Chapter 4

Pilot Projects

4 Pilot Projects

4.1 Integrated Improvement of the Collection Service

4.1.1 Background

The waste collection service in the National District is carried out by private companies, micro-companies and directly by the Municipality.

The contracts maintained between the Municipality and the private companies establish exclusively assigned territories to each of them. However, it is not fulfilled and the companies operate in areas different to those territories. On the other hand, the collection carried out by ADN with small trucks that was scheduled to collect waste in inaccessible areas and to support the collection work of sweeping waste does not fulfill its purpose. They generally carry out the service in the same areas assisted by the private companies.

The above-mentioned problems are caused by lack of collection route planning. Such overlapping work results in concentrating the service on urban areas which are easy to access and have wide avenues. There are considerable areas not covered by a collection service.

In such areas without a collection service, people take their waste to points along main avenues. Huge amounts of waste are accumulated at those points. Then, waste collection trucks repeatedly pass by those points.

The continuous flow of waste toward the main avenues causes inadequate storage of waste (small bags, containers of insufficient capacity, waste discharge at anytime). The collection which is carried out by small open trucks scatters part of the waste collected in the avenues during transport. Those are the main causes for the continuous uncleanliness of the city.

It can be said that the planning and the organization structure of the current collection service do not meet with the necessities of the city. The quality of the service is very low.

To change the current situation, a pilot project was carried out aiming at achieving efficiency, good quality and reinforcing the organization. The project was expected to lead to integral management that would achieve a better distribution of resources and a bigger coverage by the collection service.

4.1.2 Implementation Method

Two pilot projects were designed taking into account the current situation where the operation of the collection service has been chiefly contracted out to the private sector and the Municipality should act as an inspector.

Pre Pilot Project (P.P.P.): The objective was to establish a collection service that fulfills the quality set by the Municipality. It was conducted directly by ADN with the purpose of training the C/P regarding the design and inspection of the service. It was also expected that the project will serve as a reference for the private sector. The target area corresponded to sector 6 according to AAA categorization. It was carried out from September to November of 2005.

Pilot Project (P.P.): The objective was to establish a collection service of identical quality to the one achieved in sector 6 (P.P.P.) by the private operator with inspection by the ADN who also made the design of the service. The target area corresponded to the sector 5 according to AAA categorization for service charge collection routes. It was conducted from May to July 2006.

a. Overall Goal

A good quality of collection service for the urban area is defined and carried out.

b. Project Goals

Pre Pilot Project (P.P.P.)

- The collection service is established and conducted directly by ADN in the target area of the Project, Area 6.

Pilot Project (P.P.)

- A supervision method is established and implemented for the private firm operating in the Project target area (Area 5). In the Project area, even the private firm offers the same service level as that attained by PPP.

c. Expected Results

Pre Pilot Project (P.P.P.)

1. The ND has an area where a good quality collection service is carried out, which serves as a reference for the personnel of the Municipality and for the private operators.
2. The Collection Improvement Manual is prepared based on analysis and evaluation.
3. The Manual of Supervision of the Service is prepared based on the analysis and evaluation.
4. A method for data management for the collection service is established.

Pilot Project (P.P.)

1. The private operators understand that the results of the P.P.P. can be implemented so that their administration and operation are more efficient so as to improve the level of service.
2. Collection routes are designed using the Collection Improvement Manual.
3. The inspection is carried out according to the Manual of Supervision of the Service.
4. The street sweeping is improved.
5. Strengthens the coordination between the ADN and the private operator.
6. Similar results achieved in area 6 are attained.

d. Activities

Pre Pilot Project (P.P.P.)

1. Diagnostic of the service in sector 6
2. Service Design
3. Training of the C/P
4. Improvement of operation
5. Monitoring of the service
6. Preparation of the Improvement Collection Manual
7. Preparation of the Manual for the Supervision of the Service.
8. P.P.P. Evaluation

Pilot Project (P.P.)

1. Diagnostic of the service in sector 5.
2. Design of the Collection Service
3. Training of the C/P and private operators

4. Improvements Implementation
5. Implementation of the service supervision
6. Sweeping design
7. Training of the C/P as for sweeping
8. Improving the sweeping project
9. Monitoring of the sweeping
10. Projects evaluation

e. Organization

e.1 Pre Pilot Project, Area 6

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

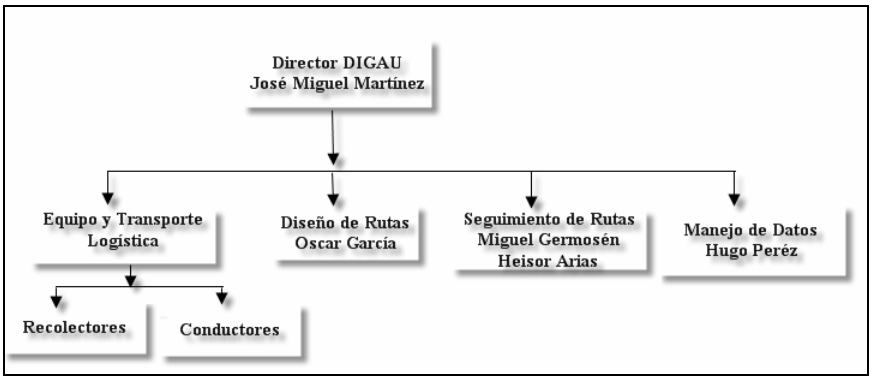


Figure 4-1: Organization of the Pre Pilot Project

e.2 Pilot Project, Area 5

The following figure shows the organization for the pilot project

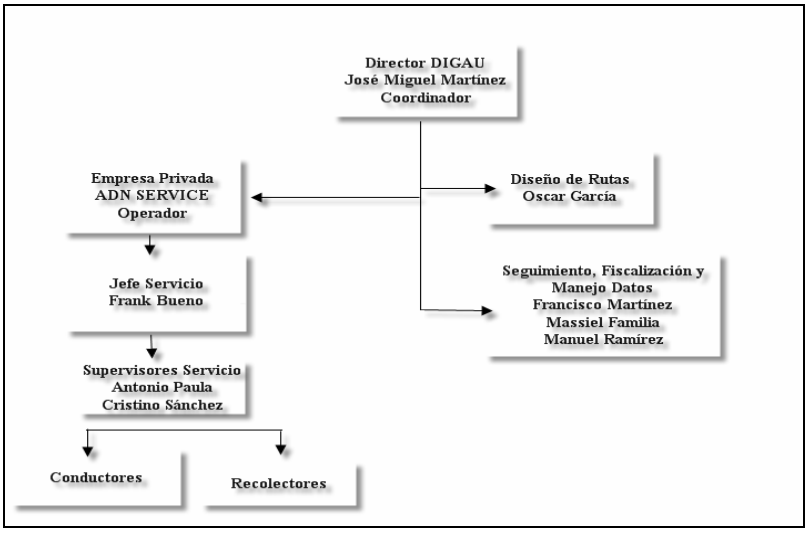


Figure 4-2: Organization for the Pilot Project

f. Profile of the Target Areas

Area 6 for PPP and the Area 5 for PP are located in the south-west part of the city as shown in the figure below. Area 6 has a population of 70,000 and Area has 90,000, in total 160,000.

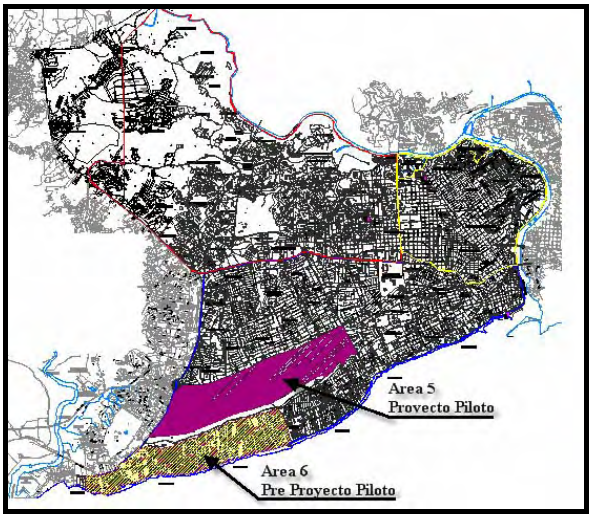


Figure 4-3: Area 5 Pilot Project

4.1.3 Results

a. Achievements

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

Table 4-1: Achievement of the Pilots Projects

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

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

Objective	Achievements
	the day of 8 hours Increase in the quantity of waste transported by trip, achieving an average of 93% of use of the load capacity. Increase of the yield of tons collected by collection time, achieving an increase of 15% with regard to the yields measured in time and movement. The previous results are reflected in the decrease of the direct costs of the service, among them fuel, lubricant, maintenance of the vehicle, and personnel cost. Pilot Project Improvement of the collection achieved the following: The covering of 100% of the area Execution of the frequency, days and schedules of attention in 98%, of the total of routes, with 70% of the routes with execution of 100% Reduction of the work day by 17% Increase of the yield of tons collected by collection time, achieving an increase of 11% with regard to the yields measured in time and movement. Additionally along the pilot project it could be seen that the quality indicators reached values that are in the established ranges at international level.
2. The collection was programmed	Pre Pilot Project Diagram plans of routes were made, indicating the beginning points and terms of each trip, besides the location of the control points for inspection. The EMUCD incorporated in its administrative and operational process the use of the Route Sheet for the rising of the information of all the collection routes. It was designed and introduced to the operation the form for the introduction and management of data that will allow obtaining the consolidation of the information lifted through the routes sheets, calculating the quality indicators and evaluating the service. Additionally with these forms and the information given by Duquesa the crossing of information can be settled which will enable increased control of the service. A procedure was settled for the installation of routes and its calibration. Pilot Project The EMUCD made the diagramming plans of routes, indicating the beginning and term points of each trip, besides the location of the control points for inspection. The private operator put into operation the route Sheet to gather information on all the collection routes. The setting of the pilot project was carried out by the personnel of the EMUCD, according to the procedures settled in the pre pilot project. The EMUCD monitored the collection routes according to the Supervision Manual and entered the antecedents of the service in the forms designed, evaluating weekly the routes and gauging those that required it, was related the inspection made in land with the entrance antecedents to Duquesa. The private operator carried out modifications in the procedures related with maintenance of vehicles, service supervision, entrance and exit control of vehicles, entrance of data and information management. The EMUCD with the private operator, starting from the fourth week of the pilot project, and repeated the experience in the other 6 routes following the same procedures carried out in this project.
Preparation of Manuals	A Manual was elaborated for the Improvement of the Collection. A Manual was elaborated for the Supervision of the Service The personnel was trained in the use of both documents
Improvement of the Sweeping service	Improvement of the sweeping service achieved: The covering of 100% of the considered area Execution of the frequency, days and schedules of attention i100%

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

a.1 Pre Pilot Project Evaluation

To evaluate the results of the pre pilot project, background details of time and motion surveys were considered, carried out in routes provided by ADNAU, since previous to the pilot project; the service was not developed in area 6 according to the route system.

Next are the results of the evaluation of the variables monitored during the course of the project.

Table 4-2: Results of the Evaluation of the Service.

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

a.1.1 Efficiency

- Tons transported per trip

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

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

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

- Trip Hours

Through the improvement of the collection service, the times of transport were reduced; increasing the times dedicated to collection and the quantity of worked hours was increased.

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

Another aspect that was detected during the study of time and movement that was due to the delay of starting the routes and as the vehicles work in two trips, the collection was generally developed until 12:00 a.m. in order of having the enough time to go to Duquesa and to begin the afternoon trip at 14:00 hr, with it the hours dedicated to the collection don't overcome the 3.5 hr, being one of the reasons for which the trucks don't travel full loaded. With the implementation of the P.P.P. it was possible to increase the collection time by an average of 1.1 hr.

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

- Tons collected vs. Collection time.

The total tons collected per hour of collection were increased on average by 15%, compared with the yields measured in the studies of time and movement, which reached 2.0 ton/hr, with those obtained in the P.P.P. where the value average for all routes was 2.21ton/hr. Inclusive for some routes the yields exceeded the value of 2.3 which fulfills the standards recommended by the CEPIS.

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

a.1.2 Effectiveness

The purpose of the project was achieved since the design of the routes enabled the improvement of the service coverage, improvement of the collection yield, increase of the times dedicated to the collection, reduction of the time outs, maximization of the use of resources, and increase of the work journey according to the indicated by Law.

With the improvement of the service resources control, quantification and minimization were achieved.

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

a.1.3 Impact

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

The above-mentioned has had a positive impact on the procedures of the EMUCD; they have

made decisions that have allowed the incorporation of new control and inspection systems, in land and by means of the prosecution of the information.

The project has had a strong impact on the operation of the Equipment and Transport Directorate who has implemented an inspection system for the exit of the trucks, modified the start time of the services and most importantly, begun work coordinated with the EMUCD.

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

a.1.4 Relevance

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

a.1.5 Sustainability

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

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

b. Evaluation of the Pilot Project

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

Table 4-3: Results of the Evaluation of the Pilot Project Service

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

Route	Frequency	Week	Ton/trip	Ton/hr	Ton/work/day	Ton/week	Hours worked hr/week	(%) of execution
C11001	Mon/ Wed / Fri	week 5	7.46	2.18	2.49	29,850	8.38	100%
C11002	Tue / Thu / Sat	week 1	10.91	1.94	3.64	32,730	8.77	100%
C11002	Tue / Thu / Sat	week 2	10.18	1.84	3.39	30,540	7.86	100%
C11002	Tue / Thu / Sat	week 3	9.68	1.89	3.23	38,730	9.17	100%
C11002	Tue / Thu / Sat	week 4	8.91	2.00	2.97	35,640	8.45	100%
C11002	Tue / Thu / Sat	week 5	11.62	2.40	3.87	34,850	8.19	100%
C11102	Mon/ Wed / Fri	week 1	11.23	2.52	3.74	44,920	7.23	100%
C11102	Mon/ Wed / Fri	week 2	10.47	2.08	3.49	41,860	8.86	100%
C11102	Mon/ Wed / Fri	week 3	10.16	2.37	3.39	50,790	8.57	100%
C11102	Mon/ Wed / Fri	week 4	10.46	2.59	3.49	52,280	8.26	100%
C11102	Mon/ Wed / Fri	week 5	10.66	2.73	3.55	63,960	8.22	100%
C12401	Tue / Thu / Sat	week 1	9.91	1.92	3.30	39,640	8.67	100%
C12401	Tue / Thu / Sat	week 2	8.36	1.93	2.79	50,162	9.78	100%
C12401	Tue / Thu / Sat	week 3	9.82	2.11	3.27	49,120	9.04	100%
C12401	Tue / Thu / Sat	week 4	9.89	2.13	3.30	49,460	10.55	100%
C12401	Tue / Thu / Sat	week 5	10.97	2.22	3.66	43,870	9.33	100%
C13001	Daily	week 1	8.61	1.87	2.87	68,909	9.90	83%
C13001	Daily	week 2	10.04	2.56	3.35	80,290	7.95	100%
C13001	Daily	week 3	10.78	2.69	3.59	118,580	9.67	100%
C13001	Daily	week 4	11.03	2.64	3.68	110,320	9.62	100%
C13001	Daily	week 5	12.48	2.84	4.16	112,330	8.71	100%
C13002	Daily	week 1	10.88	1.94	3.63	54,410	7.93	83%
C13002	Daily	week 2	11.51	2.49	3.84	103,590	8.29	100%
C13002	Daily	week 3	10.83	2.24	3.61	86,600	8.24	100%
C13002	Daily	week 4	10.31	2.29	3.44	72,190	6.92	100%
C13002	Daily	week 5	11.54	2.75	3.85	57,680	7.79	83%
C13003	Daily	week 1	9.72	2.02	3.24	58,340	7.31	83%
C13003	Daily	week 2	2.36	1.12	0.79	18,840	5.06	100%
C13003	Daily	week 3	2.24	1.17	0.75	26,930	9.02	100%
C13003	Daily	week 4	2.45	1.25	0.82	26,960	6.34	100%
C13003	Daily	week 5	2.33	1.57	0.78	27,970	8.75	100%
C1AV01	Daily	week 1	9.36	1.40	3.12	65,490	8.89	100%
C1AV01	Daily	week 2	10.04	1.66	3.35	50,210	8.02	83%
C1AV01	Daily	week 3	8.89	1.53	2.96	62,260	8.76	100%
C1AV01	Daily	week 4	8.45	1.82	2.82	50,690	9.52	100%
C1AV01	Daily	week 5	8.81	2.32	2.94	44,030	7.41	67%

Table 4-4: Results of the Evaluation of the Average Values

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

Table 4-5: Results of the Sweeping Pilot Project

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

ID	Time			Distance		Yield
	hh:mm	Hours	Hr - Man	mt	km	km/hr-man
Route 31	3:28	3.47	6.93	1,330	1.33	0.19
Route 32	2:59	2.98	5.97	1,500	1.50	0.25
Route 33	3:38	3.63	7.27	1,600	1.60	0.22
		Average	6.60	1,453	1.45	0.22

b.1.1 Efficiency

- Tons transported per trip

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

The appropriate load of the vehicles enables an increase in their useful life and a reduction of maintenance costs.

