling capacity must be the sum total of the volume of waste deposited plus the covering material (30% of the volume of waste).

Total Waste deposited (m3) + Coverage Material (m3) = Landfill Capacity (m3)

FDS Selection Process

Phases for the selection of the Site

The selection of the site must be conducted step-by-step:

- Stage 1 . Site selection process
- Stage 2. Identification of the area
- Stage 3. Sites study
- Stage 4. Final Decision

Criteria for the FDS selection(1)

Physical factors

- Distance of transport of the solid waste collection to the core.
- Useful volume or capacity of the landfill.
- Access system of the possible controlled/sanitary landfill.
- Availability of cover and sealed material.
- Existence of infrastructures, water, electricity, telephone.
- Morphology.
- Geotechnical characteristics of the soil.
- Cost of the land.
- Presence or absence of mineral resources and industrial rocks.
- Karst soils and areas with soil conditions of high permeability that allows a rapid water penetration or a possible leaching into an aquifer.

Criteria for the FDS selection (2)

Environmental Factors

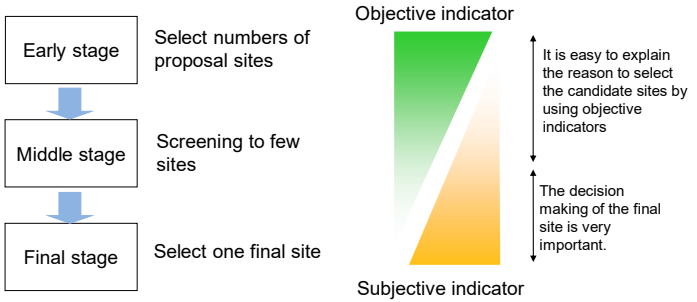
1. Distance to inhabited areas.
2. Groundwater.
3. Surface water.
4. Climate: rainfall, temperatures, wind, evaporation, evapotranspiration.
5. Soils, types, uses.
6. Vegetation.
7. Fauna.
8. Geological risks: floods, slopes' movement, erosions, seismicity.
9. Landscape quality.
10. Visual impact
11. Natural spaces or of cultural and/or scientific interests.
12. National parks, areas of nature protection and natural monuments; areas with important flora and fauna.

Criteria for the FDS selection(3)

Political, legal and social factors

1. Disturbance to neighbors by traffic, dust, noise, etc.
2. Opposition of the community near the landfill by real or perceived danger or by NIMBY (**N**ot **I**n **M**y **B**ack **Y**ard) syndrome.
3. Opposition from neighbors and nearby owners for fear of a devaluation of their property.
4. Existence of a regulatory plan of the city that limit the use of soil.
5. Existence of groups and political parties and conservationists who oppose rightly or wrongly.
6. Sites or heritage, historic, religious or cultural.

Difficulty in Explaining the Site Selection



- The final decision shall depend on the subjective indicator.
- The subjective indicator is to get the land without any troubles among the stake-holders around the site.

FDS Installation Process

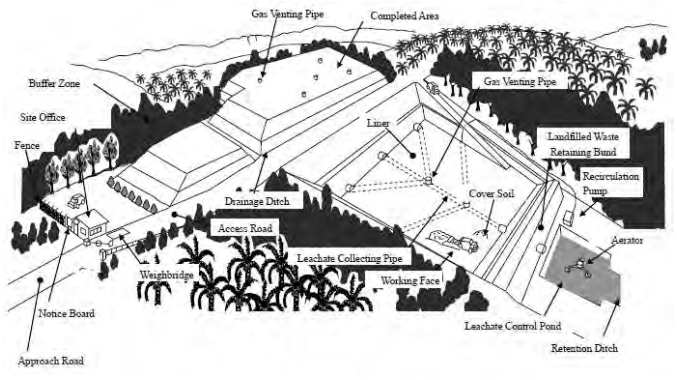
Application of EIA

- Approval of the Environmental Impact Assessment –EIA– is required for installation of the final disposal site.
- Final disposal site is required investigation of Category A or B, depending on population size.

Activity, work or project	category			
	A	B	C	D
Disposal of non-hazardous solid waste for a population of less than 100,000 population equivalent		X		
Disposal of non-hazardous solid waste for a population of more than 100,000 equivalent	X			
installation of facilities for management of individual non-hazardous solid waste			X	
Disposal and / or transportation of hazardous waste	X			

Detail design of FDS

General Image of Sanitary Landfill Site



(Source: The Technical Guideline for Sanitary Landfill, Design and Operation, JICA 2004)

Facilities

These facilities and equipment are selected taking into consideration the surrounding conditions, waste conditions, and rules and regulations.

Category	Detail
Main Facilities	Solid waste retaining structure
	Ground water drainage system
	Seepage control work
	Rainfall collection system
	Leachate collection/treatment system
	Daily cover facility
	Gas treatment equipment
Management Facilities	Vehicles monitoring office
	Environmental monitoring facility
	Administration building
	Weighbridge
	Machinery management
Supporting Facilities	Access road
	Workshop equipment
	Notice board, gate, fence
	Fire-prevention equipment
	Disaster prevention equipment

Facilities Selection

- Surrounding conditions
- Waste conditions
- Rules and regulations

OPERATION OF THE FDS

OPERATION OF THE FDS

- During the operation stage, it will be necessary: i) Handling the delivery of the waste and ii) handling the landfill.

i. <u>Handling the delivery of waste :</u>
   - ➢ Prevent the inadequate reception of waste.
   - ➢ History of amounts received.

ii. <u>Management of the landfill:</u>
   - ➢ Develop landfill cells.
   - ➢ Choose the FDS location.
   - ➢ Compact the deposited waste.

Safe closure of FDS

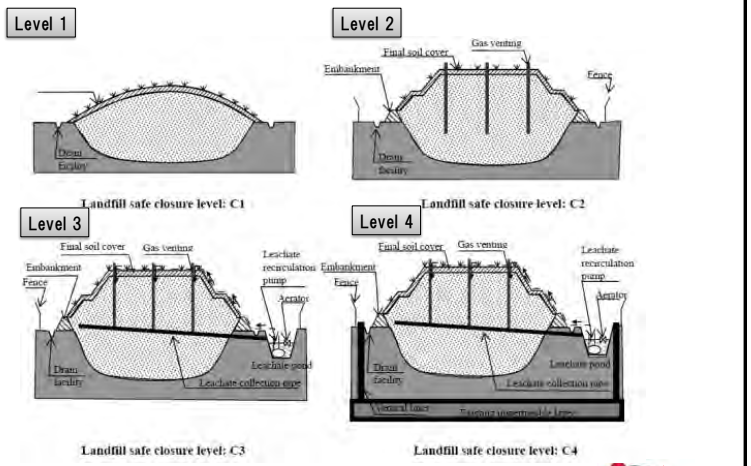
The Purpose of Safe Closure

(1) Protecting public health and the environment by proper management of landfill safe closure and post closure land use

(2) Prevention of environmental pollution and risks from the closed landfill sites

(3) Prevention of environmental pollution and risks from the uncontrolled development of closed landfill sites

Closure Levels of Dumping Site



Closure Levels and Required Measures/ Facilities

Measures	Safe closure Level			
	C1	C2	C3	C4
Final cover soil	++	+++	+++	+++
Storm-water drainage	+	++	+++	+++
Safely storage	+	++	+++	+++
Gas vent		++	+++	+++
Leachate		+	+++	+++
Groundwater			++	+++
Early stabilization		+	+++	+++
Post closure measures		+	+++	+++
Monitoring	+	++	+++	+++
Landfill system			Semi-aerobic System	

Notes: 1. +: minimum equipped/ operated, ++: fair, +++: fully equipped/operated
2. As for C3 and C4, in line with the semi-aerobic landfill concept, aerobic area of existing landfill site will be expanded by safe closure measures.

FDS Post closure use Plan

After closure:

- In sanitary/ controlled landfills and open dumps, after their closure in a period of 10 to 20 years releases and production of leachate are still being produced.
- There is a need to create a land use plan for that period.

Case of the site use (1)

Figure Used as a biotope (Yatozawa- landfill in Tokyo, Japan)

Case of the site use (2)

APPENDIX 10-2

Content– First Part

Chapter 1: Introduction

Chapter 2: General concepts

Chapter 3: Environmental education

Chapter 4: Illegal dumping

Chapter 5: Public consensus to solve NIMBY problem

Introduction

Chapter 1

Background

- The Dominican Republic has been registering a very rapid population growth and economic development, therefore the generation of solid waste has increased.
- This situation makes necessary the consensus and participation of the citizenship regarding the solid waste management.
- The current management impacts in a negative way, the public health, life quality, natural resources and the environment in general.