- Journey Hours

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

One of the biggest problems that could be appreciated during the studies of time and movement is that the work journey exceeded 10 hrs during which the same group of workers carried out two consecutive shifts, which contradicts the labor Law. Through the pilot project, the routes were designed in order develop a period of 8 hours except on heavy days where a maximum journey of 10 hrs was considered and the private operator will remunerate the worker through overtime payment.

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

An important aspect that influenced the reduction of the journey work corresponded to the schedule change at the beginning of the service, where the same approach as the pre pilot project was applied, enabling a reduction of the times of transfer for the route by up to 45 minutes.

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

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

- Tons collected vs. Collection time.

The total tons collected per hour in average increased by 11%, in comparison with the yields measured in the studies of time and movement that reached 2.10 ton/hr are compared with those obtained in the P.P.P. where the average value for the routes carried out with the compactor truck of 20 and 25 yd^3 is 2.39 ton/hr. It was not considered in the average the

small compactor truck since the collection method is different due to the difficulty of trafficking in the narrow streets. In 5 of the 9 routes the standards recommended by the CEPIS were achieved.

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

- Km./hr-man

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

This bigger yield will serve as a base for the design of the routes in the remaining area of the national district, and will allow a reduction in the number of personnel per route, reducing personnel costs and enabling enlargement of the service coverage area.

b.1.2 Effectiveness

The purpose of the project was achieved since the design of the routes allowed improvement of the service coverage, improvement of the collection yield, increase of the times dedicated to the collection, reduction of the time outs, maximization of the use of resources, and the following of the work journey according to what is indicated by Law. On the other hand, it allowed the EMUCD to conduct inspection and monitoring according to the established procedures.

With the new design the service quality was improved, carrying out constant inspection and using resources rationally.

Also the purpose of the sweeping pilot project was fulfilled, a quality service with fewer resources was implemented and it was possible to establish base yields for future designs.

b.1.3 Impact

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

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

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

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

b.1.4 Relevance

The implementation of the pilot project has allowed the EMUCD to conform a team of professionals qualified to plan, design and operate the collection and sweeping service in an

efficient way, at the same time the private company is under the conditions of generating the changes to offer a quality service.

b.1.5 Sustainability

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

4.1.4 Conclusion and Recommendations

The rational design of the collection and sweeping service attained a good quality of service, which allowed not only the increasing of efficiency and service quality but also arriving at an appropriate level of competitiveness.

A series of problems that affect the quality and efficiency of the service have been discovered during the project. These are not related with design, but with the discharge manner of the residents. Such manners should be controlled through communication programs with the community that include aspects such as characteristics of the service, obligations and the users' rights according to the Regulation and aspects related with the health risks due to a wrong solid waste management. Additionally it is recommended that a short term container project be implemented, especially in narrow street areas, high-rise buildings and small commercial (groceries stores). The improvement of storage and discharge will increase collection efficiency and will positively impact the landscape.

Provision of a good quality service and an inspection program has enabled the guarantee of maintaining the frequency, days and schedules established. Dispersed waste was not seen in the streets after the service. These achievements are the results of the application of the knowledge acquired by the personnel from the EMUCD and the private operator during the training programs.

The adequate planning and daily control of the parameters enabled calibration of the routes. Additionally, the continuous inspection of the routes assured the execution of the trips covering the assigned area. Lastly, the correct execution of the routes increased amount of waste collected. Adjustment and improvement by the private operator largely increased the productivity and effectiveness of the service.

The EMUCD has understood the importance of optimizing and inspecting the service, organizing the market and communicating with the community. This results in an improvement in the discharge manner. In the same way, they understood the necessity of strengthening their organization in order to have enough qualified personnel to make the design and inspection of the service in the rest of the District.

4.2 Implementation of Data Management

4.2.1 General Scheme of the Implementation of Data Management

This project was carried out parallel to the previous project, "Integrated Improvement of the Collection Service," aiming at conducting the following 4 activities; ① Establishment of reception process of the weighing data at Duquesa, ② Development of the weighing data capture system in the transfer station and the data reception process in a digital form, ③ Development of the Collection Route Data Base. ④ Analysis of the customer service system created by AAA.

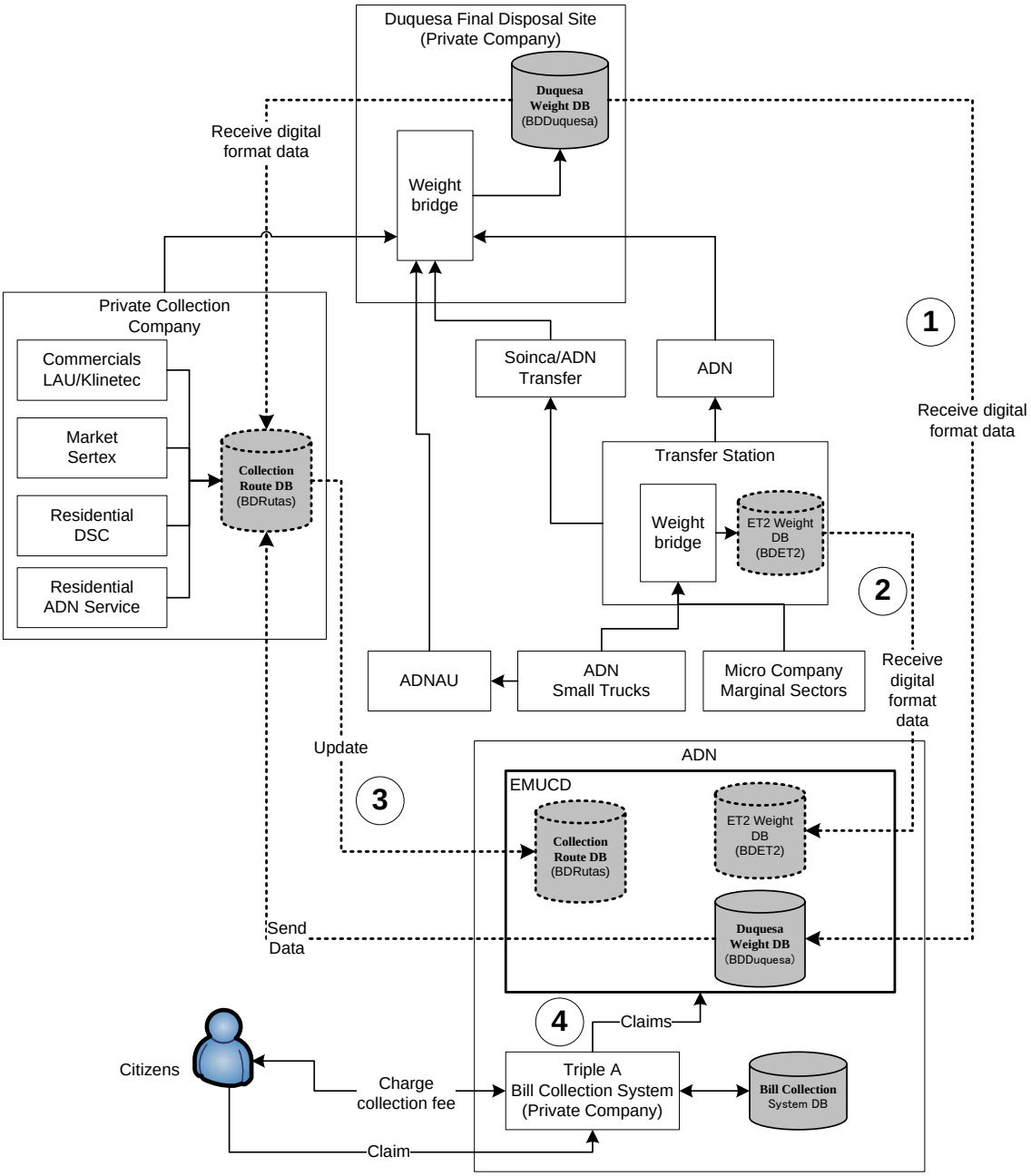


Figure 4-4: General Scheme of Data Management

4.2.2 Results

a. Established Systems

The project established the following systems.

① Reception process of the data from Duquesa	With this system, EMUCD can easily update the weighing data at Duquesa. The collection company of the National District and of the other municipalities was able to receive the weighing data in digital form. This facilitates their administration process.
② DBTS2 System	With this system, it became possible to record all weighing data of vehicles entering the transfer station and issue tickets for the registered data. Also it became possible to instantly export the data to the EMUCD.
③ Route DB System	This system makes it possible to record and analyze the data of collection works. Also it helps to dispatch trucks.
④ Analysis of the customer service system generated by AAA	This system was established aiming at responding to complaints from service users. This made it possible to identify the complaints with collection routes.

b. Training

Training for use of the established systems was conducted as follows.

Counterpart	Hugo Perez worked in the whole process, and he is in charge of continuously maintaining and improving the systems. Heisor Arias was trained in processing data at Duquesa and in managing weighing data.
Duquesa	The system administrator was trained to export the weighing data to the EMUCD.
Transfer Station 2	3 operators were trained to use the weighing system at DBTS2.
ADN Services	The RouteDB was installed and the system administrator was trained to use it.
ADNAU	The RouteDB was installed and the Administrative Manager and the operator were trained to use it.

4.2.3 Recommendations

- Regarding the reception of data from Duquesa, at this moment the information is received by magnetic media which are brought by the supervisor manager of Duquesa. Consider the possibility of accessing the Internet from Duquesa and data transmission through the Internet.
- Regarding the Transfer Station, once the construction is finished, consider the possibility of transmitting data to the EMUCD through the Internet.
- Regarding the RouteDB, continue to process the data from ADN Service and ADNAU, also commence the same work with the other collection companies.
- Regarding the complaints, once the collection routes have been established, upgrade the client file with corresponding route codes.

4.3 Promotion of Citizen Participation

4.3.1 Background

The rapid population growth and the economic growth have increased the quantity of waste and the work load of solid waste management (SWM) has exceeded the capacity of the AND. This has resulted in several problems such as waste scattered in the city and financial difficulties in SWM. One of the most important strategies to overcome these problems is to foment citizen participation in SWM. Therefore the M/P has given great priority to the promotion of citizen participation.

Although the ADN has tried to obtain the participation of the citizens, in practice, citizen participation in SWM is passive due to a lack of information about SWM.

The strengthening of ADN`s communicative ability with the residents is perceived as essential to promote citizen participation, which is important for achieving the objectives of the Master Plan. Consequently, the implementation of the Pilot Project of Promotion of the Citizens Participation has been decided.

4.3.2 Implementation Method

The main purpose of the Pilot Project was to build a model to provide SWM through providing information to residents, such as information about the waste collection service and discharge methods., and to reinforce the communication of ADN with the residents through this model's construction.

Also, the Pilot Project supported the previously mentioned Collection Improvement Pilot Project. In synthesis, one of the objectives in the development of the new collection service was to clearly transmit the information to the residents, to encourage residents to discharge waste in an appropriate way on the established days.

The formulated objectives of the Pilot Project to achieve these goals were directed at the residents of sectors 5 and 6 (refer to the Collection Improvement Pilot Project) to have access to and be able to understand the information about SWM as the collection service and discharge methods.

As mentioned, the Pilot Project was carried out in sectors 5 and 6. For descriptive purposes the first project (in Sector 6) was called the Pre- Pilot Project and the second (in Sector 5) was called the Pilot Project. The Pre- Pilot Project (PPP) started on October 30, 2005 and the Pilot Project (PP) began on June 19, 2006.

The implementation methods through to the development of PDM (Project Design Matrix) are described next.

a. Overall Goal

- Formulation of an information transmission model to the citizens in relation to the collection service, discharge methods and aspects related to SWM.

b. Project Purpose

- The residents of sectors 5 and 6 can access information about the SW collection service, discharge methods and other aspects of SW management, and they can understand the information.

c. Expected Outputs

1. Understanding of the situation through communication between ADN and residents.
2. ADN's capacity as information and service provider to the residents is strengthened.

21. ADN acquires the capacity to inform the residents of the waste collection frequency, schedule and discharge methods.
22. The citizens obtain information regarding the collection days and hours, and discharge methods (only in the PPP area) from loudspeaker vehicles.
23. The citizens can understand the concept of the basic rules of the SWM (PP area) through posters.
24. Through advertising signboards the citizens are aware of the concept of the "Clean City Project" (PP area).
25. Through the Neighbors Committee, the citizens receive information about the collection days and hours, discharge methods, and they can understand the concept of the basic rules of SWM.
26. Complaints about the collection service are decreased.

d. Activities

1. Survey and analysis of communication between the mass media and the citizens regarding SWM (Neighbors Committee and others).
2. Strengthening of ADN as a provider of information and service to the citizens.

21. Preparation and distribution of flyers.
22. Preparation and distribution of posters.
23. Preparation and distribution of advertising signboards.
24. Organization for information meetings with the Neighbors Committee and similar groups.
25. Formulation and design of communication tools for the residents and the person responsible for the collection service.
26. Formulation of a reply system to the resident complaints; recording and evaluation of the information of complaints by means of digital mapping.

e. Organization for the Promotion of the Citizen Participation

The Environmental Management and Urban Cleansing Directorate (EMUCD) is in charge of SWM; however, there are several other departments in ADN that have communication abilities with the residents. Especially, Triple A, which is in charge of billing and collections for the collection service, fulfills an important role regarding this function. The following figure shows the relationships and functions of the departments that participate in the Pilot Project.

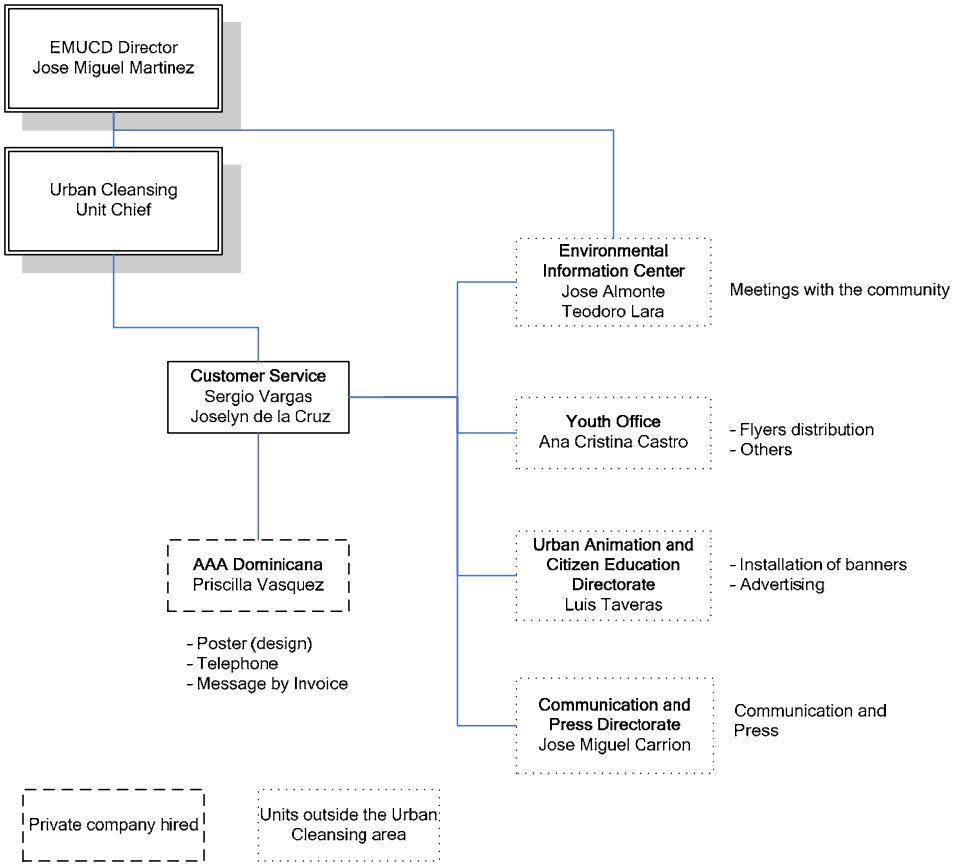


Figure 4-5: Organization for the Pilot Project

Table 4-6: Distribution of the Activities for the PPP

Activity	Information Tools	ADN (C/P)	AAA Dominicana	Youth Office and Secondary Students	Urban Animation and Citizen Education Directorate	Environmental Information Center	JICA Study Team
Inform the citizens of the collection days and hours, and discharge methods	Flyers (20,000 copies)	Design of flyers Coordination Supervision	-	Distribution of flyers in all sectors of the PPP Area	-	Meetings with the Neighbors Committee	Technical assistance production and printings
Announcements with loudspeakers (information to the citizens of the collection days and hour)	Message recorded (2) (for loudspeakers)	Design of the draft Coordination Supervision	-	-	Assistance and production of the message recorded	-	Technical assistance, supervision
Meetings with the Neighbors Committee (information to the citizens of the collection days and hour, discharge methods and cleansing regulations)	Flyers, printed materials, slides, power point, etc.	Organization and explanation to the residents	-	-	-	Facilities and provisions	Technical assistance
Information through invoice	Invoice	Supervision	Design, production, printing and distribution	-	-	-	-
Interviews	Interview format	Supervision, coordination	Design of the formats, phone calls	-	-	-	Technical assistance
Monitoring	Format	Design and supervision	Phone calls		-	-	Technical assistance

Table 4-7: Distribution of the Activities for the PPP

Activity	Information Instruments	ADN (CUSTOMER SERVICE C/P)	AAA Dominicana	Youth Office	Urban Animation and Citizen Education Directorate	Environmental Information Center	JICA Study Team
Inform the general community of the collection frequency and schedule and the basic rules	Flyers (30,000)	Design of flyers, Coordination, supervision	Distribution (jointly with the payment invoices)	Distribution of all the flyers in specific areas	Assistance in designing	Meetings with the Neighbors Committee	Technical assistance, production and printings
Inform the residents about the basic rules of discharge manners (in areas of collection payment areas and other areas)	Posters (500)	Design of the draft, coordination supervision	Distribution in pharmacies	Distribution in groceries stores, school and other entities of the PPP area	-	Meetings with the Neighbors Committee	Technical assistance, production and printings
General information to the sector community of the P/P area (in streets and roads)	Advertising signboards (50)	Design of the draft, coordination supervision	Assistance in the designing	-	Procedures and installation	-	Technical assistance, production and printings
Meetings with the Neighbors Committee	Flyers, posters, slides, Power Point, etc.	Organization and explanation to the residents	-	-	-	Provision	Technical assistance
Inform through the invoices	Invoice	Supervision	Design, production, printing and distribution	-	-	-	-
Interviews	Interview format	Supervision, coordination	Design of the formats, phone calls	-	-	-	Technical assistance
Monitoring	Format	Design and supervision	Phone calls	Monitoring in field	-	-	Technical assistance

e.1 Environmental Management and Urban Cleansing Directorate

The Environmental Management and Urban Cleansing Directorate (EMUCD) are responsible for urban area cleansing of the National District. EMUCD is responsible, in addition to SWM, for all aspects of environmental quality. Under this Directorate works the Customer Service Department and the Environmental Information Center related to the pilots projects.

e.2 Customer Service

The functions of the Customer Service Department organized inside the Environmental Management and Urban Cleansing Directorate (EMUCD) are to promote and coordinate actions, and guarantee the sustainability of the citizen participation projects. This Department will coordinate the activities for the promotion of citizen participation with AAA Dominicana, the Environmental Information Center, the Youth's Department and the Urban Animation and Citizen Education Directorate, and others.