Objective and Content of the Manual First part

- Encourage the citizen participation in the efforts for the integrated management of wastes.
- The manual covers the following aspects:
  - General concepts between environment and human being.
  - Environmental education
  - Illegal dumping
  - Public consensus to solve NIMBY problem

General concepts

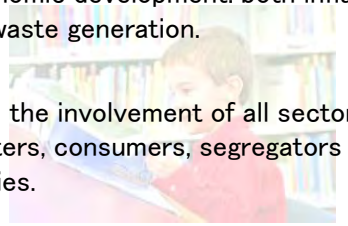
Chapter 2

About Integrated Solid Waste Management…

- **The Integrated Solid Waste Management (ISWM)** is a system of management of the solid waste that, based on sustainable development, has as a main objective the improvement in the health of the residents and the environmental preservation.

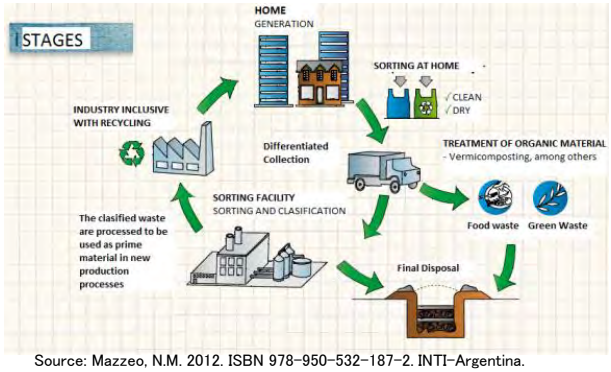
Importance of ISWM

- Due to the accelerated growth of the population and the economic development: both influence directly on the waste generation.



- It allows the involvement of all sectors: producers, distributers, consumers, segregators and recycling companies.
- Reduce the solid waste and in consequence decreases the environmental impact and increases the lifespan of the final disposal sites.

Functional cycle of the ISWM



Source: Mazzeo, N.M. 2012. ISBN 978-950-532-187-2. INTI-Argentina.

Sectors involved with the ISWM

Objectives of ISWM

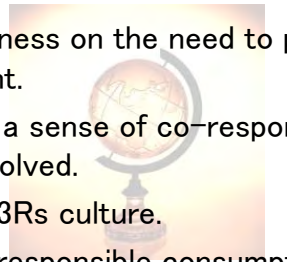
- Reducing the generation of waste.
- Favoring the reutilization and recycling, reducing with this the amount of waste destined to final disposition.
- Protecting the human health.
- Improving the quality of life of the population.
- Preserving and protecting the environment.
- Conserving and promoting the rational used of natural resources.

Environmental education

Chapter 3

Objective of environmental education in the ISWM

- Rise awareness on the need to protect the environment.
- Develop of a sense of co-responsibility of all sectors involved.
- Promoting 3Rs culture.
- Promoting responsible consumption.



Environmental Education on ISWM DR

- Experiences in the proper management of solid waste.
- Activities related to the 3Rs (segregation at source, selective collection, composting for school, etc.).
- Responsibility (attitude to the payment of the tariff for the service, including the disposal).

Illegal dumping

Chapter 4

Responsibility of the city halls

Obey and supervise what is established in the Law 64-00, on the Environment and Natural Resources:

•*Art. 106*: Operate the systems of collection, treatment, transportation and final disposal of non-hazardous solid waste, observing the official Standards for the protection of the environment and the health.

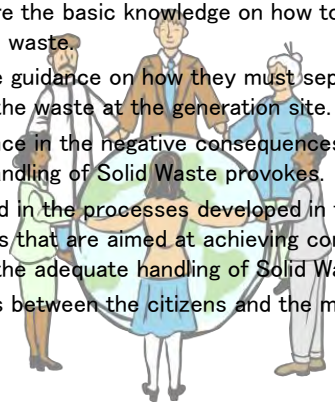
•*Art. 107*: It is prohibited the placement, throw and final disposal of solid or liquid waste, toxic or not, in sites that have not been established for that.

Civil Responsibility

- Respect the provisions of the competent authorities in relation to the appropriate handling of Solid Waste (days and schedule of collection).
- Place the waste in appropriate containers (bags, bins, buckets, sacks, etc.).
- Keep the waste inside the generation site until they are picked up.
- Maintain the household, school, workplace, etc. surroundings free of solid waste (garbage).
- Abstain from taking out or dumping waste in the sidewalks, curbs, and streets during rain periods.
- Do not dump waste in, or close to, bodies of water (rivers, creeks, ravines, lakes, lagoons, swamps, seas) to avoid the contamination of the aforementioned.

Civic participation

- Must acquire the basic knowledge on how to adequately handle solid waste.
- Receive the guidance on how they must separate and dispose of the waste at the generation site.
- Hear guidance in the negative consequences that the improper handling of Solid Waste provokes.
- Get involved in the processes developed in their communities that are aimed at achieving common goals in regards to the adequate handling of Solid Waste.
- Create links between the citizens and the municipal authorities.



Industrial and Entrepreneurial responsibility

- Ethics and social responsibility of the company
  - Quality of life in the company (social work dimension).
  - Entailment and commitment with the community and its development.
  - Care and preservation of the environment.
- Among the responsibilities, it is important to point out:
  - Contact authorized managers for the management of their waste with the objective of preventing the illegal dumping.
  - Be co-responsible of the ISWM in all processes in which they are involved (consumption, extraction of resources, manufacturing, storage, distribution and commercialization of goods and services, including the post consumption management of products at the end of their lifespan and of the resulting waste).

Public consensus to solve NIMBY problem

Chapter 5

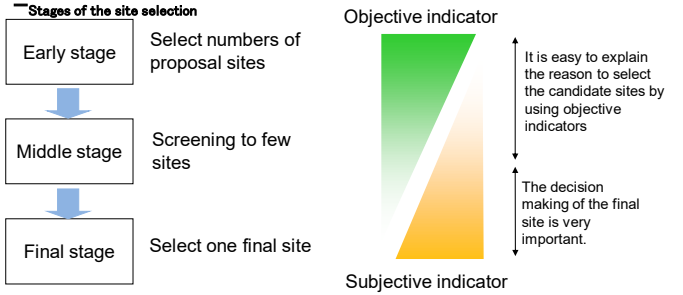
What is the process of developing public consensus?

- It is the process and methodology of joint work that allows the fulfillment of the **genuine involvement** of the residents in the solution of its problems, taking into account **not only solely technical, environmental or economic indicators, but other more extent objectives** that consider above all, the life in its physical, psychological and social dimensions (subjective indicators).
- Development of public consensus it is not a public view, which is only an aspect of the entire process of developing public consensus.

What is NIMBY?

- The **NIMBY** ("**N**ot in **M**y **B**ack **Y**ard") syndrome refers to the citizen's reactions when without opposing the activities per se, they organize against the risks that they perceive said installations, that are perceived as dangerous, would bring upon their immediate surroundings.

Consensus and selection process of solid waste FDS



- The final decision shall depend on the subjective indicator.
- The subjective indicator is to get the land without any troubles among the stake-holders around the site.

Preparation of consensus with the communities affected by the FDS

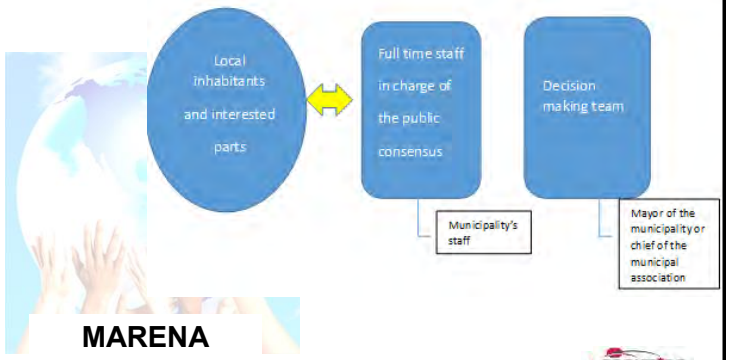
- It is important to answer all questions and comments of the inhabitants from the announcement of the definite site.
- The questions of the inhabitants cover a large range of the topic. Not only construction, but also operation of the landfill.

- Therefore, the decision-making team, must be established, who will have the responsibility of the landfill matters.

Points for building public consensus among the inhabitants

① Consider the target negotiators among the inhabitants
② Clearly designate the contract person
③ Clearly designate the person that the decision will be taken
④ Consistent explanation
⑤ Organize an internal framework to win the information War
⑥ Clarify of the reach to be revised with the public participation
⑦ Gain trust through the sincere communication

Structure for the development of public consensus



MANUAL OF ENVIRONMENTAL EDUCATION AND DEVELOPMENT OF PUBLIC CONSENSUS FOR THE INTEGRATED MANAGEMENT OF MUNICIPAL SOLID WASTE.

SECOND PART

IMPLEMENTATION OF THE EE PROCESS AND DISSEMINATION OF INFORMATION

Content

Introduction

- Chapter 1

Justification and objective second part of the manual

JUSTIFICATION

- Very weak community participation
- The bad practices trespass all social levels
- The current SWM risks one of the goals of the NDS: 10 million tourists/year.

OBJECTIVE

- Provide tools for the implementation of the EE and the dissemination to the community.

Implementation of the EE

- Chapter 2

Implementation of the EE process

- Creation of a structure inside the municipality with the participation of different departments (UGAM, Sanitation and adornment, community participation, public relations and communication, among others).
- Training of the responsible team.

Implementation of the EE process

- Prior activities: Investigation of the municipality with focus on the SWM (sectors, social classes, habits, etc.).
- Planning on how to develop the EE process.

Civic participation

- Chapter 3

Civic participation

How can the community participate in the EE process for the ISWM?

- Attending to the education activities (chats, workshops, cleaning journeys, fairs, meetings, etc.) sponsored by the city halls.
- Supporting the information dissemination.
- Monitoring the respect to the steps, schedules and collection days.

Civic participation

- The city hall must establish an interinstitutional coordination (MSP, MINERD, private sector, etc.).
- The city hall must establish partnerships with the key stakeholders (neighboring boards, church, clubs, mother's associations, etc.).
- The city hall must promote the creation of a concrete participation mechanism (committee/ council/ table)

Dissemination to the community

- Chapter 4

Dissemination to the community

- Dissemination is an action and effect of diffusing, meaning, promoting, disclosing or publishing something to have it at the reach of the public.
- It is linked to the communication task.
- Prior to this action, it is necessary to know **what** it is that will be disseminated or informed, **to who** (target public), for what (objective), **how** (means/method) and **where**

Dissemination to the community

MEANS/METHODS

- Visits door to door/ Personal contacts
- Meetings with the community
- Handing out informative fliers, brochures, sheets or bulletins.
- Placing signs, posters and billboards in strategic points of the public road.

Dissemination to the community

MEANS/METHODS

- Telephone line/ call center
- Internet (web sites, social networks)
- Videos/documentaries
- Mass communication means (radio, TV, newspaper, magazines)
- Campaigns
- Others (competitions, murals, posters, visits to the SWM facilities, etc.)

Good practices of the EE in DR focused on the ISWM

- Chapter 5

ISWM INITIATIVES

- 2002–2006: Project **SABAMAR** (Sanitation of Marginal Neighborhoods, by its acronym in Spanish) in the National District.
- 2004: **Didactic Guideline** on the environmental education regarding solid waste directed to teachers (GIZ support). Reedited in the 2013.

ISWM INITIATIVES

- 2010: The Center for the Agricultural and Forestry Development– CEDAF started an **educational program** in an education center called **"I recycle"**, with the sponsoring of the Dominican Popular Bank. After the **2013**, the program was called **"I Recycle with clean points"**.

ISWM INITIATIVES

- 2010: The city hall of San Jose de Las Matas began the implementation of the **program "Basura Cero"**, with the support of GIZ, following the model of Las Placetas, pioneers in the country.
- 2011: CEDAF, Ministry of Environment and Ministry of Education, made the dissemination of the **GUIDELINE OF THE 3Rs: REDUCE – REUSE – RECYCLE.**

ISWM INITIATIVES

- 2013: The National Network of Corporate Support for the Environmental Protection– ECORED, with the support from the Inter–American Bank of Development, started the **projects of formalization of the informal segregators** (waste pickers), which includes the awareness and involvement of the citizens in **SDE, Samana** and **SPM**.

ISWM INITIATIVES

- 2013: I National Recycling Week

Launching of the **Campaign "Clasificando aportas" (Classifying you contribute).**

- 2014: FOCIMIRS
- 2014: II National Recycling Week
- 2015: III National Recycling Week

Conclusions and Recommendations

- Chapter 6

CONCLUSIONS

- Notwithstanding such a **big problem**, the low demand for the sanitation services evidence the **lack of transcendence and priority** that the population in general assigns to the solid waste management.
- The civic participation is very weak.

CONCLUSIONS

- Not all necessary efforts have been made in terms of education and dissemination of the information aiming to the stimulation of the civic participation in the solid waste management.
- Some isolated campaigns have been developed by the communication means.
- There have been no permanent campaigns for awareness/consensus for the development of the sense of co-responsibility in the citizens.

RECOMMENDATIONS

- Develop permanent programs for the dissemination, awareness and environmental education focusing on the ISWM, in order to create attitude and values that translate into responsible behavior in the citizens.
- Create mechanisms for the civic participation in the ISWM.

RECOMMENDATIONS

- The city halls must elaborate an information dissemination procedure, taking into account their intrinsic reality (organizational structure for example) and of the community to which it is directed to.
- Allocate the financial resources needed for the implementation of the EE and the dissemination of information in their budget.

Thank you!

Introduction

This manual describes the methods for municipalities to implement adequate financial management:

- Understanding the municipal financial situation in solid waste management.
- Cost estimate required by the Integrated Solid Waste Management Plan.
- Clarify the means to secure the necessary funds for the budget.

Objective

Provide a tool for municipalities to develop the capacity to develop an accounting system in the integrated management of solid waste, which allows to understand the financial condition of each municipality.

The accounting system of each municipality can be developed in collaboration with the headquarters of the Ministry of Environment and Natural Resources and its Provincial Directorates.

Content

Legal Framework

The following are the legislations related to financial management for ISWM:

✓ Standard for Environmental Management of Non-Hazardous Solid Waste (NA-RS-001-03).

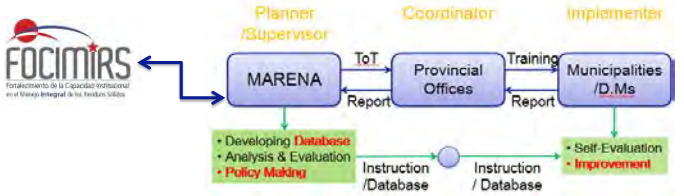
✓ Policy for the Integrated Management of Municipal Solid Waste (RSM).

✓ Law No. 176-07 of the National District and Municipalities.

System of Accounting for the Management of Solid Waste

Accounting systems are developed exclusively to maintain order and transparency in a specific area; hence the importance of implementing such a system in the municipality, in relation to the management of solid waste.

What is it that we want to achieve?



→ Development of training and a Database system.

Information flow of the database for the ISWM in the municipalities

What is it that we have to do?

1. Develop a format and collect data
   To understand the financial situation of the target municipalities.
2. Data analysis and evaluation
   To develop a database and indicators for ana and evaluation.
3. Take action
   To examine measures for improvement.

Accounting formats

Develop formats, collect and record data related to the various operations and aspects involved in the management of solid waste. The formats for recording information should be simple and easy to fill (where possible).

Revenue Format for Solid Waste Management

No.	Item	Ingreso (RD$)
1.	Fondos provenientes del Presupuesto del gobierno central	
	1.1 Presupuesto del Ministerio de Hacienda.	
	1.2 Presupuesto de LMD (si aplica).	
	1.3 Presupuesto de otras entidades gubernamentales (especificar si existen).	
2.	Fondos provenientes del Presupuesto del municipio	
	2.1 Presupuesto anual del municipio.	
	2.2	
3.	Cobro de Tarifa de recolección	
	3.1 Tarifa de recolección.	
	3.2 Tarifa de recolección para empresas, instituciones, etc.	
	3.3 Tarifa de recolección de otros generadores de residuos (si existen).	
	3.4	
4.	Subsidio de donantes, ONGs y/o proyectos específicos (si existen).	
5.	Otros (especificar).	
Total		

Elaboración por el equipo de expertos de JICA del proyecto FOCIMIRS.