This Department conformed by the personnel of the C/P during the PP had active participation in the implementation of the pilot project for Promotion of Citizen Participation (preparation of information materials, coordination with the different pertinent organizations, implementation of opinion surveys, distribution of information materials, meetings with the community, follow-up of the PP activities, etc.) with the support of the JICA Team.

e.3 Environmental Information Center

The Environmental Information Center provides an environmental information service by means of data diffusion and documents relative to the environment and natural resources as forms of preventing possible deterioration of the environment and potential damage to health. The Center will also provide information related to solid waste management and the facilities for community meetings. If necessary, they will also carry out educational activities and residents` awareness in order to develop and strengthen the integral solid waste management in the National District area.

During the implementation of the pilots projects the CIA provided the facilities and the place to develop environmental education workshops (PPP) and meetings with the community (PP).

e.4 Youth Department

The mission of the Youth Department is to program and coordinate the youth's activities in the projects of the Urban Animation and Citizen Education Directorate.

In the PPP and PP, this Department collaborated in the distribution of information toward the community (leaflets, posters, verbal communication, etc.) through the group of youths under the supervision of the Customer Service Department.

e.5 Urban Animation and Citizen Education Directorate

The general functions of the Urban Animation and Citizen Education Directorate are to formulate and execute policies for citizen education and citizenship of the city, promoting citizens' participation, and to pay attention to the education and orientation of the citizens on SWM and the preservation of the environment.

In the PPP this directorate supported the preparation and production of messages recorded for loudspeaker announcements to broadcast information to the residents about collection days and discharge hours. During the development of the PP they cooperated in the design of "banners" for signboards and their installation in sectors of the PP area to promote citizen participation through advertising signboards.

e.6 Communication and Press Directorate

This Directorate is in charge of communication and press in the Municipality. During the PPP they promoted the activities of the project through the internal press of the Municipality.

e.7 AAA DOMINICANA, S.A.

AAA Dominicana known as Triple A, is a Dominican commercial society, created in April 2000 according to the laws of the Dominican Republic, their social objective is to provide public water work services, a sewage system, cleansing and other complementary activities to these services.

The social capital of the company is made up of 50% from Dominican investments and 50% from Colombian and Spanish investments through AAA Services, S.A., in addition to being shareholder of the company, is the company operator in charge of the management and administration of AAA Dominicana, S.A.

In their organization there is a section, the Waste Billing and Collections, Billing and Tributes Customer Service that is directly related to the EMUCD. Their activities relating to SWM are the following:

- Emission and delivery of invoices
- Customer service
- Collection management
- Collection and digitations of payments
- Users cleaning cadastre and maintenance of the database

The company also gives a service to the ADN in the field of billing of tributes, it is also linked contractually with the Waterworks and Sewer Corporation of Santo Domingo (CAASD), and it also provides services to the Municipalities of Santo Domingo East and Santiago de los Caballeros in the commercial cleansing management, tributary administration and municipal taxes.

The **Customer Service Office** of Triple A, whose office is related to the Project Pilot of Citizen Participation, has 6 employees.

This office carries out the following activities:

- Attention to clients
- Reception, removal and analysis of claims, complaints and applications
- Realization of payment agreements
- Reception and application of payments
- Tele-payment
- Customer service for consultation of clients' balances and taxpayers.

During the implementation of the pilot projects (PPP and PP) the Customer Service Office cooperated actively in the realization of public opinion surveys, training the C/P on the survey methods and telephone calls, and conducting a follow-up. It also broadcasted information of the collection days and hours through invoices (PPP and PP) and distribution of leaflets jointly with the invoices (PP) and related activities.

f. Information Material Used

In the Pilot Project several information tools were used to reach the residents. Meetings with the neighbors' committee were carried out as means of interactive communication to inform the citizens of the new service and also to obtain their points of view. Flyers were distributed with information of the new collection service together with the collection invoices and directly distributed to each house. Also, posters were placed in grocery stores and in waste tariff payment shops, and "banners" on advertising billboards at bus stops areas.

The designed information tools below were presented and produced to promote citizen participation.

f.1 Flyers (30,000 units)

Flyer (front)

Flyer (back)

f.2 Poster (500 units)

f.3 Advertising signboards (50 units)

Signboard installed

Design 1

Design 2

Design 3

Design 4

Design 5

f.4 Message recorded for the phone calls

ROUTE AND FREQUENCY 1

The ADN will begin a new waste collection in your sector. Discharge your waste in closed plastic bags on **MONDAYs, WEDNESDAYs and FRIDAYs**. For further information call to 809-534-5666 ext 221.
"Help us live in a clean city"
Thank you

ROUTE AND FREQUENCY 2

The ADN will begin a new waste collection system in your sector. Discharge your waste in closed plastic bags on **TUESDAYs, THURSDAYs and SATURDAYs**. For further information call to 809-534-5666 ext 221.
"Help us live in a clean city"
Thank you

ROUTE AND FREQUENCY 3

The ADN will begin a new waste collection system in your sector. Discharge your waste in closed plastic bags from **MONDAY to SATURDAY**. For further information call to 809-534-5666 ext 221.
"Help us live in a clean city"
Thank you

g. Information Flow

The information tools presented previously were distributed to the citizens by each organization. The figure shows the flow of information to the resident.

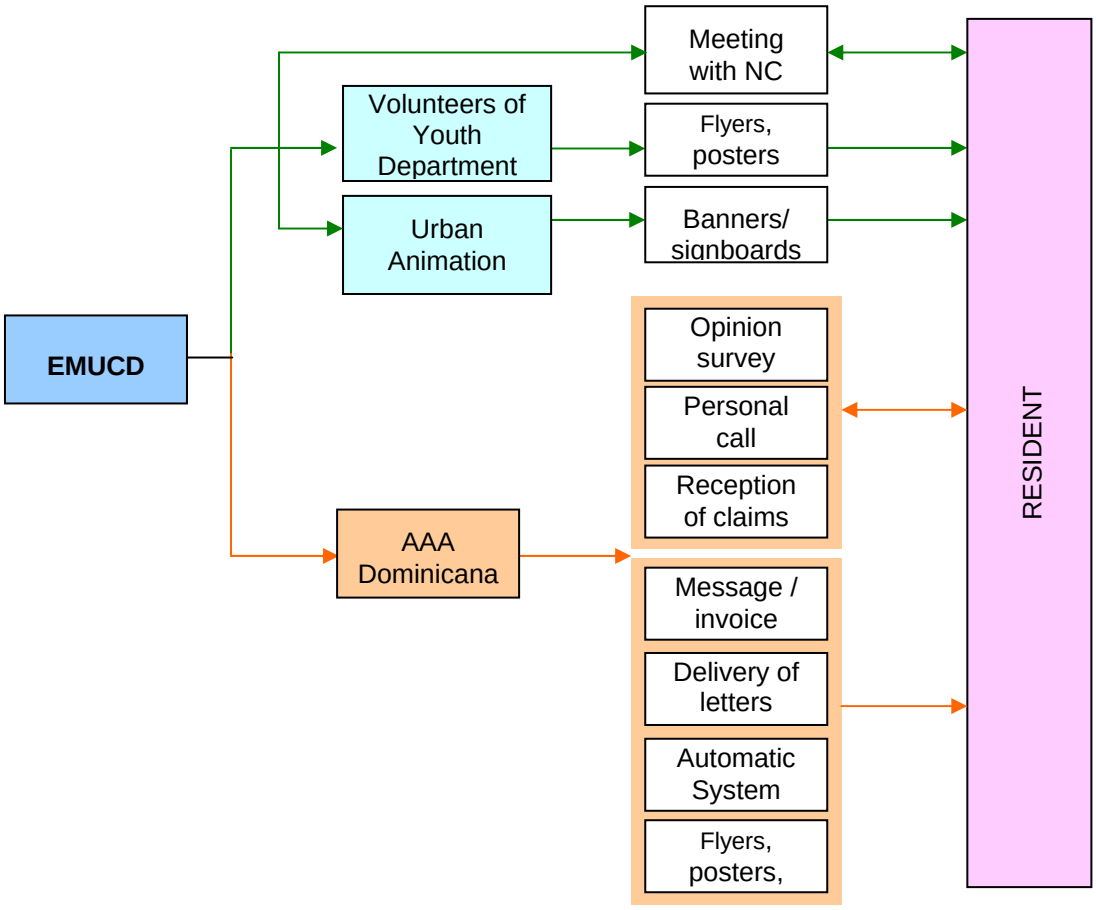


Figure 4-6: Flow of the Resident Information

4.3.3 Results

a. Effects of the information tools

The flyers were the most effective means for the communication of the new collection service to residents. It is difficult to measure the effectiveness of the posters and advertising signboards; however, they are considered an important mass media communication tool. The information written in the payment invoices has had little impact on the receivers. The meetings with the neighbors committee were effective in sectors where the residents have participated actively. In the following table a summary of the results is shown.

Table 4-8: Effects of the information tools implemented in the PPP and PP

Activity	Area	Descriptions	Effects
Distribution of flyers, information through verbal communication	PPP	Before the execution of the PPP with 70,000 people in Sector 6, 20,000 flyers were distributed through the Neighbors Committee, ADN sweeping personnel and with the participation of 120 students of secondary informing the days of waste collection.	According to the phone survey carried out by Triple A, the distribution of flyers has been the most effective means of information communication tool to the residents.
	PP	30,000 flyers were produced, of which 20,000 were distributed jointly with the payment invoices by AAA Dominicana; about 8,000 flyers were distributed in selected areas to reinforce the information by volunteers of the Youth's Office and the remaining 2,000 were distributed during meetings with the neighbors' committee, grocery stores, institutions, etc.	Both in the PPP and PP areas the most effective means of information tool has been the distribution of flyers.
Announcements by loudspeakers	PPP	Announcement of the collection days and hours have been carried out to complement the flyers.	It has not been possible to check the effectiveness of this means.
Distribution of posters	PP	The posters were distributed in all the grocery stores (near 100) and schools of the PP area by the volunteers of ADN Youth Office. They were also distributed to pharmacies where payment of the invoice for the cleansing service by AAA Dominicana is carried out.	Visual information to the public in general. The measurement of its effectiveness is in process. However, it seems very important its production and distribution. The effectiveness as information mean occupied the second place after the flyers.
Information written in the payment invoices	PPP and PP	All the clients of the collection service receive the payment invoice where they could be informed of the schedule and days of collection.	All the clients receive the invoice which is an advantage. However, the disadvantage is the written note, which is very small due to a lack of space in the invoice, which can be ignored by the receivers. However, in the PP area this means was reinforced with the combined delivery of flyers.
Meetings with the leaders of Neighbors Committee and the residents	PPP and PP	The Neighbors Committee is an organization of the community that exists in many places in the Study Area, although its capacities vary. This social capital is effective not only to inform the residents but also to promote them. Before and	The information through the Neighbors Committee has been very effective in those sectors where the participation of leaders of the Neighbors Committee has

Activity	Area	Descriptions	Effects
		during the implementation, if it works well, some meetings should be carried out with the members of the Neighbors Committee of the target area.	been very active.
Advertising signboards in public roads	PP	50 advertising signboards were installed in the PP area with phrases such as: "How beautiful is to live in a clean city! ", "The waste problem is solved by all", "In the bag… it looks better", "In the container… it looks better", "as well as taking care of your house… take care of your city."	Most of the signboards have been installed at bus stops in the PP area and surroundings

b. Achievements of the experience of the P/P

With the purpose of measuring the achievements, surveys were conducted to compare the changes experienced through implementation of the Project.

In the Pre-Pilot Project (PPP) four surveys were carried out, the first related to the satisfaction of residents regarding the collection service, the second one on the announcement and reception of the PPP, the third on the follow up of the results of the PPP and the last one, on the results of the PPP. In sector 6 a sample of 400 houses was taken for each survey.

In the Project Pilot (PP) two surveys were conducted (before and after the PP), measuring the following variables: frequency of the collection service, the quality, the knowledge, discharge manners, the communication between the ADN and the residents, the participation of residents in information meetings and the practices associated with the appropriate SW management, and others. A total of 302 houses were surveyed, both in the initial and the final phase.

b.1 Surveys carried out in the PPP

b.1.1 First survey on the satisfaction of the users' of the waste collection service in the Sector 6

1) Outlines

The first survey was carried out in the week from the October 7th-14th 2005. It was carried out in different urbanizations of sector 6, such as: Jardines del Sur, Alfimar, José Contreras, Miramar, Nordesa, Enriquillo, INVI, among others. A sample of four hundred (400) residents was surveyed in this sector to measure the people`s satisfaction in regard to the current waste collection service provided by ADN. The survey was conducted by phone and the participants answered the following questions:

2) Questionnaire

1) Do the trucks pass by your sector to collect the waste?
2) How do you evaluate the frequency of the trucks to collect waste?
3) Do you pay the waste collection service fee?
4) Why you do not pay the waste collection service?
5) In general, how do you evaluate the waste collection service?
6) What do you think should improve with regard to the waste collection service in the city?
7) According to you, what must be improved with regard to the collection service in the city?

3) Results

89% of those interviewed said that the trucks pass by their sector to collect the waste while 11% said that they do not pass by.

89% of those interviewed said that their waste is collected, 49% said that the trucks pass with little frequency, 26% said that the trucks pass irregularly and 25% said that they pass frequently.

Only 46% answered that they do not to pay the waste collection fee, while 54% said that they pay it (a curious fact according to Triple A, since of the sample taken, more than 95% have more than 6 pending invoices payment).

Of this 46% that does not pay the invoice, 31% said that the fee is very high, 46% said they do not receive the appropriate service, 9% does not receive the invoice, 4% receives the service from a private company and 10% admits to not paying due to irresponsibility (they do not want to, they are not forced, among other answers of this type).

In general, 54% of the participants qualified the waste service as regular, 28% qualified it as good and 18% as bad.

Within the aspects that the residents of the sector 6 think should be improved regarding the waste collection service in the city, 63% coincided in that the most important thing is the improvement of the quality of the service, pointing out important points such as clean collection (without scattering waste in the street neither spill of liquids, less noises by the trucks, placing the containers in the original position once the waste is collected, etc.); 11% considers that more containers should be installed in public areas, 5% considers streets sweeping to be important and in response to the question "According to you what must be improved with regard to the service of collection in the city?", 20% emphasized setting schedules to regularize the waste collection service in a permanent way.

b.1.2 Second survey on the announcement and acceptance of the PPP in Sector 6

1) Outlines

The second survey was carried out in the neighborhoods of the sector 6: Jardines del Sur, Buenos Aires, Miramar, Tropical, Honduras, and Costa Verde. A sample of four hundred (400) residents was surveyed in this sector to measure the acceptance of the PPP. The survey was conducted by phone and the participants answered the following questions:

2) Questionnaire

1) Have you heard about the Pilot Project that the ADN initiated to improve the waste collection service?
2) How did you find out?
3) Do you know what days you should take out the waste?
4) Do you know what time you should take out the waste?
5) In general, how do you evaluate the plan for this project? (Frequency established, collection schedule, information delivered, etc.)