Format of Solid Waste Management Costs

No.	Item	Costo (RD$)
1.	Costos iniciales	
1.1	Costo de construcción, rehabilitación & demolición.	
1.1.1	Instalaciones de recolección y transporte.	
1.1.2	Instalaciones de tratamiento intermedio y reciclaje.	
1.1.3	Instalaciones de disposición final.	
1.1.4	Otras instalaciones.	
1.2	Costo de encuestas para instalaciones (F/S, EIA, etc.).	
1.3	Costo de contribución (en el caso de inversión multi-municipal para instalaciones).	
	Subtotal	
2.	Costos operacionales	
2.1	Costos de personal	
2.1.1	Personal de gestión y administrativo	
2.1.2	Personal técnico y de campo	
2.1.2.1	Responsable de recolección y transporte	
2.1.2.2	Responsable de tratamiento intermedio y reciclaje.	
2.1.2.3	Responsable de disposición final	
2.2	Costo de operación y mantenimiento.	
2.2.1	Operación y mantenimiento de recolección y transporte	
2.2.2	Operación y mantenimiento de tratamiento intermedio y reciclaje.	
2.2.3	Operación y mantenimiento de disposición final	
2.3	Costo de compra de vehículo.	
2.4	Costo de subcontratación (outsourcing).	
2.4.1	Subcontratación de recolección y transporte.	
2.4.2	Subcontratación de tratamiento intermedio y reciclaje.	
2.4.3	Subcontratación de disposición final.	
2.4.4	Otras subcontrataciones.	
2.5	Costo de contribución (en el caso de operación y mantenimiento multi-municipal)	
2.6	Costo de encuesta de satisfacción, investigación educación ambiental y difusión a la comunidad (excepto para F/S, EIA, etc. para instalaciones).	
	Subtotal	
3.	Otros (especificar)	
Total		

Elaboración por el equipo de expertos de JICA del proyecto FOCIMiRS.

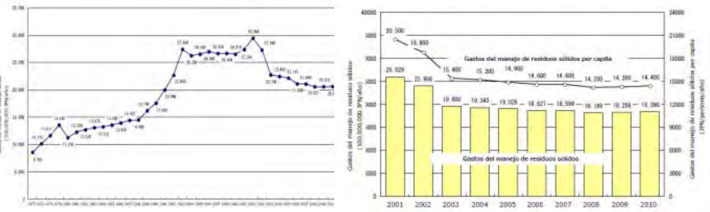
The costs of solid waste management and trends in solid waste management in Japan

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Población Total (1,000person)	127,007	127,299	127,507	127,606	127,712	127,781	127,487	127,530	127,429	127,302
Ingresos – Total	2,120,033	1,975,963	1,750,387	1,709,196	1,683,421	1,862,653	1,859,902	1,823,476	1,832,021	1,838,976
Ingresos – Finanzas generales	1,497,631	1,480,046	1,411,268	1,353,531	1,357,926	1,350,754	1,345,236	1,343,986	1,340,785	1,352,056
Ingresos – Fuentes de ingresos específicos – Gastos de la tesorería nacional	131,508	53,354	37,276	50,178	31,033	56,650	46,752	37,099	47,880	50,662
Ingresos – Fuentes de ingresos específicos – Gastos de la provincia	9,410	7,971	6,072	8,448	5,462	5,406	5,370	5,068	6,651	8,632
Ingresos – Fuentes de ingresos específicos – Tarifas y comisiones	131,418	136,731	144,119	152,860	166,229	231,113	234,965	235,077	230,928	231,862
Ingresos – Fuentes de ingresos específicos – Bonos municipales	292,861	235,627	91,539	76,539	61,551	125,949	107,184	85,012	99,293	82,206
Ingresos – Fuentes de ingresos específicos – Otros	57,205	62,234	60,113	67,640	61,220	92,781	120,395	117,234	106,484	113,558
Ingresos – Fuentes de ingresos específicos – Sub-total	622,402	495,917	339,119	355,665	325,495	511,899	514,666	479,490	491,236	486,920
Gastos – Gastos del manejo de residuos solidos	2,602,866	2,395,621	1,960,037	1,934,330	1,902,500	1,836,474	1,856,771	1,815,073	1,813,551	1,837,438
Gastos – Costos de construcción – Costos de construcción – Instalaciones de los vehículos de recolección	-	-	-	-	-	26,182	3,130	1,873	3,037	1,539
Gastos – Costos de construcción – Costos de construcción – Instalaciones de tratamiento intermedio	861,391	654,322	260,994	214,516	207,294	164,470	177,530	153,068	173,406	151,144
Gastos – Costos de construcción – Costos de construcción – Sitio de disposición final	79,370	80,074	62,110	71,692	62,040	42,114	23,966	17,096	10,356	24,031
Gastos – Costos de construcción – Costos de construcción – Otros	17,907	23,874	12,844	12,117	10,276	7,302	4,777	4,230	5,071	8,483
Gastos – Costos de construcción – Costos de construcción – Encuestas/Estudio	10,229	7,484	6,104	3,450	2,796	4,277	3,188	3,430	3,356	3,769
Gastos – Costos de construcción – Costos de construcción – Sub-total	968,897	765,754	342,052	301,775	282,406	218,163	209,461	177,824	192,189	187,427
Gastos – Costos de construcción – Costos de construcción – Cuotas de sindicato (Referencia)	54,481	54,381	37,009	38,136	31,318	24,852	24,967	27,357	24,848	20,810
Gastos – Costos de mantenimiento, etc. – Gastos de personal	610,407	588,769	561,777	550,043	534,988	522,187	519,282	495,676	473,014	488,464
Gastos – Costos de mantenimiento, etc. – Gastos de tratamiento – Recolección y transporte	81,568	79,309	77,212	78,861	75,538	67,048	71,687	65,967	63,975	64,792
Gastos – Costos de mantenimiento, etc. – Gastos de tratamiento – Tratamiento intermedio	263,008	269,099	277,061	283,153	277,656	277,683	284,230	285,512	273,069	268,864
Gastos – Costos de mantenimiento, etc. – Gastos de tratamiento – Disposición final	40,569	42,994	36,770	36,140	28,825	29,817	31,756	34,624	33,288	36,714
Gastos – Costos de mantenimiento, etc. – Compra de vehículos	11,749	11,902	10,105	7,702	8,016	7,329	5,933	6,792	7,959	4,855
Gastos – Costos de mantenimiento, etc. – Comisión expenses – Recolección y transporte	-	-	-	-	268,980	277,128	279,929	292,206	300,504	300,959
Gastos – Costos de mantenimiento, etc. – Comisión expenses – Tratamiento intermedio	-	-	-	-	238,779	254,516	264,068	279,650	287,098	294,342
Gastos – Costos de mantenimiento, etc. – Comisión expenses – Disposición final	-	-	-	-	47,949	48,543	52,948	46,911	44,140	43,036
Gastos – Costos de mantenimiento, etc. – Comisión expenses – Otros	-	-	-	-	29,053	22,999	25,167	21,386	21,393	22,766
Gastos – Costos de mantenimiento, etc. – Comisión expenses – Gastos de contratación externa	488,225	504,265	529,341	545,482	584,761	603,186	622,112	640,152	653,134	661,102
Gastos – Costos de mantenimiento, etc. – Otros	50,929	45,193	43,950	43,210	-	-	-	-	-	-
Gastos – Costos de mantenimiento, etc. – Estudios de investigación	-	-	-	-	3,918	1,575	1,222	1,426	1,167	1,173
Gastos – Costos de mantenimiento, etc. – Sub-total	1,546,455	1,541,531	1,536,216	1,544,591	1,513,702	1,508,825	1,536,222	1,530,149	1,505,606	1,525,964
Gastos – Costos de mantenimiento, etc. – Cuotas de sindicato (Referencia)	271,315	277,943	285,904	272,923	250,682	241,279	243,117	247,728	249,676	234,946
Gastos – Otros	87,514	88,336	81,769	87,964	106,392	109,486	111,088	107,100	115,756	124,047
Gastos del manejo de residuos sólidos per capita(JPN/capita/año)	20,500	18,800	15,400	15,200	14,900	14,600	14,600	14,200	14,300	14,400

Source: Solid Waste Management of Japan, fiscal year 2010 edition, Ministry of Environment, Secretary of the Minister in Solid Waste Management and the Recycling Department. Division of Solid Waste Management.

Analysis and Evaluation

Once the information is recorded, it is necessary to process it to proceed with the analysis and evaluation of the data obtained. The resulting data can be presented in the form of graphs for a better understanding and visualization of trends in solid waste management.



Trends in spending on solid waste management in Japan until 2010.

Indicators of performance

- Efficiency in the Collection & Transportation:

Collection & *Transportation Efficiency*= $\frac{Collection\ cost\ (RD\$)}{Collected\ waste\ (t)}$

- Efficiency in the Final Disposal:

Final Disposal Efficiency= $\frac{Disposal\ cost\ (RD\$)}{Disposed\ waste\ (t)}$

- Overall ISWM Efficiency:

Overall SWM Efficiency= $\frac{SWM\ cost\ (RD\$)}{Discharged\ waste\ (t)}$

Comparison among the municipalities taking into account the population density ($person/km^2$), economic level (GDP), etc.

APPENDIX 10-2

Take action

The purpose of the evaluation is to determine the behavior of the elements of ISWM management to detect deviations in the execution and, if necessary, to apply the corrective measures in a timely manner.