3) Results

58% of those interviewed said they did not to know anything about the pilot plan while 42% knew about the project.

Of the 42% of those interviewed who said that they knew of the Pre- Pilot Project, 60% was informed through the flyers distributed in the different sectors, 29% knew from invoices and 11% through the neighbors committee meetings.

In another order of ideas, 100% of those interviewed who knew about the Pilot Project, knew what day and time they should take out the waste.

The project was evaluated by those interviewed in the following way: 60% considered it to be regular, 34% evaluated it between excellent and good while 6% considered it to be bad.

4) Comments

The survey left a blank space so that those interviewed could give their suggestions or comments regarding the plan that is been carried out. Among these comments the most common are the following:

- That the trucks are staying at Ave. Independencia and that they have to walk a lot to discharge the waste.
- That they pay to particulars so they can take the waste and that they are not interested in what ADN is doing now.
- That ADN is not performing the plan.

b.1.3 Third survey about the follow up of PPP results in Sector 6

1) Outlines

A sample of four hundred (400) residents was surveyed in this sector to measure the people`s satisfaction with regard to the current waste collection service provided by ADN. The survey was conducted by phone and the participants answered the following questions:

2) Questionnaire

1) Are the trucks fulfilling the schedules and frequencies established for the waste collection in your sector?
2) Do you perceive some difference in the cleanliness of your sector?
3) Are you satisfied with the implementation of this new plan to improve the waste collection service?
4) Do you consider the communication that maintains the ADN with your sector to inform about the improvements that they are implementing to be effective?
5) Do you participate in the meetings of the neighbors' committee?
6) Does the neighbors committee communicate the changes and the plans implemented by the ADN in improvement of the services offered?
7) Would you prefer that the ADN communicates and informs the information to your sector in a more direct way?

3) Results

88% of those interviewed coincided that the trucks are fulfilling the frequencies and schedules established for their sector. 10% said that they are not and 2% said they do not know.

Of those interviewed, 87% perceived a difference in the cleanliness of the sector while 13% said they do not see a change.

Regarding the implementation of this pilot project to improve the waste collection service, 94% said they feel very satisfied while 6% is not very satisfied with the results obtained.

For those interviewed, 85% said that the communication that maintains the ADN has been effective. 15% considered that the ADN has not been sufficiently clear in their official statements and that they should improve.

Continuing with the information transmission part and follow up of the pilot project, 59% of the interviewees said they participate in meetings with the neighbors committee, 30% does not participate and 11% said that where they live they do not have neighbors' committee.

From the sectors that have a neighbors' committee, 54% coincided that the Presidents of these committees fulfill the duty of informing the plans of the Municipality for the improvement of the service. However, 46% says they did not.

When asking residents if they would prefer the ADN to communicate and inform the information in a more direct way, 61% of interviewees answered “yes” and 39% answered that it is ok for them to do it through the neighbors’ committee.

The following suggestions were offered by those 61%:

- Meetings in the sector with all the residents (52%)
- Information should be given by phone (1%)
- A representative from the Municipality should participate in the meetings of the neighbors' committee of their sector (38%)
- Communication should be written and given to every sector resident (9%)

b.1.4 Fourth survey about the PPP results in Sector 6

1) Outlines

A sample of four hundred (400) residents was surveyed in this sector to measure the people`s satisfaction with regard to the current waste collection service provided by ADN. The survey was conducted by phone and the participants answered the following questions:

2) Questionnaire:

1) Are you satisfied with the implementation of the PPP to improve the waste collection service of your sector?
2) Do you agree with the collection frequency that was established in your sector?
3) Do you consider the communication implemented by ADN on the setting of the plan carried out through flyers, communication letters and loudspeakers to be effective?
4) Would you be willing to cooperate in a recycling project?
5) What is your opinion of the trucks that are collecting solid waste?
6) Do you agree with the fee established for the collection of waste collection service?

3) Results

97% of those interviewed said they feel very satisfied with the implementation of the plan to improve waste collection service. 3% said they are not very satisfied.

The 97% that is satisfied with the plan agreed with the frequency and the schedules established for their sector while the remaining 3% that is not satisfied, showed disagreement with the logistics of the plan.

With regard to the communicating method implemented by the ADN (loudspeakers were already included) 95% of those interviewed considered that it was very effective while 5% said the opposite.

72% of the interviewees said they are willing to cooperate with a new recycling project, while 28% answered negatively to this question.

When asked their opinion about the conditions of the trucks, 60% said that the quality of the trucks should improve, 27% considered that new trucks should be bought and 13% said that they are sufficient.

With regard to the fee established for the waste collection service, 27% said they do not agree with it because the amount is very high, while 73% agreed with the amount established.

b.2 Surveys carried out in the PP

b.2.1 First survey on solid waste collection system in the PP area

1) Outlines

During the week of May 30th to June 2nd of 2006, surveys of the community of the PP area (Sector 05) were carried out from the offices of AAA Dominicana with the participation of the C/P personnel and volunteers from the Youth Office of ADN. The survey was carried out under the assistance of the S/T and the supervision of AAA Dominicana by C/P personnel (Lic. Joselyn de la Cruz and Engineer Sergio Vargas) and two volunteers from the Youth Office.

The following is the result of the survey carried out in the different areas of sector 05, such as: Renacimiento, Cacicazgos, Bella Vista, Mirador Norte, Mirador Sur and El Manguito.

A sample of 302 houses were surveyed in this sector taking proportional samples of each area to measure the quality, payment, application of rules and the satisfaction of the current waste collection service provided by the ADN.

This survey was carried out by phone and those interviewed answered the following questions:

2) Questionnaire

P1. Do the trucks pass by your sector to collect the waste? How frequently?
P2. Who discharges the waste from your house?
P3. Do you pay the waste collection service fee?
P3.1 If you do not pay indicate the reason.
P4. If rules are applied to improve the waste discharge manners by establishing a day and time schedule, would you willing to cooperate?
P5. Are you satisfied with the waste collection service?
P6. If you are not satisfied, please give the reason.

Interviewees

Person	No.	%
Head of family (f)	59	19.53
Head of family (m)	42	13.91
Maid	68	22.52
Doorman/janitor	8	2.65
Son/daughter	59	19.54
Grandfather/grandmother	12	3.97
Shop employee	37	12.25
Shop manager	17	5.63
Total	302	100.00

3) Results

P1. Do the trucks pass for your sector to collect the waste? How frequently?

96.02% of those interviewed (290 people) answered that the trucks pass by their sector to collect waste, while 3.98% (12 people) say they did not.

From those interviewed, 38.74% affirmed that the trucks pass every other day, 5.96% said that they pass more than twice a day, 4.64% said that they do not know when the trucks pass, 27.15% said that they pass every day, 9.60% said that they pass once every two weeks, while 9.93% said that they pass once a week.

P2. Who discharges the waste from your house?

40.40% of those interviewed said that the waste is discharged by the maid, 23.50% said that is taken out by a doorman, 13.25% said that it is discharged by the head of family (f), 11.92% said that it is discharged by the head of family (m), while 10.93% said that all the members of the family discharge it.

P3. Do you pay the waste collection service fee?

From all of the interviewees, 86.75% said that they pay the waste fee and only 13.25% admitted to not paying the waste fee.

Of those that do not pay (13.25%), 3.32% does not pay it because they are exonerated from this payment, 0.77% said that the fee is very high, 1.86% does not receive the invoice, 2.0% said they do not know where to pay it, 3.0% said they do not receive the appropriate service, 0.44% does not know and 1.86% said they do not have sufficient economic resources.

P4. If rules are applied to improve the waste discharge manners by establishing a day and time schedule, would you willing to cooperate?

Only 1.0% of those interviewed said they would not be willing to fulfill the rules in the event of applying them, while 99.0% said they would be willing to fulfill them.

P5. Are you satisfied with the waste collection service?

73.51% said they are satisfied with the service and only 26.49% said they are not satisfied with the waste collection service.

P6. If you are not satisfied, please give the reason

Of those that answered that they are not satisfied (26.49%), 10.60% claimed that after the

elections they have been neglected, 2.12% said that over one month passed without the truck passing by, while 13.77% said that the truck does not pass by frequently.

4) Most common comments

- The collection trucks should pass by more frequently.
- The days and schedules established to discharge the waste are only used in “barrios”.
- If day and time schedules are established they should fulfill them.
- The workers must pick up the waste better, that is to say not to spread waste along their route, reduce the noise and the leached.
- If the old bills free him they could be updated.

b.2.2 Second survey on satisfaction follow up on the new waste collection system

1) Outlines

The following is the result of the survey carried out in the different neighborhoods of the sector 05 (Bella Vista, Cacicazgos, Mirador del Norte, Mirador del Sur, Renacimiento and Los Manguitos), during the last week of July 2006.

To measure the acceptance of the Pilot Project "Clean City"; the urbanizations and neighborhoods were selected in a random way and taking into account that they are included in the three frequencies designed for this plan; "Monday, Wednesday and Friday", "Tuesday, Thursday and Saturdays" and "Monday to Saturdays". Equally it took the quantity of inhabitants of each neighborhood as a reference and the total sample was of 302 residents being a representation of 5% of the administrators of houses.

The survey was carried out by phone and those interviewed answered the following questions:

2) Questionnaire

P.1 About the knowledge of the new collection system

P.1a Are you informed about the new waste collection system that was implemented in your sector or neighborhood?
P.1b How did you know about it?
P.1c Do you know what days and at what time the waste collection truck passes by?
P.1d Do the trucks fulfill the collection schedule and frequency in your sector or neighborhood?
P.1e Do you discharge the waste only on the established days?

P.2 Regarding the quality of the service

P.2a Do you perceive some difference in the cleansing conditions of your sector or neighborhood? Is the change good or bad?
P.2b Do you consider the quality of the service to have improved?

P.3 Regarding the citizen participation and information

P.3a Have you participated in workshops or information meetings of this "Clean City Project"?
P.3b Do you consider the communication between the Municipality and your sector or neighborhood to be effective?
P.3c Do the neighbors committee communicate to you about the changes and the plans of the Municipality about the waste collection service?

3) Results

P.1a Are you informed about the new waste collection system that was implemented in your sector or neighborhood?

60% of those interviewed affirmed to be informed of the new waste collection system that was implemented in their sector, while 40% alleged not to be informed.

P.1b How did you know?

100% of those interviewed that knew about the Pilot Project, were informed by the following ways:

- 2% by telephone calls
- 15% by posters
- 1% by radio
- 10% by meetings with neighbors' committee
- 72% by flyers

P.1c Do you know what days and at what time the waste collection truck passes by?

Of those that knew about the new collection system, 100% was informed about the route and frequency of the truck. Equally 13% of those not well-informed knew the day and hour that the collection truck passes by.

P.1d Do the trucks fulfill the schedules and frequency of the collection in your sector or neighborhood?

70% of those interviewed confirmed that the trucks fulfill the schedules and frequencies of the waste collection in their sector. While 30% considered that they were not sure of its fulfillment.

P.1e Do you take out the waste only on the established days?

83% of the total of those interviewed affirmed to taking out the waste on the established days. While 17% alleged not to be sure about fulfilling the schedule and frequency.

P.2a Do you perceive some difference in your sector or neighborhood cleanliness? Is the change good or bad?

According to 94% of those interviewed in general affirmed that a positive change exists in the cleaning of their sector. While 5% considered that it should improve the waste collection service. Equally there is 1% that pointed out that they have not seen any changes.

P.2b Do you consider the quality of the service to have improved?

Generally 93% perceived that the quality of the service in their sectors has improved considerably. While 7% considered that it should be improved.

P.3a Have you participated in workshops or information meetings on this "Clean City Project"?

13% of the total of those interviewed affirmed to have participated in workshops and meetings carried out by the Municipality and 87% of those interviewed affirmed that they have not participated.

P.3b Do you consider the communication between the Municipality and your sector or neighborhood to be effective?

83.11% of the total considered the communication between the Municipality and its sector to be effective. While 16.56% assured that effective communication does not take place. Equally 0.33% alleged to ignore the communication.

P.3c Do the neighbors committee communicate to you about the changes and the plans of the Municipality about the waste collection service?

30% of the total of those interviewed have been informed through the Neighbor Committee meetings of its sector regarding overall information, plans and changes related to the services provided by the ADN. While 70% does not participate with neighbor committee meetings.

4) Comments

Some relavant comments to improve quality are that the operation personnel should be trained, so that when they are collecting waste they are careful to not spoil the bags and spread waste in the streets. Other comments are that the prudence of the drivers must be improved because they often cause traffic jams on the roads.

4.3.4 Conclusions and Recommendations

a. Conclusions

a.1 Achievements of Results Expected

Before the pilot project, communication between the EMUCD and the residents consisted only of receiving the residents' complaints through Triple A. For the implementation of the project, 2 people from the C/P were assigned for Customer Service. They acquired several abilities such as coordinating with departments related to communication with the residents, and also how to design and distribute information tools and how to carry out meetings with the neighbors committee.

The Environmental Information Center has facilities available where residents can meet and is equipped with a projector and a computer donated through the cooperation of JICA. In the pilot project the facilities worked in a satisfactory way to carry out the meetings with the Neighbors Committee.

The results of the survey carried out for the residents showed that the flyers have been very effective for communicating information to the residents. A great number of the flyers were distributed directly by volunteers from the Youth's Department. This direct distribution, person to person, revealed the importance and the effectiveness of the communication of information.

The Urban Animation and Citizen Education Directorate controls the private companies that operate the means of advertising that are placed in public roads and the bus stops. It was verified that these means turned out to be very effective for publicizing SWM.

The Communication and Press Directorate is in charge of the communication and press of the Municipality. They can inform the media about Customer Service activities, as well as to diffuse the achievements, actions and projects to the community in general through the massive means of communication.

AAA DOMINICANA S.A. carried out important work in the Pilot Project carrying out several activities like sending flyers to the residents jointly with the invoices, sending notes in invoices with informations of the new service and distribute posters in places where the quota of the service is paid (pharmacies and other places) and carrying out a survey of residents through telephone calls. The work carried out was reliable and of high quality.

a.2 Achievements of the Goal and Purpose of the Project

The goal of the Pilot Project was directed toward the residents of sectors 5 and 6 (refer to the Pilot Project of Improvement of the Collection Service) to have access and understand information related to SWM such as the waste collection service and discharge manners.

From the results of the resident survey, it was possible to detect that the majority of the residents have had access to the information about the new service. Besides, the information was well communicated, and the residents had knowledge of the collection day and also the appropriate behavior to discharge waste and other related aspects. Therefore, the different information tools such as flyers, posters and the contents used to communicate the information were very suitable for the purpose of the project.

However, approximately 40% of the residents of the PP area do not have knowledge of the implementation of the new service and this suggests the necessity of the communication of additional information.

On the other hand, the objective of the project was to build a model to communicate the information about SWM to residents, and through the implementation of the Pilot Project, reinforce the capacity of the ADN to communicate with residents. Thus in that sense, it has carried out the communication of the ADN to the residents. There are several departments related, and through appropriate coordination they can work well.

First to mention that, through the implementation of the Pilot Project it has become evident that Triple A has the facilities in their organization for communication with the residents, for example receiving and assisting complaints and through these daily activities, they accumulate many knowledge and related techniques.

b. Recommendations

- To improve the coordination among the related departments in the ADN, including to Triple A, the Customer Service of the EMUCD should reinforce these facilities continually. It is recommended that the activities carried out in the Pilot Project are transformed from special events to routine activities through the preparation of an activities manual and begin the classification of the details of the activities and functions of the office.

- There is the problem in the departments in the municipal offices of not having with opportunely funds that are essential to carry out the activities. Therefore, it is suggested that a Mixed Fund is created with the Triple A to subsidize the costs of information materials such as flyers and posters.

- The production of the information materials does not require big costs, except some design aspects. The JICA Study Team has given all the negatives, original sheets and CD for the reproduction of the information materials. Therefore, the Environmental Management and Urban Cleansing Directorate within their financial possibilities or through the Mixed Fund can follow-up the production of the information materials for other sectors of the National District.

4.4 Environmental Education

a. Outline

Environmental education activities focusing on minimization were implemented in two periods: from October to November 2005 and from January to February 2006. Members of the C/P, teachers, and primary school students participated in these activities. One of the main achievements from the environmental education pilot project was the integration and participation of different government entities such as ADN, Ministry of Education, Ministry of Environment and Natural Resources, and NGO's among others.

Another achievement obtained through environmental education, in addition to having a better knowledge on adequate waste management, was the participation and exchange of knowledge and ideas among the different schools in the PPP area.

Through the integration of the different entities a series of workshops on environmental education were conducted; the first training was focused on the entities themselves and, subsequently, teachers of 7 primary schools in the PPP area were trained by C/P personnel. Finally, teachers who received training conducted experimental classes in their respective schools.

The Center for Environmental Information (CEI) of ADN has been assigned to continue environmental education activities. After the first workshop for teacher, C/P personnel from ADN, SEE, and SEMARN conducted by themselves a second workshop for teachers at the beginning of March 2006; seven (7) private primary schools participated in this workshop.

It is expected that in the near future, ADN will continue environmental education activities through CEI jointly with other related entities.

b. Activities

The following table shows environmental education activities for waste minimization which were carried out between November 2005 and March 2006.

Details of the activities conducted during the workshops for waste minimization are shown in the Annex.

Table 4-9: Environmental Education Activities in the PPP Area

Date	Activity	Content	Organized by:	Participants
(2005) November 23	Training Workshop (17 C/P persons)	Training Workshop for C/P personnel Waste minimization for a Clean City	JICA Study Team	Personnel from ADN SEE SEMARN ONG
(2005) December 8	Training Workshop (practice)	Training Workshop for high school students. Waste minimization for a Clean City	C/P Team (ADN, SEE, SEMARN)	Students from Victor Garrido School
(2006) January 27	1st. Training Workshop (17 teachers)	1st. Training Workshop for primary school teacher in PPP Area. Waste minimization for a Clean City	ADN, SEE, SEMARN	Teachers from the following Schools: ● San Jose ● Rosa Duarte ● Domingo Savio ● F.X.Billini ● Victor Garrido ● Movearte ● Rafaela Santaella
(2006) February 7 February 10 February 15 February 17 February 21 February 23 February 28	School Workshops	Experimental Workshops about waste management by teachers for primary school students	Schools: ● San Jose ● Rosa Duarte ● Domingo Savio ● F.X.Billini ● Victor Garrido ● Movearte ● Rafaela Santaella	Studens Special Guests, Parents association, teachers from other schools
(2006) March 1st	2nd. Training Workshop (25 teachers)	2nd. Training workshop for primary school teachers in PPP Area Waste minimization for a Clean City	ADN, SEE, SEMARN	Teachers from Private Schools in PPP Area.
After March 2006	School Workshops	Experimental Workshops about waste management by teachers for students in primary schools	Private Schools	Students Special Guests

c. Recommendations

Overall improvement in SWM cannot be achieved without sustained work in mutual cooperation among the following entities:

- Municipality and related government organizations (public actors)
- Community and residents (community actors)
- NGO's and other social organizations (moderating actors)

The most important reason should be clarified: why environmental education should be introduced and why a sense of cooperation is needed.

The educational system should establish public cooperation among related entities and should create cooperation conditions with other social programs. Improvement and maintenance of an adequate SWM can only be attained under this social environment.

Each cooperation module or unit has its own obligation and responsibility in SWM improvement programs and environmental education:

- The municipality functions as a coordination entity among other entities and actors; it provides an innovative SWM by using financial and human resources; and it takes decisions on environmental education related to SWM.
- Related government organizations also provide SWM services and support environmental education in many ways.
- Community actors through Juntas de Vecinos (Neighbors' Committee) should be well organized and will allocate voluntary efforts in actions directed to SWM in cooperation with other related entities.

Chapter 5

Preconditions for Planning

5 Preconditions for Planning

This chapter shows the fundamental conditions and issues for preparation of the Master Plan.

5.1 Population

a. Population Forecast

The National Bureau of Statistics (ONE in Spanish) had not prepared a population projection until 2015 for the study area. ONE´s officers suggested using the population growth rate between censuses (1993 and 2002) and the projection made by the National Council for Population and Family (CONAPOFA in Spanish) for the years 2004, 2005, and 2006 for this study. Consequently, a 1.425% growth rate was established for the projection; this growth rate was defined between the projection for 2004 and 2005 produced by CONAPOFA. Furthermore, a consensus was reached between the Counterpart team and the Study team to use this growth rate and a geometric projection for this study. The results are shown in the following table.

Table 5-1: Population Forecast

Year	Circumscription			
	1	2	3	Total
2005	340,024	256,254	384,375	980,653
2006	344,869	259,906	389,852	994,627
2007	349,784	263,609	395,408	1,008,801
2008	354,768	267,366	401,042	1,023,176
2009	359,824	271,176	406,757	1,037,756
2010	364,951	275,040	412,553	1,052,544
2011	370,152	278,959	418,432	1,067,543
2012	375,426	282,934	424,395	1,082,756
2013	380,776	286,966	430,443	1,098,185
2014	386,202	291,055	436,576	1,113,834
2015	391,706	295,203	442,798	1,129,706

b. Population Density

The National District has an area of 93.48 km^2 (Junta Central Electoral) The population density of 10,491 person/km^2 in 2005 is estimated to be 12,085 person/km^2 in 2015. Circumscription No. 3 is the most populated area.

Table 5-2: Estimated Population Density

Year	Circumscription			
	1	2	3	Total
Area	43.62	38.28	11.58	93.48
2005	7,795	6,694	33,193	10,491
2015	8,980	7,712	38,238	12,085

c. Urban Structure and Population Movement

There are some large projects, which might affect the urban structure and population movement. “Metro”, which is a project for urban transportation, is under construction in the National District. The project may change the population movement from the outside of the city to the city center and vice versa. Commencement of the operation of Isabera Airport, which is located close to the Duquesa landfill, may cause urban development at its

surroundings. Furthermore, construction of an artificial island on the seafront of the city is being hotly debated in newspapers these days. If it is carried out, a large impact may be caused on the urban structure and the population movement.

It is uncertain how those changes would influence solid waste management in the National District at present. Therefore, such probable changes are not taken into account in the preparation of the Master Plan.

5.2 Economics and Finance

a. Industrial Structure

As already mentioned, macroeconomic data was available only at the national level, while the Study required regional data for the National District. The 2003 national level macroeconomic data indicated the following sector composition of the Dominican economy: 11% primary sector, 30% secondary sector and 59% tertiary sector. This was the result of a gradual structural change over 30 plus years, and has been quite constant over the past 15 years. The secondary sector has been the most stable sector, with around 30% since 1970, although with recognizable changes within the sector, where the growing importance of the free trade zones has been quite noticeable.

Starting from the available gross domestic product (GDP) data, the gross regional product (GRP) of the National District was estimated by making adjustments of the GDP data. For such adjustments, diverse assumptions were made on the relative importance of the different components of the national accounts in the National District. The said assumptions are detailed in Section 2.5.2 Regional Economy. This procedure resulted in a sector structure of the GRP of the National District composed as follows: primary sector 0%, secondary sector 31% and tertiary sector 69%. The estimated sector composition of the GRP in the National District is assumed to remain unchanged over the Master Plan period, since the absence of the primary sector eliminates the most volatile sector, which can be extremely sensitive to changes in climatic and international economic conditions.

b. Economic Growth

In the Report of the Dominican Economy January-September 2005, the Central Bank of the Dominican Republic presented the GDP growth rates of 2005 and 2006 estimated by the International Monetary Fund and the World Economic Outlook at 4.5% for both years, implying the need of this Study to estimate the growth rates from 2007 up to 2015, the last year of the Master Plan. The said report indicated a much better than expected performance of the Dominican economy, having reached growth rates of 5.8% from Jan-June 2005 and 7.3% from Jan-Sep 2005.

In order to estimate the GDP growth rates during the Master Plan period, the method used was the projection of the historical growth rates. Data on GDP was available from 1970 to 2003, for which the yearly growth rates were calculated. And, the yearly growth rates for the last ten years of data availability, 1993 to 2003, were used as the base data to project the yearly GDP growth rates, because of the almost unchanged sector composition during said period.

The resulting yearly GDP growth rates for the country were:

Table 5-3: Past GDP Growth Rates & Projection

Year	GDP (Million RD$ 1970)	Actual Growth Rate (%)	Projected Growth Rate (%)
1993	4,193.7	3.0	-
1994	4,374.9	4.3	-
1995	4,579.4	4.7	-
1996	4,907.4	7.2	-
1997	5,307.6	8.2	-
1998	5,702.0	7.4	-
1999	6,166.6	8.1	-
2000	6,644.9	7.8	-
2001	6,909.9	4.0	-
2002	7,206.8	4.3	-
2003	7,175.3	-0.4	-
2004	-	2.0	-
2005	-	Central Bank, IMF, WEO	4.5
2006	-	Central Bank, IMF, WEO	4.5
2007	-	Projection 1993-2003	3.8
2008	-	Projection 1993-2003	3.7
2009	-	Projection 1993-2003	3.5
2010	-	Projection 1993-2003	3.4
2011	-	Projection 1993-2003	3.2
2012	-	Projection 1993-2003	3.0
2013	-	Projection 1993-2003	2.9
2014	-	Projection 1993-2003	2.7
2015	-	Projection 1993-2003	2.5

For the National District, as the dominant segment in the Dominican economy, these GDP growth rates were assumed to be 1% larger for each year of the Master Plan period. Consequently, the growth rates of the GRP in the National District during the Master Plan period will be assumed to be as follows.

Table 5-4: Projection of GRP Growth Rates

Year	Growth Rate (%)
2005	5.5
2006	5.5
2007	4.8
2008	4.7
2009	4.5
2010	4.4
2011	4.2
2012	4.0
2013	3.9
2014	3.7
2015	3.5

c. Ability to Pay (ATP) and Willingness to Pay (WTP)

The purpose was to achieve a reasonable compatibility between the existing solid waste service charges, the ATP of households and their WTP for the SW service, in a situation of dire scarcity of relevant information.

Ability to Pay (ATP) has to be ideally based on the results of a detailed household income and expenditures survey. However, as the latest household income and expenditures survey in the Dominican Republic was conducted in 1997-1998, results of the Public Opinion Survey (POS) were used for the analysis, recognizing and trying to offset their limitations with additional information, for instance Central Bank publications, the AAA database and exchange of opinions with the C/P and executives of AAA Dominicana, the company in charge of SW bill collection under contract with ADN. A new household income and expenditures survey is scheduled to start in June 2006 by the National Statistics Office and the Central Bank of the Dominican Republic.

Willingness to Pay (WTP) is based on the results of the POS, complemented with the information and opinions of C/P and executives of AAA Dominicana. The WTP of households and business firms in the National District, expressed in the POS, was most likely influenced by the existing SW service charges or tariff structure.

In the case of business firms, their expressed WTP for the SW service was not taken into consideration, as the existing tariff structure consists of a large number of fixed monthly payments, which are too complex for a straightforward and fair implementation. More importantly, the POS revealed that a volumetric tariff would be preferred by 96.3 % of business firms. Accordingly, the new Urban Cleansing Regulation or “Reglamento de Aseo” establishes the volumetric tariff for business firms. A volumetric tariff for business firms would confer the characteristics of clarity, equity and justice to the SW tariff system.

Surprisingly, 40.3% of households also expressed their preference for a volumetric SW tariff, which indicated that a new tariff system for households could be volumetric based. However, for the present analysis of income potential, the prevailing fixed monthly payments were regarded as relevant, since the five categories of tariff levels are relatively easy to apply.

The WTP expressed in the POS should be interpreted as the lowest possible WTP, because the POS was conducted when no improvement had been introduced to the SW service, which was perceived as unsatisfactory by most of the SW service users. The WTP certainly would have been higher if the POS was conducted after the Pre-Pilot Project (PPP) of October 2005.

c.1 Household ATP

The ATP of households is usually calculated as the proportion of income that a household can afford earmarking as expenses for the SW service charges. The generally accepted percentage of household income was estimated empirically from the implementation of many SWM projects by international aid agencies. For instance, World Bank literature gives as reference for the ATP for the SW service, a proportion of household income ranging from 0.7% to 1.7%, and these are the percentages that will be used in this analysis. This means that reliable information on household income is required in the estimation of ATP.

c.1.1 Household ATP as per POS

The POS provided some information on household income levels, which in a POS is usually, categorized into three income groups, namely, low, medium and high-income brackets. This is to facilitate the financial analysis on the basis of household income groups and the corresponding SW service tariff that would be most appropriate to each income group.

Alternatively, income levels can be categorized into groups corresponding to the existing SW

tariff structure. The current tariff schedule for households in the National District is composed of 5 tariff Categories I to V, and, accordingly, households are classified into five income levels, namely, poor, low, medium low, medium high, and high. One more group will have to be added in the financial analysis, and will correspond to the group unable to pay the SW service fee. The analyses to define the income levels characterizing each income group sought to take due consideration of all available information, and to make them mutually compatible, while reflecting as faithfully as possible the socioeconomic situation of households in the National District.

Especially difficult was the grouping of income levels of the POS into income brackets in the National District, as many combinations of income categories were possible depending on subjective interpretations. In this stage, it would have been very helpful to have a detailed and updated household income and expenditures survey for the National District. As such, a survey was not available, different combinations of income categories were made as alternatives for analyses.

The alternative groupings were based on different combinations of proportions of households in diverse monthly income levels classified as follows:

Less than 1,800 RD$
1,801 – 3,000 RD$
3,001 – 5,000 RD$
5,001 – 10,000 RD$
10,001 – 20,000 RD$
20,001 – 30,000 RD$
30,001 – 60,000 RD$
60,001 – 90,000 RD$
More than 90,001 RD$

- **First Household Income Grouping**

The POS indicated that the average household income in the National District amounted to 8,000 RD$ per month. Then, the initial grouping was made taking a monthly income of 10,000 RD$ as the limit between low and medium income households, while a monthly income of 60,000 RD$ was assumed to separate households in the medium and high-income groups. This categorization placed 54.75% of households in low income, 32.75% in middle income and 12.55% in high-income groups.

The initial classification of income groups took into consideration the reported average yearly household income of RD$8,000, and chose the income bracket containing this amount as the limit for the low-income group. Therefore, it was heavily weighed in the low-income group of households, as can be seen below.

Low income:	60%
Medium income:	30%
High income:	10%

Table 5-5: Distribution of Household Income & Possible Grouping for SW Tariff

Household Income (RD$-month)	%	Group %	Class	RD$/mo.
Does not know or does not respond	4.75			
< 1,800	2.25			
1,801 - 3,000	6.50			
3,001 - 5,000	10.25			
5,001 - 10,000	31.00	54.75	Low	50-125
10,001 - 20,000	19.50			
20,001 - 30,000	13.25	32.75	Medium	175
30,001 - 60,000	8.25			
60,001 - 90,000	3.80			
> 90,001	0.50	12.55	High	200

Source: POS

This distribution of income groups would produce unfavorable results in the financial analysis, because the larger the proportion of poor income groups, the lower the income potential. The relatively high proportion of low-income households would have to be accepted if such a distribution reflected the reality of the National District socioeconomic situation. However, although the income disparity appears to be quite pronounced in the National District, a 60% concentration in the low-income group may be slightly exaggerated. As there is no updated data to corroborate or to refute the figures of the initial grouping, another possible income distribution was tried as an alternative scenario.

- **Alternative Housing Income Grouping**

The second grouping attempted to classify households in five groups so as to match them with the existing five categories of SW service tariff, plus the group unable to pay for the SW service.

For this purpose, the first income level was considered to be 1,800 RD$, and resulted in 7% of households without the ATP for SW services.

The limit between “poor” households and those in the “low income” was taken to be 5,000 RD$ per month, which resulted in 16.75% of households in the poor income group. And income levels between 5,001 RD$ and 10,000 RD$ were assumed as low-income households, which amounted to 31.00% of households.

Then, households with monthly income between 10,001 RD$ and 20,000 RD$ were taken to be “medium low” income households, which amounted to 19.50% of households. And households between 20,001 and 30,000 RD$ were assumed to be “medium high” income households, amounting to 13.25% of households.

And finally, households with monthly income in excess of 30,001 RD$ were taken to be in the “high” income group, and amounted to 12.55% of households.

Table 5-6: Alternative Household Income Grouping for SW Tariff

Household Income (RD$/month)	%	Group %	Class	RD$/mo.	Household . Distrib. (%)	Corrected Distrib. (%)
Does not know or does not respond	4.75					
< 1,800	2.25	7.00	No ATP	0	7.00	10
1,801 - 3,000	6.50					
3,001 - 5,000	10.25	16.75	Poor	50		
5,001 - 10,000	31.00	31.00	Low	100		
10,001 - 20,000	19.50	19.50	Medium low	125	67.25	65
20,001 - 30,000	13.25	13.25	Medium high	175	13.25	15
30,001 - 60,000	8.25					
60,001 - 90,000	3.80					
> 90,001	0.50	12.55	High	200	12.55	10

Source: POS

The above income distribution of households could be summarized as follows.

Table 5-7: Summary ATP as per POS

Monthly Income (RD$)	Household Distribution (%)	Income Category	ATP Existing SW Tariff (RD$/month)
Less than 1,800	7	No ATP	0
1,801 – 5,000	17	Poor	50
5,001 – 10,000	31	Low	100 - 175
10,001 – 20,000	19	Medium low	175 - 200
20,001 – 30,000	13	Medium high	200
More than 30,000	13	High	200

Source: POS, ADN

It can be seen that the above table is a simple re-arrangement of the first grouping of household incomes (six income brackets instead of three), since the summation of the three income categories (No ATP, Poor and Low) would add up to 55% as the Low income group (54.75% of low income in the first grouping), while the summation of two income categories (Medium low and Medium high) would add up to 32% as the Medium income group (32.75% of Medium income in the first grouping), and the remaining 13% as the High income group (12.55% of high income in the first grouping).

c.1.2 Household ATP as per Central Bank Income Data

The Central Bank of the Dominican Republic has a yearly publication known as “Labor Market”, the latest available issue being was in 2004. The said publication contains data on hours worked per week and hourly wages by decile, thereby making it possible to calculate the weekly and monthly income by decile. Unfortunately, broken down data for the National District was available only until 2002, before the reorganization of the National District, implying that the income calculated with this data was probably underestimated, due to the larger geographic area and the inclusion of activities in the primary sector which are usually paid lower wages. Further, the publication explained that income distribution took into consideration only the income from the main activity, and not the total income of the household, having excluded the transfers and incomes from financial and non-financial assets. However, even if household income could be estimated more precisely, other factors like unemployment and underemployment will pose difficulties on the ability to pay.