Following the cycle of continuous improvement, according to the results obtained, it will be necessary to take measures to improve the quality, effectiveness and efficiency of the services offered by the municipality.

Benefits

For the municipalities/D.M.:

✓Understand the financial reality of ISWM.
✓Understand your performance level (and compare with other municipalities)
✓Identify causes of problems and find solutions for improvement.
✓Improve processes
✓Design new services
✓Make decisions about how a given service will be delivered
✓Define the sustainability of your services

For MARENA

- Understand actual situation in municipalities;
- Identify excellent & poor municipalities;
- Develop law & policy for improvement.

Measures to improve the financial sustainability of the ISWM

Measures without additional budget

✓Positioning and properly assigning the personnel involved in the ISWM.
✓Establish minimum and logical routes and a collection schedule [1].
✓Operation with minimum management criteria established by the Ministry of Environment and Natural Resources [2].
✓Examine an adequate allocation of the budget between the different service areas of a municipality.

Establish and charge fees for services

In setting the rates of grooming rates, municipalities should pay particular attention to the following points:

✓The unit rate should be determined based on the accurate analysis of the costs of the operation and maintenance services.
✓Accountability of the general public must be achieved.

[1] Refer to the Collection and Transportation Manual.
[2] Refer to the Final Disposal Manual.

Technically, there are several types of fees and collection methods:

- Types of tariff:

Payment for single tariff | Pay per simple dumping | Payment for excess dumping

- Collection methods:
  - Separate invoice (e.g., ADN);
  - Bolsa de Residuos Designada (Japón);
  - Junto a la factura de la electricidad / Agua, etc.

Tariff calculation method

Calculation of monthly rate for total recovery without subsidy

$$Trt = \frac{Cat}{12\ FCS} \quad (6)$$

Where:
Trt = Family monthly rate for total recovery (RD $ / family)
Cat = Total annual cost of service (RD $ / year)
FCS = Number of families with service in the population.
12: Conversion factor from year to months (12 months / year). The year has twelve months

Calculation of monthly fee according to generation

$$Tmf = \frac{30\ (ppci)(Cut)(N)}{1000} \quad (7)$$

Tmf = Monthly family rate for the social stratum i (RD $ / family-month)
Ppci = Production per capita in the socioeconomic stratum i (kg / inhab. / Day)
Cut = Total unit cost (RD $ / ton)
N = Average number of people per family (inhab / family)
30 and 1.000 = Dimensional parameters. 30 refers to the days / month and 1,000 is the conversion of kilograms to tons (kg / t).

17

Public sector projects

The public sector projects have as main objective to provide services to the public seeking public welfare and not profits. Some examples of the public sector are: hospitals, parks, schools, roads, landfills, among others.

Before designing a project for the public sector, a financial profitability analysis should be done, which is the first step in the evaluation of a project, since the feasibility of the project must be studied from the point of view of its financial results.

There are significant differences in the characteristics of the projects carried out by the public and Private sectors.

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Differences between public and Private projects

Characteristics	Public Sector	Private Sector
Magnitude of the Investment	Bigger	Some great; Most medium to small.
Lifespan	Longer (30-50 or more years)	Shorter (2-25 years)
Estimated Annual Cash Flow	No gain; Costs, benefits and counter-benefits are estimated.	Income contributes to profit; The costs are estimated
Financing	Tax, royalty payments, bonds, Private funds	Stocks, bonds, loans, individual owners.
Interest Rate	Lower	Higher, based on the cost of capital in the market.
Criteria for selecting alternatives	Multiple Criteria	Primarily based on performance rate.
Evaluation environment	Influenced by politics	Mainly economic

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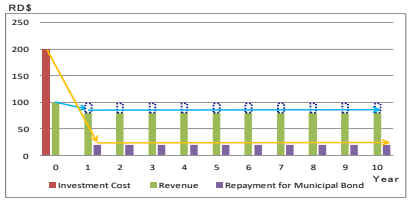
Request Loans

The loan is a long-term debt. In principle, local governments must cover annual expenses for annual income. However, the construction of certain public infrastructure, such as a controlled dumping site / landfill, requires a huge investment and its useful life will be extended for many years. Therefore, the municipality can consider a loan for the development of infrastructures in the long term.

This modality allows a shared cost among the generations (users), since the infrastructure will benefit the current generation as well as future generations.



Amortization of capital

20

APPENDIX 10-2

Public Private Alliance

It is an instrument through which government authorities can assign to any natural person or legal entity to design, project, finance and execute, within a specified period, the construction, development, maintenance and exploitation, or only the exploitation, of a work of art. Infrastructure for the provision of a public service

They are of vital importance where governments face old infrastructures and require more efficient services, a partnership with the Private sector could be useful in promoting a new solution.

This allows governments to benefit from the specialties of the Private sector, allowing them to focus on policy, planning and regulation by delegating day-to-day operations.

Benefits of Public Private Alliance (PPP)

Benefits for the City Hall	Benefits for the Private Sector
– Because the Private Sector will contribute with the initial investment and working capital, the City Hall will benefit with less expenses when it comes to the municipal budget. – The involvement of the Private sector in matters related to Municipal SWM. – Benefits that will be obtained of the administrative and technological specialization provided by the Private sector, etc.	– Ensuring a market without competition for the time the contract lasts. – Projecting an image of social responsibility before clients. – Incursion in the development of the solid waste valorization market.

Risks of Public Private Alliance (PPP)

Risks for the City Hall	Risks for the Private Sector
Discontinuity of the service. Low performance in the quality of the service. Breaches of contract.	Contract breaches because of the lack of political willingness or political conflicts. Lack of capacity to obtain utilities during the contractual period. Uncertainty when it comes to renewing the contract.
Shared risk	
Obsolescence of service or entrepreneurship due to abrupt fluctuations in the market or technological innovations.	

Must be taken into account in a PPP

- A cautious analysis of the objectives to be developed in the long term, and the detection of risks, is essential in order to achieve a successful union.
- The legal framework should adequately support this new model of service delivery and be able to monitor and regulate the products and services provided.
- A well drafted PPP agreement will be nurtured both by the country's laws and international best practices, to clearly delineate the risks and responsibilities.

PPP Options

Options for BOT	Official Name
DC (DB)	**Design –Construcción** (Design–Build)
COT (BOT)	**Construye–Opera–Transfiere** (Build–Operate–Transfer)
CTO (BTO)	**Construye–Transfiere–Opera** (Build–Transfer–Operate)
CPOT (BOOT)	**Construye–Posee–Opera–Transfiere** (Build–Own–Operate–Transfer)
CPO (BOO)	**Construye–Posee–Opera** (Build–Own–Operate)
DCO (DBO)	**Diseño–Construcción–Operación** (Design–Build–Operate)
DCFO (DBFO)	**Diseño–Construcción–Financia–Operación** (Design–Build–Finance–Operate)
AROT (LROT)	**Construye–Arrienda–Transfiere–Mantiene** (Build–Lease–Transfer–Maintain)
CATM (BLTM)	**Arrienda–Renueva–Opera–Transfiere** (Lease–Renovate–Operate–Transfer)

Source: Manual for Public-Private Partnership Handbook, Ministry of Finance, Singapore 2004.

Comparison of possible PPP options

Option	Assets Owner	Operation and maintenance	Capital Investment	Commercial risks	Duration of the contract
Service contract	Public	Public and Private	Public	Public	1-2 years
Franchise	Public	Public and Private	Public	Public	1-5 years
Management Contract	Public	Private	Public	Public	3-5 years
Leasing contract	Public	Private	Public	Public and Private	8-15 years
Concession	Public	Private	Private	Private	25-30 years
BOT and its variations	Public y Private	Private	Private	Private	20-30 years
Complete privatization	Private/Private and Public	Private	Private	Private	Undefined

Source: Manual for Public-Private Partnership Handbook, Ministry of Finance, Singapore 2004.

Criteria for the optimal selection of PPP

Clear criteria should be used to select the best and optimal option for private sector participation in the provision of solid waste management services:

- ✓Benefits
- ✓Costs
- ✓Sustainability
- ✓Effectiveness
- ✓Normative
- ✓Competition and Efficiency
- ✓Accessibility to Capital Investment
- ✓Responsabilidad y Transparencia
- ✓Risks and Sustainability
- ✓Equity
- ✓Transparency
- ✓Institutionality
- ✓Importance of the project

Experience in different types of contracts

- **Provision of vehicles or heavy equipment:** By lease agreement with equipment owners.
- **Pre-collection of household solid waste:** By franchise.
- **Pre-harvesting of solid household waste:** By service contract.
- **Collection of general municipal waste from whole neighborhoods:** By service or franchise agreement, or by management agreement.
- **Sweeping streets and open spaces:** By service contract.
- **Repair of municipal solid waste equipment:** By contract of service according to the needs.
- **Repair of municipal solid waste equipment:** By long-term service contract.
- **Conversion of waste to compost:** By service contract or concession.
- **The operation of a final disposal site:** By service contract or concession.