Despite the limitations, in the absence of other data, the 2002 Labor Market data for the National District was used to estimate the ATP of the National District residents, as a comparison with the POS results.

Table 5-8: Estimated Income & ATP in the National District in 2002

Decil	Employed Population	Hourly Wages (RD$)	Weekly Working Hours	Weekly Income (RD$)	Monthly Income (RD$)	Ability to Pay (ATP) (RD$/Month)	
						Low	High
1	109,395	8.18	46.85	383.23	1,642.43	11.50	27.92
2	109,395	12.73	46.71	594.62	2,548.36	17.84	43.32
3	109,395	16.29	45.65	743.64	3,187.02	22.31	54.18
4	109,395	19.56	44.09	862.40	3,696.00	25.87	62.83
5	109,395	23.69	42.81	1,014.17	4,346.44	30.43	73.89
6	109,395	28.91	43.41	1,254.98	5,378.50	37.65	91.43
7	109,395	35.71	41.76	1,491.25	6,391.07	44.74	108.65
8	109,395	45.67	41.27	1,884.80	8,077.72	56.54	137.32
9	109,395	64.39	40.08	2,580.75	11,060.36	77.42	188.03
10	109,395	149.99	38.33	5,749.12	24,639.07	172.47	418.86
Total	1,093,950	40.51	43.10	1,745.98	7,482.78	52.38	127.21

Source: Mercado de Trabajo 2002, Banco Central, Republica Dominicana, 2003

As shown in the above table, the ATP defined as specified, percentages of income were calculated for the average income and for each “decil”. Considering the overall average income of around 7,583 RD$ encompassing all deciles, it can be said that affordable monthly payments for the SW service would range between 50 RD$ to 125 RD$.

Looking at the high end of the ATP percentage (1.7% of income), it can be said that decil 1 (monthly income of 1,642 RD$) and decil 2 (monthly income of 2,548 RD$) would be unable to pay the lowest 50 RD$ tariff of SW service. On the other hand, looking at the lower end of the ATP percentage (0.7% of income), the lowest SW service tariff of 50 RD$ did not become affordable before decil 8 (monthly income of 8,078 RD$).

On consideration that the above income levels were underestimated as household incomes, and that improvements in SW service are expected to increase the WTP of the service users, the higher end of the ATP percentage (1.7% of income) was considered as appropriate for this analysis. This means that the following conclusions can be drawn.

Table 5-9: Income in National District Households & ATP

Deciles	Monthly Income (RD$)	ATP existing Tariff (RD$/month)
1	1,642	0
2	2,548	0
3	3,187	50
4	3,696	50
5	4,346	50
6	5,378	100
7	6,391	100
8	8,078	125
9	11,060	175
10	24,639	200
Total	7,483	125

Source: Central Bank, ADN

It can be seen that the overall average income of 7,483 RD$ is quite similar to the average household income of 8,000 RD$ as reported in POS. Both POS and Central Bank income data tend to confirm that the minimum SW tariff of 50 RD$ per month would become affordable to pay when households reach monthly income of around 3,000 RD$. This means that 20% of households, those in decil 1 (1,642 RD$) and decil 2 (2,548 RD$), would not be able to pay any SW service fee. Income levels between 3,000 RD$ and 5,000 RD$ would be able to afford SW fee of 50RD$, while those between 5,300 RD$ and 6,300 RD$ would be able to afford 100 RD$ per month. Income level of around 8,100 RD$ would be able to afford a monthly SW fee of around 125 RD$, while that of 11,000 RD$ would be able to afford 175 RD$. Finally, income level of around 12,000 RD$ would be able to afford a SW service fee of 200 RD$ a month.

c.1.3 Household ATP as per AAA Dominicana Data

AAA Dominicana, the billing and bill-collection firm under contract with ADN provided the following data in December 2005.

Table 5-10: Household Distribution by AAA Dominicana

Tariff Category	Tariff (RD$/month)	Number of Clients	% of Clients
I	50	36,457	28.88
II	100	18,608	14.74
III	125	24,753	19.61
IV	175	8,948	7.09
V	200	37,421	29.64
Sub-total		126,187	99.95
Under construction	1,000	61	0.05
Total		126,248	100.00

Source: AAA Dominicana

The AAA data referred to the household clients whom this firm billed to and collected from, excluding clients who could not pay. In a comparison with the ATP derived from POS and Central Bank data, the AAA data tends to confirm that around 30% of residential SW service users pay 50 RD$, around 10% pay 100 RD$, and around 10% pay 175 RD$. However the AAA data indicates that households paying 125 RD$ comprise of around 20%, twice as much as POS and Central Bank data, and that 30% of households pay 200 RD$, which is about three times the ATP indicated by POS and Central Bank data.

Although convenient for financial analysis, the heavy concentration of paying households in the high-income group raised some doubts, and questions were asked in this regard. AAA Dominicana constantly updates information on household distribution by income group. While this information is in the process of confirmation, calculation of alternative income potential may be conducted using the AAA distribution of households into income groups.

c.1.4 ATP for the Financial Analysis

Financial analysis will be based on the results obtained from the data of POS and the Central Bank, as summarized below.

Table 5-11: Summary of ATP by Household Income Group

Household Income Categories	Household Distribution (%)	ATP (RD$/month)
No ATP	20	0
Poor	30	50
Low	20	100
Medium low	10	125
Medium high	10	175
High	10	200

Source: POS, Central Bank

The rather high unemployment and underemployment rates that were observed would have the effect of reducing the ability to pay of the citizens. Statistical data for the country indicates historical unemployment rates hovering around 16%

c.2 Household WTP

c.2.1 WTP as per POS

The WTP revealed in the POS and the analytical process of matching the revealed WTP with the corresponding income groups and SW tariff levels are summarized in the following table. The POS results concerning WTP were interpreted as follows.

Those answering “Does not know” and “Cannot pay”, adding up to 10.00% of respondents, were considered as households in the “No WTP” income group who are unwilling to pay (probably also unable to pay) for the SW service. This would correspond to a new group of households unwilling, and probably unable to pay, which would have to be added to the household groups with SW tariffs set at five levels or categories.

Table 5-12: WTP Revealed in POS by Income Groups, & SW Tariff

WTP RD$/month	%	Group %	Class	RD$/mo.	Household Distrib. (%)	Corrected Distrib. (%)
Does not know	1.00					
Cannot pay	9.00	10.00	No WTP	0	10.00	10
< 50	31.75	31.75	Poor	50		
50 - 100	25.75	25.75	Low	100		
101 - 125	9.50	9.50	Medium low	125	67.00	70
126 - 175	4.25	4.25	Medium high	175	4.25	10
176 - 200	7.00					
> 200	11.80	18.80	High	200	18.80	10

Source: POS, ADN

Those answering that they could pay less than 50 RD$ per month were considered as households pertaining to the “Poor” income group. A pessimistic interpretation would include this group also in the group unwilling and unable to pay for the SW service, which then would add up to 41.75% of households. However, SW service improvement and education campaign may be able to induce this group comprising of 31.75% of households to pay the existing lowest tariff of 50 RD$ per month corresponding to category I.

Those answering that they could pay 50-100 RD$ per month comprised of 25.75% of households, and were considered as households in the “Low” income group who could pay

the existing SW tariff of 100 RD$ corresponding to category II.

Those answering that they could pay 101-125 RD$ per month comprised of 9.50% of households, and were considered as households in the "Medium low" income group who could pay the existing SW tariff of 125 RD$ per month corresponding to category III.

Those answering that they could pay 126-175 RD$ per month comprised of 4.25% of households were considered as households in the "Medium high" income group who could pay the existing SW tariff of 175 RD$ corresponding to category IV.

Those answering that they could pay 176-200 RD$ and over 200 RD$ per month added up to 18.80% of households, and were considered as households in the "High" income group who could pay the existing SW tariff of 200 RD$ per month corresponding to category V.

c.2.2 WTP for the Financial Analysis

All the above can be summarized as follows.

Table 5-13: Summary of WTP by Household Income Group

Household Income Categories	Household Distribution (%)	WTP (RD$/month)
No WTP	20	0
Poor	30	50
Low	20	100
Medium low	10	125
Medium high	10	175
High	10	200

Source: POS

Table 5-13 on WTP was adjusted according to Table 5-11 on ATP, on the basis of the following rationale. Households unable to pay comprised of 20% against 10% of households unwilling to pay. In this case, the 20% of households unable to pay should take precedence over the 10% of households unwilling to pay. Accordingly, adjustments were needed in the proportions of households in the low-income group and in the high-income group.

d. Grants to Local Governments

Law 166 of October 6, 2003 established in Article 1 the participation of municipalities and municipal districts in the income of the Central Government. This participation was set at 8% of the income of the Central Government in 2004, and 10% starting in 2005 (Article 3). Article 4 states that the participation amount would be distributed monthly, as one-twelfth of the yearly amount, calculated in terms of the population size in each municipality relative to the total population of the country, according to the latest Population Census carried out by the National Statistics Office (ONE).

Of the 2005 ADN budget amounting to 1,701 Million RD$, Law 166-03 contributed 1,338 Million RD$ or 78% of the total income.

The monthly amount to be distributed to a municipality should not be lower than 500,000 RD$ in the case of municipalities and 250,000 RD$ in the case of municipal districts (Article 5).

The Dominican Municipal League is to receive 5% of the amount assigned by the Central Government to municipalities and municipal districts, to be deducted from the said amount (Article 6). In addition, the Central Government is to assign 20 Million RD$ to the Dominican Municipal League and the municipalities, of which one-half should be applied to the pension fund of municipal employees, and one-half to capitalize the credit lines of the

Dominican Municipal League in favor of municipalities (Article 7).

Article 10 establishes the way in which municipalities can use the funds received through Law 166-03, setting the following limits:

(a) 25% for personnel expenses, permanent or temporary
(b) 35% for operating expenses and municipal services like solid waste management
(c) 40% for investment and capital expenses, including 2% to be set aside for the preparation of plans and projects for municipal development

The above percentages should be strictly respected, and transfer of funds from one use to another is permitted only with the favorable vote of two-thirds of the municipal council, and with the approval of the Dominican Municipal League.

Applying the above percentages to the 2005 ADN budgeted income of 1,338 Million RD$ provided by Law 166-03, the fund could be used as follows.

(a) Personnel expenses: 335 Million RD$ (US$ 9.6 Million)
(b) Municipal services: 468 Million RD$ (US$13.4 Million)
(c) Investment: 535 Million RD$ (US$15.3 Million)

The supervision and control of the application of funds provided by Law 166-03 is to be in charge of a commission presided by a representative of the Executive Branch, and one representative from each of the political organizations operating in the municipality (Article 12).

5.3 Waste Amount and Composition

The country has economically been growing rapidly and further economic growth is forecast for the future. It is known that the waste amount per capita increases along with economic growth in developing countries. Then, it will stop at a certain level of the economy as experiences of industrialized countries show. The Gross Regional Product (GRP) of the National District has reached approximately 10,000 US$ per capita, although the Gross Domestic Product (GDP) of the country is still just beyond 2,000 US$ per capita. In addition, the current waste generation amount per capita in the National District, 1.56 kg, is almost the same or beyond that in developed countries. Therefore, the waste generation amount per capita will not increase along with the economic growth in the future.

Meanwhile, waste composition changes along with economic growth in general even if waste amount per capita has been stabilized. Especially, it can be seen that the portion of kitchen waste decreases and the portion of paper increases.

Taking into account the discussion above, the following assumptions are set up for preparation of the Master Plan.

- Waste generation amount per capita, 1.56 kg per capita, will not change
- Ratio of kitchen waste will drop by 10% by 2015; 1% decrease per year between 2006 and 2015
- Ratio of paper will rise 10% by 2015; 1% increase per year between 2006 and 2010

5.4 Final Disposal Site

The Duquesa disposal site is located in the Municipality of Santo Domingo Norte at approximately 18 km to the northwest of the D.N., and at this moment it assists the Municipalities of Santo Domingo Norte, Santo Domingo Oeste, Santo Domingo Este and National District.

Figure 5-1: Location of Duquesa Disposal Site

It covers an approximate surface of 123 ha of which approximately 45 ha have already been used in the waste disposition. Heights cells are from 1 m to over the 10 m. The following figure shows the disposal site area and the area with waste disposition.

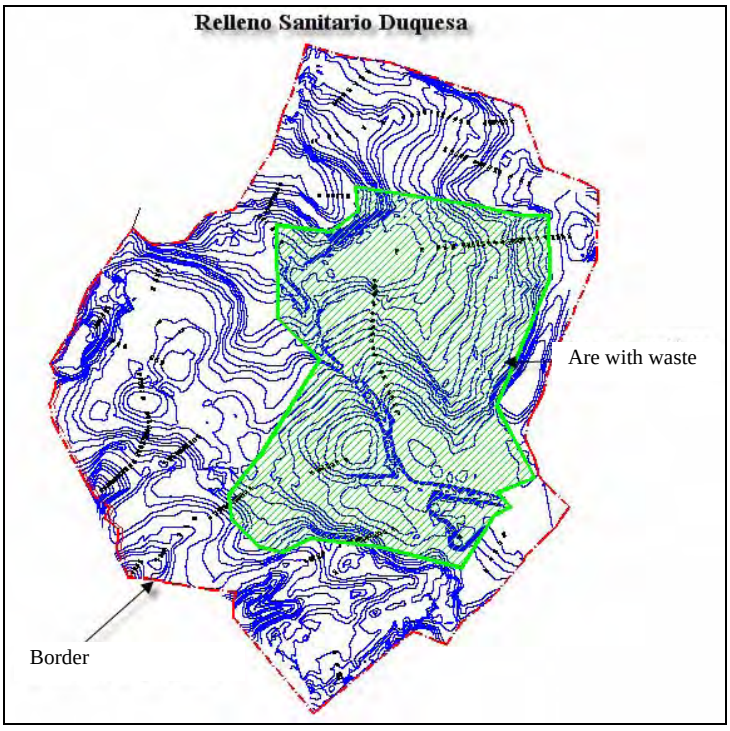


Figure 5-2: Area with waste disposition in Duquesa

The Consortium Duquesa, a company that maintains the operation contract of the final disposal site, presented an Environmental Impact Declaration, with the purpose of regularizing its situation with the environmental authorities and also enlarging the useful life of the site.

The EID of Expansion of Duquesa Sanitary Landfill refers to the expansion of the waste reception area, over an extension of 1,238,145.16 m², in the northeast of the entrance platform. The project contemplates the improvement of the current disposition and an increase in the volumetric capacity of reception of waste. For it the land has been divided into five areas, of which three are already filled with waste and two which have been projected to make excavations of more than 10 m of depth to increase the available volume for waste and at the same time to obtain covering material. The total quantity of excavation reaches the 300,000 m³. The maximum height proposed is 33 m, it is proposed that the impermeable bottom of the areas that does not have waste with a layer of humid clay compacted of 1.5 m height (the permeability of the material is not indicated), leachate collection system, chimneys of dissipation of gases and lagoon of oxidation for leachate, stabilized access roads, cell for biomedical waste properly signaled, isolated and waterproofed. Additionally it considers the construction of a cell to be used only on intensive rainy days that impede the use of the regular cells, to guarantee the operation of the landfill. In addition, it considers continuously using the current facilities such as the weighbridge, offices, workshop areas, and so on. It will also have a perimeter buffer area planting trees that will serve as a visual barrier, dust control, besides improving the environmental conditions of the area, offering shade, fresh and cleaner air.

The project incorporates mitigation measures, contingency plan, monitoring program, and closing plan for the landfill. Under these new conditions the new project represents an annual cost of approximately 5,600,000 US$/year, this is approximately equivalent to 5 US$/ton of disposed waste.

On the basis of this study, the available volume for the waste disposition and Duquesa's useful life period has been determined.

a. Calculations of the remainder capacity

The area designated to the construction of the sanitary landfill is 87.6 ha approximately, of which 85.1ha are designated for the waste disposition and 2.5 ha for the construction of leached storage lagoons as shown in the following figure.

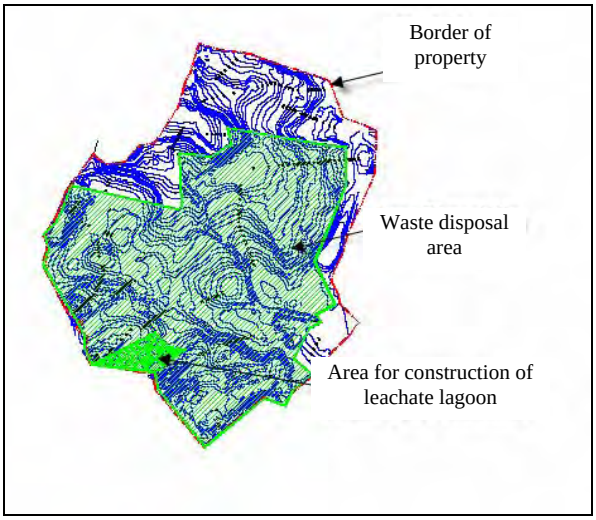


Figure 5-3: Distribution of the Areas

For the construction of cells, the Duquesa Consortium has divided the zone into five areas as shown in the Figure 5-4, the characteristics of construction of cells in each area shown in the Table 5-14.

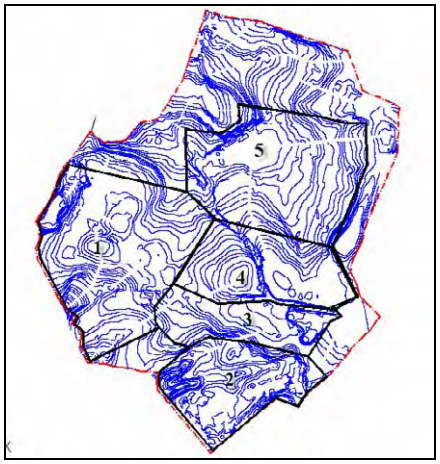


Figure 5-4: Program for the Construction of Cells of Waste

Table 5-14: Characteristics of the Landfill Construction per Area

Area	Surface (m2)	Initial level(m)	Final level (m)
1	244,467.80	90	145
2	130,189.32	90	145
3	106,652.47	120	145
4	111,541.15	120	145
5	240,852.17	110	145
Total	833,702.91		

According to the area and taking into account the design of the cells showed in Figure 5-5 that consider a height of 5 m, banks 1:3, the available volume for waste disposition was calculated, the following table shows the results of the calculations, which differ from those mentioned in the EID that does not consider the loss of volume due to bank of cell, 1:3 (v:h).

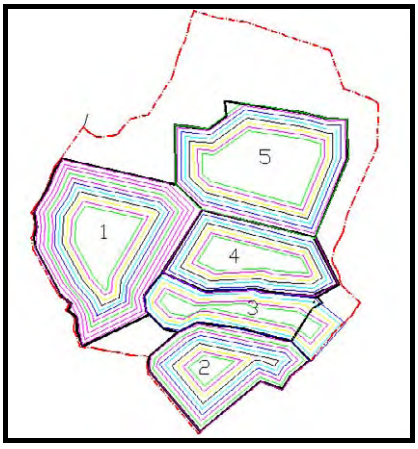


Figure 5-5: Construction Cells Design

Table 5-15: Available Volume for the Construction of Cells

Area	Nº Cells	EID Volume (m3)	Volume Calculated (m3)
1	11	8,362,595.55	7,538,321.28
2	11	3,908,494.15	3,559,315.25
3	5	1,604,630.40	1,269,077.13
4	7	2,142,444.10	1,820,204.23
5	7	5,765,797.75	4,918,727.35
Total		21,783,961.95	19,105,645.23

On the base of these volumes Duquesa's life period was determined, considering a final density of the waste of 0.8 ton/m³ and a 5% annual growth of incoming waste.

Table 5-16: Calculation of the Useful Life According to the EID data

	Waste Entrance		Volume
	Year	Accumulated	Available
Year	m3/year	m3 accumulated	m3 surplus
2006	1,380,000	1,380,000	20,403,962
2007	1,449,000	1,449,000	20,334,962
2008	1,521,450	2,970,450	18,813,512
2009	1,597,523	4,567,973	17,215,989
2010	1,677,399	6,245,371	15,538,591
2011	1,761,269	8,006,640	13,777,322
2012	1,849,332	9,855,972	11,927,990
2013	1,941,799	11,797,770	9,986,192
2014	2,038,889	13,836,659	7,947,303
2015	2,140,833	15,977,492	5,806,470
2016	2,247,875	18,225,366	3,558,596
2017	2,360,268	20,585,635	1,198,327
2018	2,478,282	23,063,916	-1,279,954

Table 5-17: Calculation of the Useful Life According to the S/T

	Waste Entrance		Volume
	Year	Accumulated	Available
Year	m3/year	m3 accumulated	m3 surplus
2006	1,380,000	1,380,000	17,725,645
2007	1,449,000	1,449,000	17,656,645
2008	1,521,450	2,970,450	16,135,195
2009	1,597,523	4,567,973	14,537,673
2010	1,677,399	6,245,371	12,860,274
2011	1,761,269	8,006,640	11,099,006
2012	1,849,332	9,855,972	9,249,674
2013	1,941,799	11,797,770	7,307,875
2014	2,038,889	13,836,659	5,268,986
2015	2,140,833	15,977,492	3,128,154
2016	2,247,875	18,225,366	880,279
2017	2,360,268	20,585,635	-1,479,989

The useful life according to what is indicated in the EID is 12.6 years, according to the calculations where the loss of volume by the banks is considered it is 10.4 years.

The proposed design considers a maximum height of the landfill of 33 m, measured from the level 112 approximately, and it contemplates excavations in area 1 and 2 over the 10 m depth. As you can see in Figure 5-5, each area will be managed in an independent way, with what increases the areas exposed to erosion and additionally hinders the management of rain water. On the other hand, the existence of gulches in the waste deposal area as well as the adjacent area requires specific geotechnical studies that will allow designing the protection works to avoid the slip of the waste or the collapse of the landfill.

According to the EID, the project has a life between 12 and 13 years, however, due to the lack of antecedents, verification of the design is recommended, especially the aspects related with stability of the mass of waste and the leached management.

From the discussion above, it is technically estimated that Duquesa would operate until 2016 or 2017. However, there is concern that it may not be possible to heap up the waste as planned and the ground may slip due to the cumulated waste. In addition, there is the fear that safety hazards may occur for the new airport nearby due to fire and birds. Then, there is a risk that Duquesa may be closed earlier than its life period. Consequently, this Master Plan considers two options as follows.

Master Plan 1 (MP1): Duquesa operates until 2015

Master Plan 2 (MP2): Duquesa is closed by the end of 2011 and a new landfill that locates at 40 km away from the center of the city operates from 2012.*

* The assumption of a new landfill location, i.e., at 40 km away from the center of the city, was established on a mutual agreement between the Dominican side and the Japanese side during the discussion on the Inception Report as described in the Minutes of Meetings signed on 12 August 2005.

Chapter 6

Selection of an Optimum Scenario

6 Selection of an Optimum Scenario

6.1 Goal Setting

The SWM principally has three roles, i.e.,

(1) to collect waste to maintain a healthy living environment,
(2) to dispose of waste in an environmentally-sound manner,
(3) to minimize the waste amount to the reduce burden on the SWM system and to contribute to the conservation or resources.

The above roles shall be efficiently fulfilled.

Goals for the respective roles shall be set up taking into account the current situation. Those are the collection rate, final disposal and waste minimization rate.

The National District is a populated city. All residents need a waste collection service. Currently 90% of the residents are covered in some way by a collection service, although the majority receives an irregular service. 10% of the residents, especially the poor who live along the Ozama River, do not receive the service at present.

Final disposal in the future has been discussed in the previous section, Preconditions for Planning. Therefore, this issue is not dealt with in this section.

The waste generation amount per capita is considerably large as well as the disposal amount per capita, the former is 1.56 kg and the latter is 1.37 kg. Meanwhile, the recycling rate is low, estimated at 7% of the generation amount. Consequently, it is assuredly necessary to minimize the waste amount in order to reduce the burden on the SWM and to contribute to resource conservation.

Taking into account the current situation described above, alternatives to the goal can be thought as follows.

Collection:

1) no change
2) 90% of residents covered with regular collection service
3) 100% of residents covered with regular collection service

Waste Minimization:

1) No change
2) 15% of waste minimization
3) 24% of waste minimization

6.2 Scenario Options

Taking into account the alternatives to the goal, some scenarios have been set up as shown in the table below. Scenario 0 is “Baseline,” Scenario 1 is “Conservative,” Scenario 2 is “Progressive,” and Scenario 3 is “Radical.” Also, the Master Plan period between 2007 and 2015 is divided as shown in the table.

Table 6-1: Scenario Setting

Scenario	Short term by 2008	Medium term by 2011	Long term by 2015
0 (Baseline)	• 90% with irregular collection service • no waste minimization	• 90% with irregular collection service • no waste minimization	• 90% with irregular collection service • no waste minimization
1 (Conservative)	• 90% with regular collection service • no waste minimization	• 95% with regular collection service • no waste minimization	• 100% with regular collection service • no waste minimization
2 (Progressive)	• 95% with regular collection service • Minimization rate at 7%	• 100% with regular collection service • Minimization rate at 10%	• 100% with regular collection service • Minimization rate at 15%
3 (Radical)	• 95% with regular collection service • Minimization rate at 7%	• 100% with regular collection service • Minimization rate at 13%	• 100% with regular collection service • Minimization rate at 24%

Details of the scenarios are described below.

Scenario 0

Collection:

- 90% of the citizens are covered by the collection service, but the majority has an irregular service.

Waste Minimization:

- Recycling activities are found in the private sector, which is currently carried out in the context of market principles. No public recycling measure has been implemented.

Scenario 1

Collection:

- 90% of the citizens are covered by the regular collection service, i.e., collection time; frequencies and other necessary manners are established and practiced.

Waste Minimization:

- Recycling activities are found in the private sector, which is currently carried out in the context of market principles. No official measure is taken.

Scenario 2

Collection:

- 100% of the citizens are covered by the regular collection service.

Waste Minimization:

- Generation control; 3% of the waste generation amount is reduced by environmental education, application of waste collection service fee by volume/weight for ICIs (Institution, Commerce and Industry).

- Discharge control; 20% of households and 40% of ICIs other than municipal markets participate in waste exchange, recycling at supermarkets, colmados, communities and schools. This discharge control is encouraged in line with market principles and environmental education.

- Composting; 70% of the municipal markets participate in a composting program, in addition, 30% of sweeping waste (pruning waste) is brought to the program.

Scenario 3

Collection:

- 100% of the citizens are covered by the regular collection service.

Waste Minimization:

- Generation control; 3% of the waste generation amount is reduced by environmental education, application of waste collection service fee by volume/weight for ICIs.

- Discharge control; 20% of households and 40% of ICIs other than municipal markets participate in waste exchange, recycling at supermarkets, colmados, communities and schools. This discharge control is encouraged in line with market principles and environmental education.

- Composting; 70% of the municipal markets participate in a composting program, in addition, 30% of sweeping waste (pruning waste) is brought to the program.

- Material Recovery; 40% of households and ICIs other than municipal markets participate in a separate collection program and recyclable materials such as paper, textile, plastic, metal and glass are recovered at a MRF (material recovery facility).

a. Waste Streams

The waste streams of the scenarios in 2015 are shown in this section.

Table 6-2: Waste Steams of Scenarios (2015)

No.	Waste stream	Scenario 0	Scenario 1	Scenario 2	Scenario 3
1	Generation potential	1,761	1,761	1,761	1,761
2	Generation control	0	0	53	53
3	Generation	1,761	1,761	1,709	1,709
4	Discharge	1,716	1,716	1,527	1,527
5	Self-disposal	8	8	8	8
6	Recycling at source	37	37	174	174
7	Collection & Transport	1,628	1,715	1,526	1,526
8	Direct haul	1	1	1	1
9	Clandestine dumping	88	0	0	0
101	MRF in	0	0	0	309
102	MRF recycled	0	0	0	154
103	MRF residue	0	0	0	154
111	Compost in	0	0	51	51
112	Compost residue	0	0	18	18
113	Compost product	0	0	5	5
114	Compost reduced	0	0	33	33
12	Haulage into disposal site	1,629	1,716	1,494	1,339
13	Recycling at disposal site	0	0	0	0
14	Final disposal	1,629	1,716	1,494	1,339
151	Minimization	45	45	268	422
152	Minimization rate	3%	3%	15%	24%

Scenario 0 in 2015

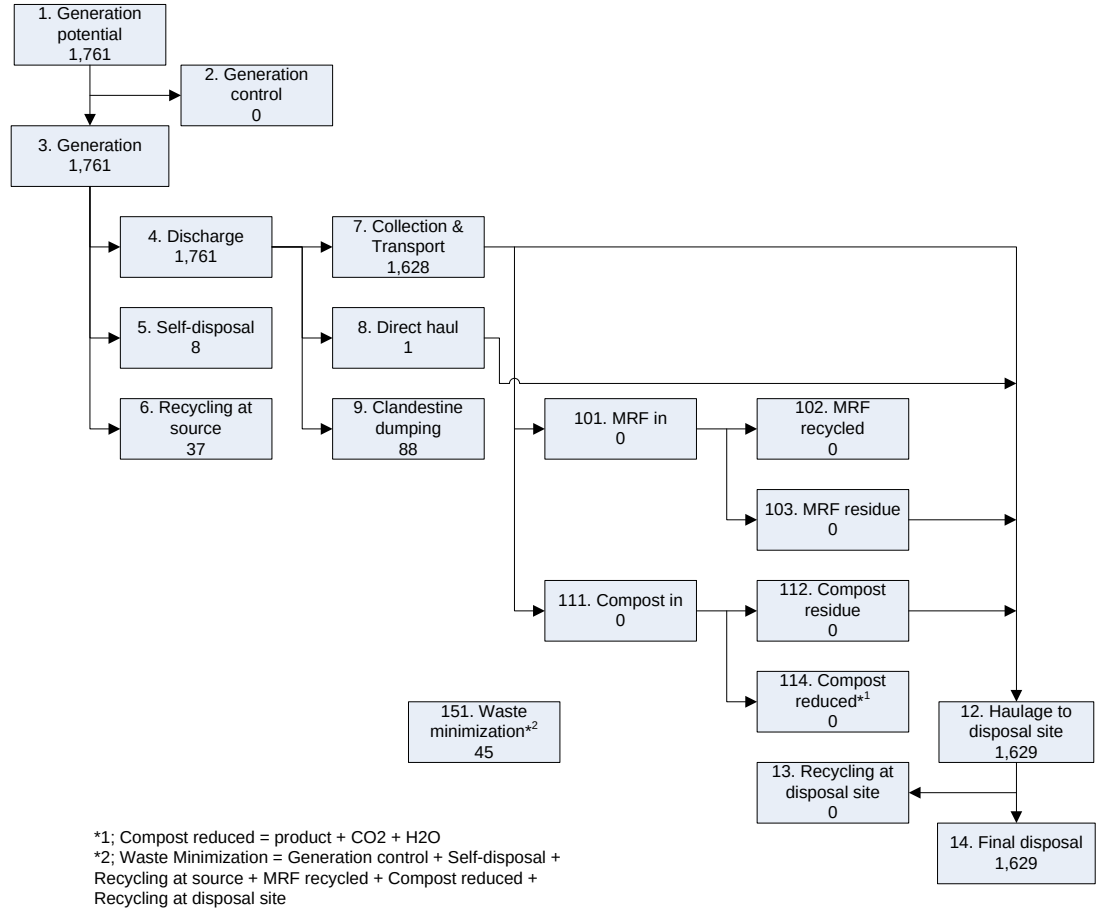


Figure 6-1: Waste Steam of Scenario 0 (2015)

Scenario 1 in 2015

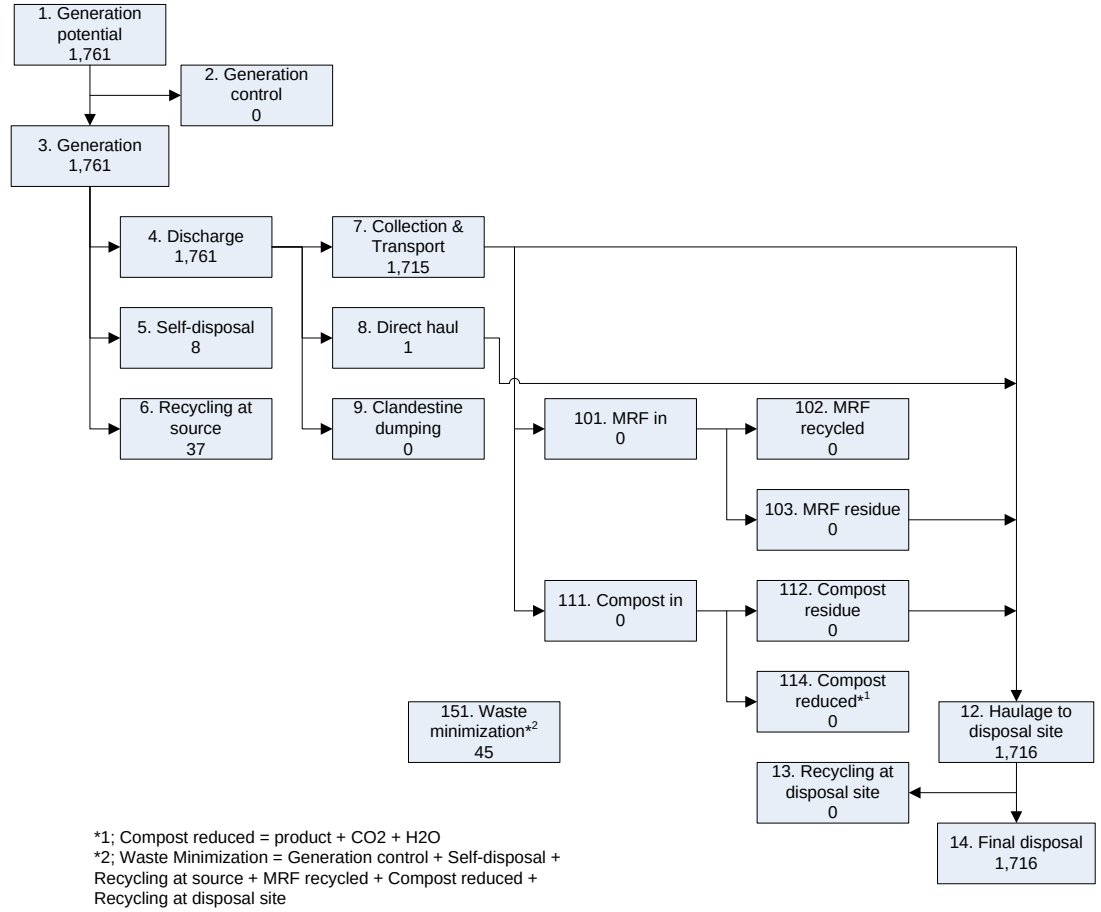


Figure 6-2: Waste Steam of Scenario 1 (2015)