Source: "Participation of the Private Sector in the Management of Municipal Solid Waste, Part I: Executive Review "by WR.

Thank you!

FOCIMIRS

Progress of Component Database of Solid Waste Management

2 de Agosto 2016

María De León

Content

Time	Content		min
13:00 -	Presentation		15
13:15 -	Demonstration of how to fill out the Questionnaire		25
	Equipment Table Practice		20
	Number of trips Table Practice		20
14:20 -	Break		5
14:25 – 15:15	Practice of Entering Data with Working Groups	Questionnaire	15
		Table of equipment	15
		Amount of garbage	15

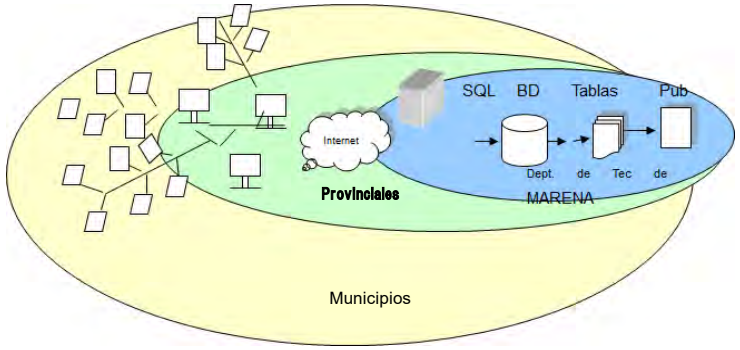
Contenido (presentación)

1. Introduction
2. Structure of the Database
3. Collection of data
4. Terms & Conditions
5. Results and Projections
6. Next steps

What is a Database?

- A Database is a tool developed through the collection of interrelated data, processing, analysis, interpretation of data and its use.
- An advantage of using a database is to make it easier for the user to obtain more information.

General structure of database system design



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5

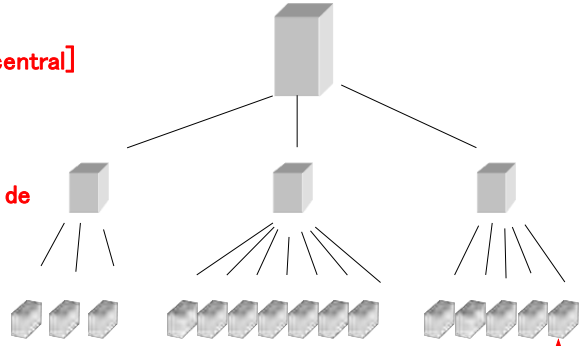
Estructura de las Instituciones Colaboradoras

Tres instituciones:

MARENA [central]

Direcciones Provinciales de MARENA

Municipios



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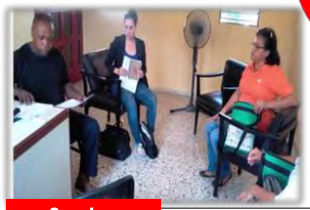
6

Collection of Data

Moca

D.M.



Sanchez

Azua

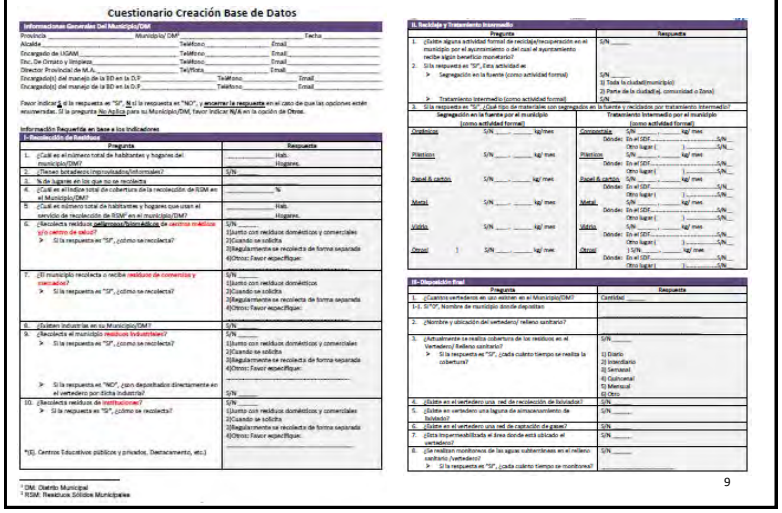
7

Visits to Final Disposal Locations and Team Workshops

8

APPENDIX 10-2

Working tools / Questionnaire


Cuestionario Creación Base de Datos

9

Working instruments / Equipment table

Ficha/ID	Tipo de equipo	Descripcion	Capacidad (Ton)	Observaciones
MACK-01	Compactador	Contenedores de, empresariales plástico y residuos sueltos y residenciales	10	Americano
IVECO-02	Compactador	Contenedores de metal	6.0	*Italiano/solo contenedores metal. *En proceso de disolución
DAIHATSU-03	Compactador	Residencias	1	
ISUZU-04	Compactador	Residencias	1	
ISUZU-05	Compactador	Residencias	1	
TOYOTA-06	Volteo	Podas escombros y otros orgánicos residenciales comerciales.	1	
NISSAN-07	Volteo	Podas escombros y otros orgánicos residenciales comerciales.	1	
DAIHATSU-08	Volteo	Podas YB, otros orgánicos residenciales.	1	

Example: City Hall of Sánchez

FichaID	Tipo de equipo	Descripcion	Capacidad (TON)
F-26	Volteo	Isuzu Verde	2.4
F-29	Volteo	Daihatsu Azul	3.6
F-30	Recolector Compactador	Iveco Blanco	5.4
F-31	Recolector Compactador	Iveco Blanco	5.4
F-33	Compactador	Iveco	9.6
F-36	Compactador	Hino Verde	2.6
F-39	Volteo	Isuzu Blanco	2.4
F-40	Volteo	Fuso Azul	3.5
F-42	Volteo	Isuzu Azul	2.4
F-43	Compactador	Mack	13.2
F-44	Volteo	Daihatsu Blanco	3.6
F-45	Volteo	Daihatsu	3.6
F-46	Compactador	Isuzu Azul	2.6
F-68	Compactador	Mitsubishi Verde	1.7
F-101	Volteo	Toyota 6000	3.5
	Pala Mecanica		DAÑADA
	Camiones		DAÑADOS

Example: Azua City Hall

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Working instruments / Trips table

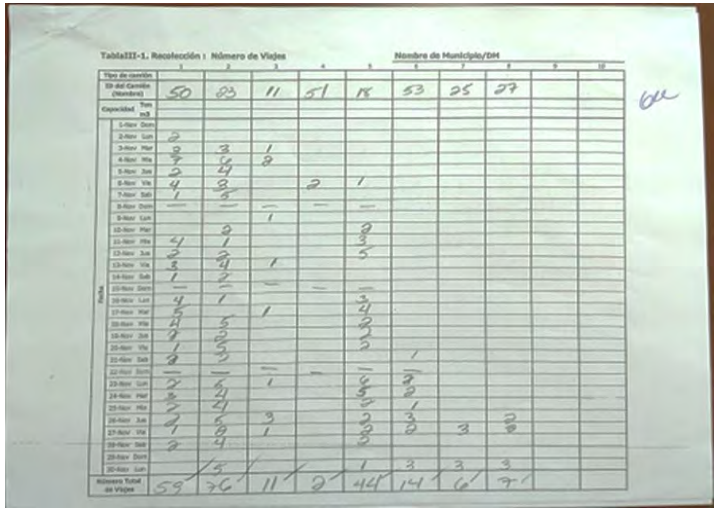
Tabla III-1. Recolección : Número de Viajes

11

Test of Database in Provincial Directorates

Technology Management explains the Process

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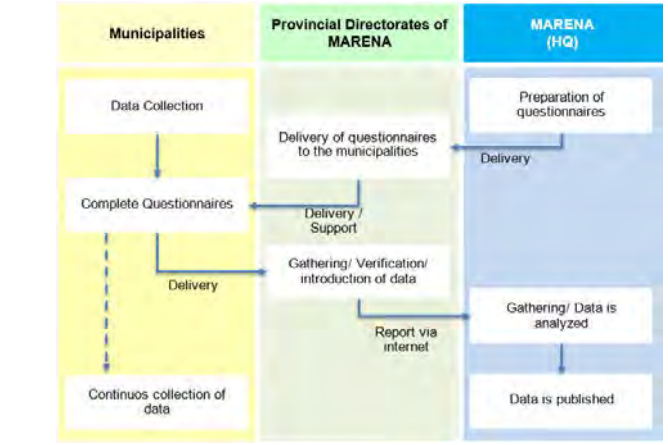
APPENDIX 10-2

Data Collection Scheme



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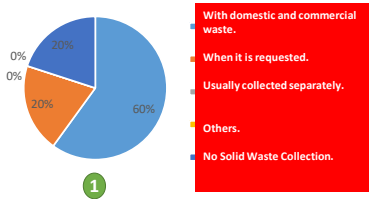
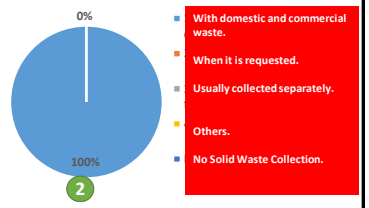
Images of the results of the "waste collection" data

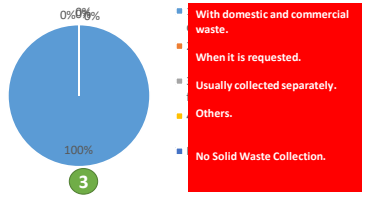
Biomedical-Hazardous Waste Collection



Recolección de Residuos Institucionales



Recolección de Residuos Comerciales



Recolección de Residuos Industriales

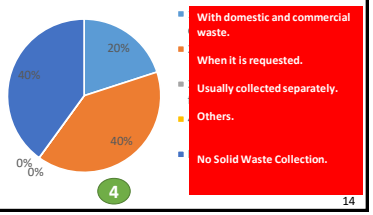
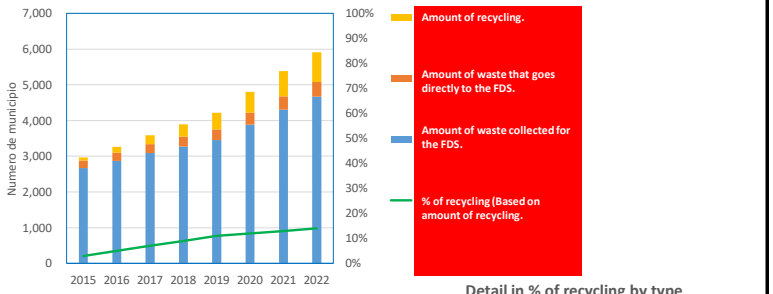
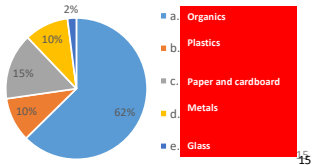


Image and Projections on "Recycling" data

Trend in the amount of Recycling



Detail in % of recycling by type



Practice Data Collection Test

- Questionnaire (1/year)
- Amount of waste (Monthly)

Questionnaire (1/year)


Cuestionario Creación Base de Datos

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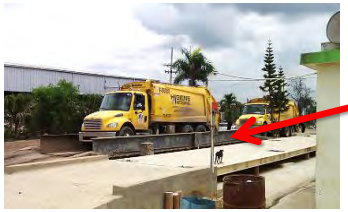
Amount of Waste (Monthly)



If there is a weighing machine available

Weighbridge in Duquesa's Dumping Site in Santo Domingo Norte

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VIII- Amount of solid waste	
Question	Answer
1. Amount of solid waste disposed in the dumping site / sanitary landfill by municipality / DM (ton / month)	_____ ton/m
2. Amount of solid waste disposed in the dumping site / landfill by businesses or industries, taken directly to the landfill (ton / month), if it has	_____ ton/m
3. Amount of solid waste disposed by other municipalities / DMs in their dumping site / sanitary landfill.	_____ ton/m

Equipment Table (If there is no weighing machine)

	Type of equipment	ID	Description	Measures	Capacity		
				L x A x H	M^3	t/m^3	ton
	Compactor						
	Compactor						
	Dump Truck						
	Truck						

1:Tipo de equipo de recolección

- Volquetas (estaciones de transferencia)
- Compactador (de lado, frente y carga trasera, con brazo mecánico)
- Volteo (grandes y pequeños)
- Camión (de cama fija y móvil)
- Tractor /Gredar
- Carretillas
- Camiones especiales

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APPENDIX 10-2

Equipment Table (If there is no weighing machine)

	Type of equipment	Ficha/ ID	Description	Measures	Capacity		
				L x A x H	M^3	t/m^3	ton
	Compactor	F-1 or Isuzu01					
	Compactor	F-2 or Isuzu02					
	Dump Truck	F-3 or Daihatsu03					
	Truck	F-4 or Mack04					

2: Ficha/ID del equipo

- ID: F-1,F-2,F-3....
- Brand: Daihatsu-01, Mitsubishi-02, Isuzu...
- Color: Azul-01, Rojo-02,
- Plate:
- Chassis, etc.
- Bed-01, Bed-02, Bed-03.....

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Measure of capacity

Volume(M^3) = Width(m) x Length(m) x Height(m)

Capacity(TON) = Volume(m^3) x 0.3-0.5 (t/m^3)

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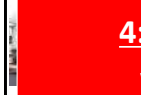
Equipment table (If there is no weighing machine)

	Type of equipment	ID	Descripción	Measures	
				L x A x H	M^3
			Isuzu, 388794, Azul	2.8 x 1.8 x 1.8	10.1
			Isuzu, 698794, Branco	3.0 x 1.8 x 1.9	10.3
			Daihatsu, 0au8794, Branco	3.9 x 1.8 x1.6	8.35
			Mack, 0329994, Azul	2.5 x 1.7 x 1.6	7.23

3: Measure

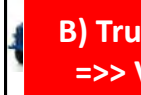
Length x Width x Height

4: Calculation

Volume (m^3) = Width(mts) x Length(mts) x Height(mts)

23

Equipment table (If there is no weighing machine)

	Types of equipment	ID	Description	Measures			
				L x A x H	M^3	t/m^3	ton
					10.1	0.5	5.5
					10.3	0.5	5.2
					8.4	0.3	2.5
					7.2	0.3	2.2

5: Calculation of conversion to Ton:

A) Compactors
=>> Volume(m^3) x 0.5 (t/m^3)

B) Trucks and Open Dump Trucks
=>> Volume (m^3) x 0.3 (t/m^3)

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Table Calculation of the Number of Trips (monthly)

Public

Direct

Ficha/ ID del Camion							
Capacidad Ton							
Fecha (Junio)	1-Jun Lun						
	2-Jun Mar						
	3-Jun Mie						
	4-Jun Jue						
	5-Jun Vie						
	6-Jun Sab						
	7-Jun Dom						
	8-Jun Lun						
	9-Jun Mar						
	10-Jun Mie						
	11-Jun Jue						
	12-Jun Vie						
	13-Jun Sab						
	14-Jun Dom						
	15-Jun Lun						
	16-Jun Mar						
	17-Jun Mie						
	18-Jun Jue						
	19-Jun Vie						
	20-Jun Sab						
	21-Jun Dom						

Tabla III-2: Directa: Número de Viajes

Nombre de la Empresa	1	2	3	4	5	6
Fecha (Junio) 1-						
2-						
3-						
4-						
5-						
6-						
7-						
8-						
9-						
10-						
11-						
12-						
13-						
14-						
15-						

Moca and its Municipal Districts Monitoring Activities Trips Table

Person in charge of entry and exit of vehicles in the Dumping Site

Number of Trips Table (Public)

Tipo de camion	Compactador	Compactador	Volteo	Volteo
Ficha/ ID del Camion	F1 o Isuzu01	F2 o Isuzu02	F3 o Daihatsu03	F4 o Mack4
Capacidad Ton	3	3.1	2.5	2.2
Fecha 1-Jun Lun				
2-Jun Mar				
3-Jun Mie				
4-Jun Jue				
5-Jun Vie				
6-Jun Sab				
7-Jun Dom				
8-Jun Lun				
9-Jun Mar				
10-Jun Mie				
11-Jun Jue				
12-Jun Vie				
13-Jun Sab				
14-Jun Dom				
15-Jun Lun				

(Each column represents a truck)

Tipo de equipo	Ficha/ ID	Descripcion	Medida L x A xP	Capacidad M3	t/m 3	ton
Compactador	F-1 o Isuzu01	Isuzu	2.0 x 1.8 x 2.8	10.1	0.3	3.0
Compactador	F-2 o Isuzu02	Isuzu	1.9 x 1.8 x 3.0	10.3	0.3	3.1
Volteo	F-3 o Daihatsu 03	Daihatsu	1.8 x1.6 x 2.9	8.35	0.3	2.5
Camion	F-4 o Mack4	Mack	1.7 x 1.6 x 2.5	7.23	0.3	2.2

Step 1: Please include ALL incoming trucks, including those under maintenance.

Number of Trips Table (Public)

Tipo de camion	Compactador	Compactador	Volteo	Volteo
Ficha/ ID del Camion	F1 o Isuzu01	F2 o Isuzu02	F3 o Daihatsu03	F4 o Mack4
Capacidad Ton	3	3.1	2.5	2.2
Fecha 1-Jun Lun	3	4	3	
2-Jun Mar	2	3	2	
3-Jun Mie	2	2	2	
4-Jun Jue	2	2	2	
5-Jun Vie	1	2	2	
6-Jun Sab		1	1	
7-Jun Dom				
8-Jun Lun	2	4	4	
9-Jun Mar	3	3	2	
10-Jun Mie	3	2	2	
11-Jun Jue	2	2	2	
12-Jun Vie	2	2	2	
13-Jun Sab	1	2	1	
14-Jun Dom				
15-Jun Lun	3	4	2	
16-Jun Mar	2	3	2	2
17-Jun Mie	2	2	3	
18-Jun Jue	2	2	2	2
19-Jun Vie	1	2	2	
20-Jun Sab	1	2	1	2
21-Jun Dom				

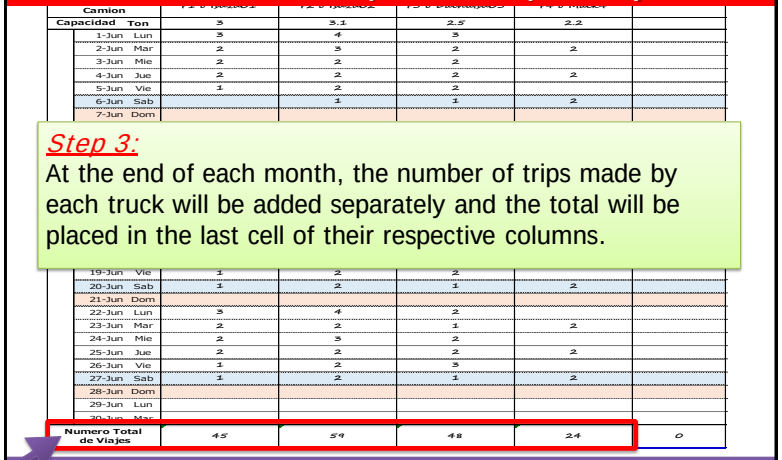
(Each column represents a truck)

Step 2: The number of trips each truck makes each day will be recorded in the cell that corresponds to the date of the day it is recorded.

Each cell represents one day and the number in this represents the number of trips per truck.

APPENDIX 10-2

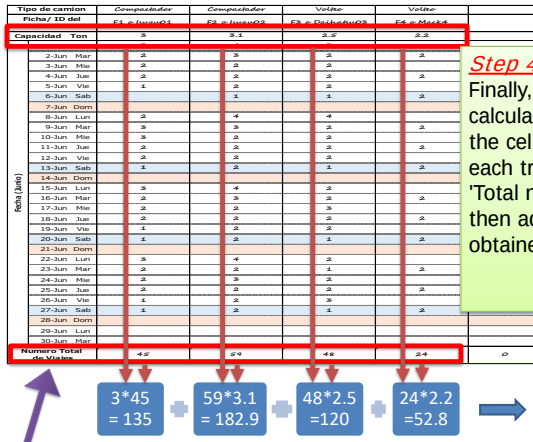
Number of Trips Table (Public)



Step 3:
At the end of each month, the number of trips made by each truck will be added separately and the total will be placed in the last cell of their respective columns.

Here the number of trips per column will be added.
The total will be recorded in the last cell of each of these columns.

Number of Trips Table (Public)

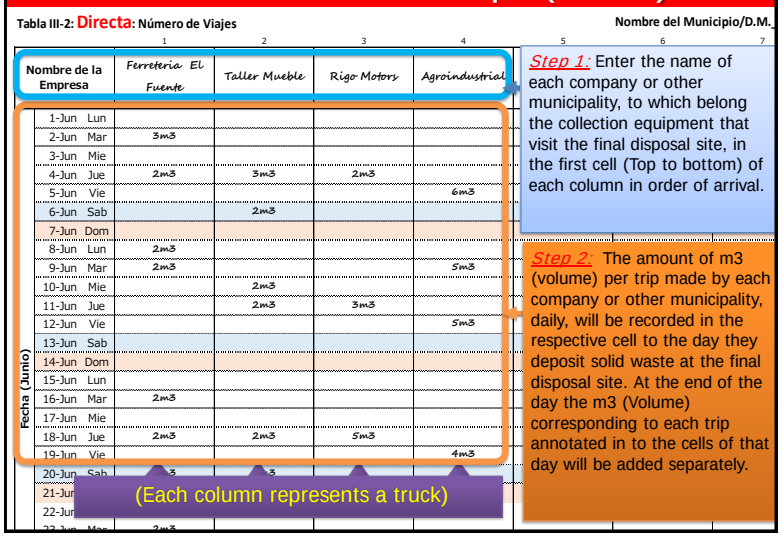


Step 4:
Finally, the total in Tons is calculated by multiplying the cell "Ton Capacity" of each truck by the cell 'Total number of trips', then add all the totals obtained.

3*45 = 135 | 59*3.1 = 182.9 | 48*2.5 =120 | 24*2.2 =52.8 → Total: = 490.7

Here the number of trips per column will be added.
The total will be recorded in the last cell of each of these

Table of Number of Trips (Direct)

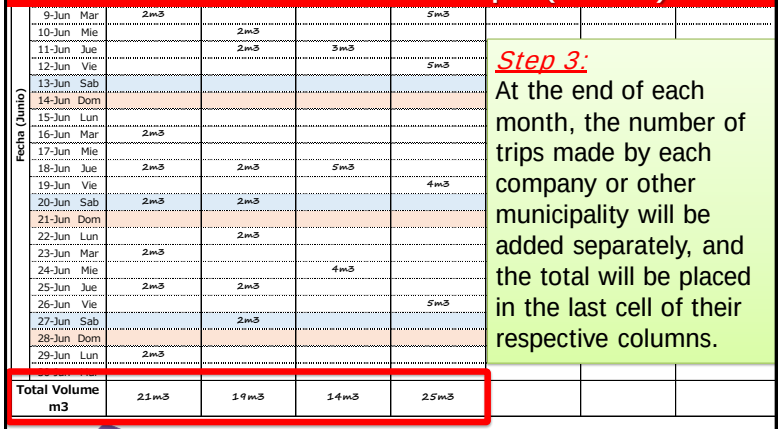


Step 1: Enter the name of each company or other municipality, to which belong the collection equipment that visit the final disposal site, in the first cell (Top to bottom) of each column in order of arrival.

Step 2: The amount of m3 (volume) per trip made by each company or other municipality, daily, will be recorded in the respective cell to the day they deposit solid waste at the final disposal site. At the end of the day the m3 (Volume) corresponding to each trip annotated in to the cells of that day will be added separately.

(Each column represents a truck)

Table of Number of Trips (Direct)



Step 3:
At the end of each month, the number of trips made by each company or other municipality will be added separately, and the total will be placed in the last cell of their respective columns.

Here the number of trips per column will be added.
The total will be recorded in the last cell of each of these columns.

Table of Number of Trips (Direct)

Fecha (Junio)					
9-Jun	Mar	2m3		5m3	
10-Jun	Mie		2m3		
11-Jun	Jue		2m3	3m3	
12-Jun	Vie			5m3	
13-Jun	Sab				
14-Jun	Dom				
15-Jun	Lun				
16-Jun	Mar	2m3			
17-Jun	Mie				
18-Jun	Jue	2m3	2m3	5m3	
19-Jun	Vie			4m3	
20-Jun	Sab	2m3	2m3		
21-Jun	Dom				
22-Jun	Lun		2m3		
23-Jun	Mar	2m3			
24-Jun	Mie			4m3	
25-Jun	Jue	2m3	2m3		
26-Jun	Vie			5m3	
27-Jun	Sab		2m3		
28-Jun	Dom				
29-Jun	Lun	2m3			
Total Volume m3		21m3	19m3	14m3	25m3

Step 4:
Finally, at the end of each month, the totals of m3 collected by each company or other municipality will be added, then this total will be converted to tons.

Total=79 m^3

Here you will add all the totals.

79 m^3*0.3ton/m^3=23.7 tons

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Database System practice

http://sistemas.ambiente.gob.do:882/

FOCIMRS
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"There are three types of people: Those who make things happen, those who watch things happen and those who ask what happened".

- Nicholas Murray Butler

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APPENDIX 10-2