Scenario 2 in 2015

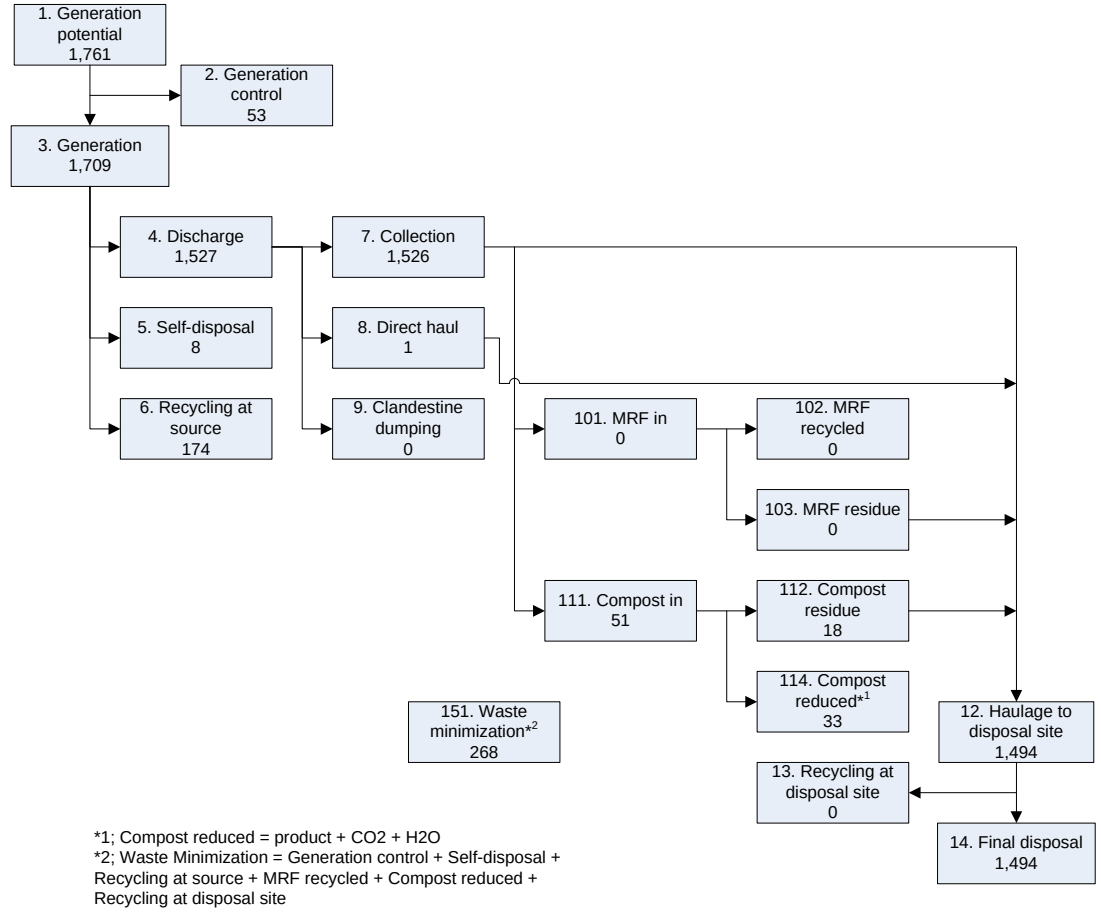


Figure 6-3: Waste Steam of Scenario 2 (2015)

Scenario 3 in 2015

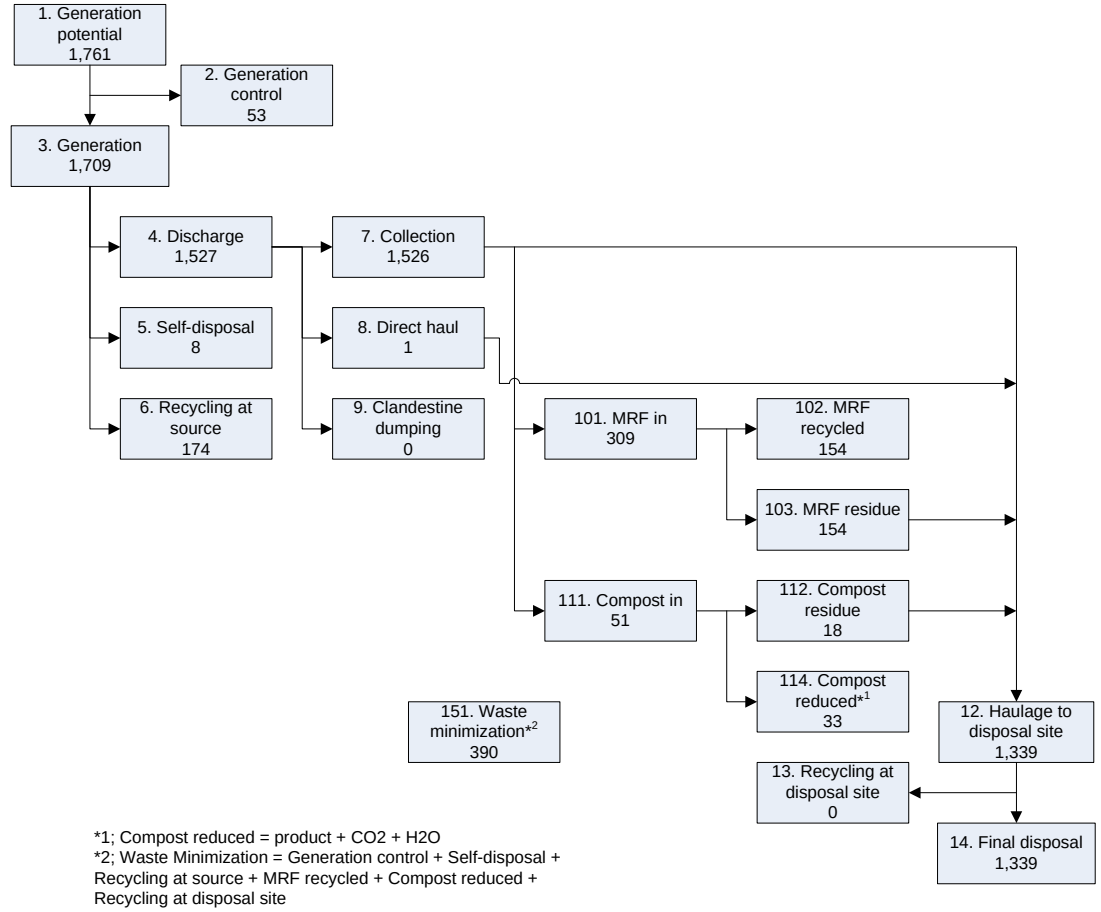


Figure 6-4: Waste Steam of Scenario 3 (2015)

b. Cost Comparison

The costs of the scenarios are estimated based on available information such as previous JICA studies in Latin American countries and CEPIS (Centro Panamericano de Ingenieria Sanitaria y Ciencias del Ambiente), and taking into account the actual situation in the National District.

As for revenue from composting and MRF: no revenue from composting is considered as there is no market at present; meanwhile, a market for recovery materials has been established. This cost comparison considers income from the recovered materials.

The cost comparison results in Scenario 1 being the most expensive (84.9 thousand US$/day), Scenario 0 is the second (80.6 thousand US$/day), Scenario 3 is the third (77.1 thousand US$/day) and Scenario 2 is the least cost (76.9 million US$/day).

Table 6-3: Unit Rate for Cost Comparison of Scenarios

Component	Unit cost US$/ton	Remarks
Collection and Transport	35	inc. sweeping
Composting	30	-
Material Recovery	30	-
Final Disposal	10	-
Administration	10%	of the total cost

Note: Unit costs are estimated by the Study Team

Table 6-4: Waste Amount (2015)

Unit: ton/day

Component	Scenario 0	Scenario 1	Scenario 2	Scenario 3
Collection and transport	1,628	1,715	1,526	1,526
Composting	0	0	51	51
Material Recovery	0	0	0	309
Final Disposal	1,629	1,716	1,494	1,339

Table 6-5: Estimated Costs of Scenarios

US$/day

Component	Scenario 0	Scenario 1	Scenario 2	Scenario 3
Collection and transport	56,969	60,034	53,405	53,397
Composting	0	0	1,536	1,536
Material Recovery	0	0	0	9,260
Final Disposal	16,288	17,164	14,937	13,391
Sub total	73,257	77,198	69,878	77,584
Administration	7,326	7,720	6,988	7,758
Total cost	80,583	84,918	76,866	85,342
Unit cost (US$/ton)	50	50	50	56

Table 6-6: Income from Material Recovery

Category	Recovered ton/day	Price US$/ton	Income US$
Paper	160	25	4,007
Textile	36	5	182
Plastic	68	19	1,297
Metal	22	100	2,212
Bottle/Glass	22	25	539
Total	309	-	8,237

*Prices per ton are estimated based on the results of the Recycling Market Survey.

Table 6-7: Required Costs of Scenarios

US$/day

Item	Scenario 0	Scenario 1	Scenario 2	Scenario 3
Expenditure	80,583	84,918	76,866	85,342
Income	0	0	0	8,237
Required cost	80,583	84,918	76,866	77,105
Required cost per ton	50	50	50	51

6.3 Evaluation of Scenarios

This section evaluates the scenarios. The table below shows the results of the evaluation.

Table 6-8: Evaluation of Scenarios

Evaluation items	Scenario 0	Scenario 1	Scenario 2	Scenario 3
1. Goal setting				
1) Collection	Collection rate remains at 90% (in population) with irregular service: The city is not clean similar to the current situation.	100% collection rate with regular service is achieved. The city is kept clean. The citizens enjoy a sanitary living environment.		
2) Waste Minimization	No waste minimization measure is taken.	No waste minimization measure is taken.	15% of waste minimization is achieved. This has a considerable impact.	24% of waste minimization is achieved. This has a huge impact.
2. Technical aspect	No new technology is applied.	Collection routes are planned. This is not an advanced technique.	In addition to the collection routes, composting is introduced. However, this is not an advanced technique.	In addition to the Scenario 2, a Material Recovery Facility is introduced. It generally requires higher technical capability than the composting.
3. Financial aspect cost thousand US$/day	Total cost is the second highest. However, intensive investment is not required. 80.6	Total cost is the highest. Investment for purchasing collection vehicles is required. 84.9	Total cost is the lowest. Investment for collection vehicles and a composting facility is required. 76.9	Total cost is the second lowest. However, intensive investment for a composting facility and a MRF is necessary. 77.1
4. Environmental and social considerations	Esthetic of the city is deteriorated by scattered waste. Waste accumulated in marginal areas may cause diseases.	Esthetic of the city is not deteriorated by scattered waste.	The composting facility may cause some impacts, e.g. mal odor. Mitigation measures may be necessary.	The composting facility and the MRF may cause some impacts, e.g. mal odor. Mitigation measures may be necessary.

6.4 Selection of an Optimum Scenario

Scenario 3 is the best for performing SWM roles, i.e., to collect waste to maintain a healthy living environment, and to minimize the waste amount to reduce the burden on the SWM system and to contribute to resource conservation. In addition, it is the second least costly.

Scenario 3 requires appropriate participation of waste dischargers in the separate collection. Otherwise the MRF does not perform successfully. Furthermore, this scenario requires intensive investment for construction of the MRF and a certain level of technical capability to operate it.

Scenario 2 is the least costly. Although it requires investment in the composting facility, the cost is small due to its size of the facility. There exist some methods of composting. It has high adaptability to various conditions.

Scenario 1 is not recommendable due to its high cost without any minimization. As for Scenario 0, there is no room for consideration. The current situation must be improved.

Consequently, **Scenario 2 is recommendable as the optimum scenario** taking into account above discussions.

It should be noted that institutional capacity development is fundamental whichever scenario is followed. Such institutional capacity assures that the municipal government; the citizens and the private sector appropriately play their roles and communicate each other.

Chapter 7

Description of the Master Plan

7 Description of the Master Plan

7.1 Outline

a. Basic Concept

a.1 Guiding Principle

The Master Plan assumes a part of ADN's "Mission" and contributes to the realization of its "Vision."

Vision: The National District is an environmentally sustainable space where its residents progressively improve their quality of life in a cultural, healthy, rich and diverse environment, and where the public and collective interests are the fundamental references for participatory municipal management.

In particular, ADN has a vision in the field of Municipal Solid Waste Management, i.e., **"Clean City (Ciudad Limpia)."**

Mission: To make the National District a clean, orderly and socially educated territory, with the lowest environmental contamination level to increase the city of Santo Domingo de Guzman's residents and the visitors' quality of life.

a.2 Basic Approach

The basic approach of the Master Plan is the **"collaboration between the municipal government, the citizens and the private sector"** in order to establish a sustainable solid waste service with satisfactory quality.

Collaboration means that each party plays their respective role. ADN has to provide a proper solid waste service to the citizens and to supervise the private sector, the citizens have to discharge waste appropriately and pay for the service, and the private sector has to operate the solid waste service in accordance with the contracts.

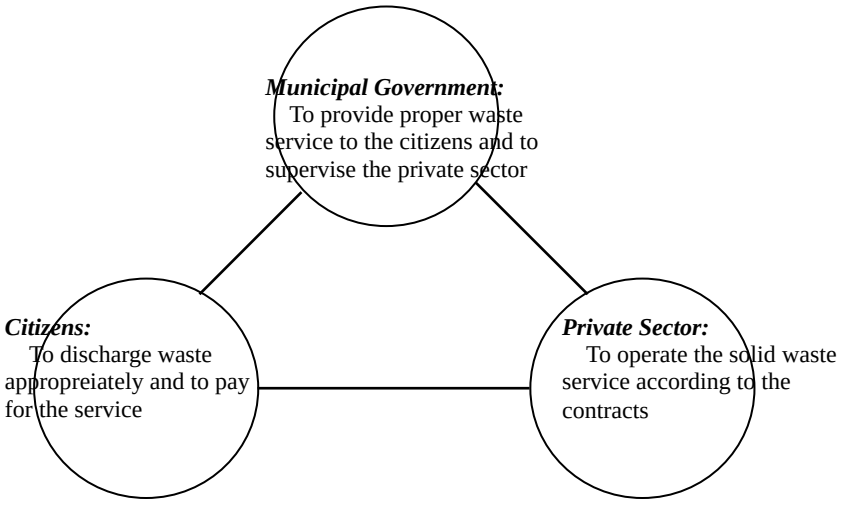


Figure 7-1: Collaboration between the Municipal Government, the Citizens and the Private Sector

b. Objectives

The Master Plan aims to establish a "Sustainable Solid Waste Service" which has the following objectives:

1) to collect waste to maintain a healthy living environment,

2) to dispose of waste in an environmentally-sound manner,

3) to minimize the waste amount to reduce burden on solid waste management and to contribute to resource conservation, and

4) to provide the service efficiently in order for the service to be financially sustainable.

c. Scope

The scope of the Master Plan is as follows.

Target Area:	National District, Santo Domingo de Guzman
Target Year:	2007 – 2015 that is divided into three stages 1st stage 2007 – 2008 2nd stage 2009 – 2011 3rd stage 2012 - 2015
Target Population:	Citizens, about one million, and visitors in the National District
Target Solid Waste:	Municipal waste, which is non-hazardous waste generated from households, institutions, commercial entities, small industries and public areas

d. Goals

The Master Plan set up the following four goals according to its objectives mentioned above.

Goal 1: Collection Rate 100%

All the citizens enjoy high quality of collection service.

Goal 2: Sanitary Landfilling

Sanitary landfilling is practiced at Duquesa or a new disposal site.

Goal 3: Minimization Rate 15%

A 15% waste minimization rate is achieved by activities such as generation control and recycling.

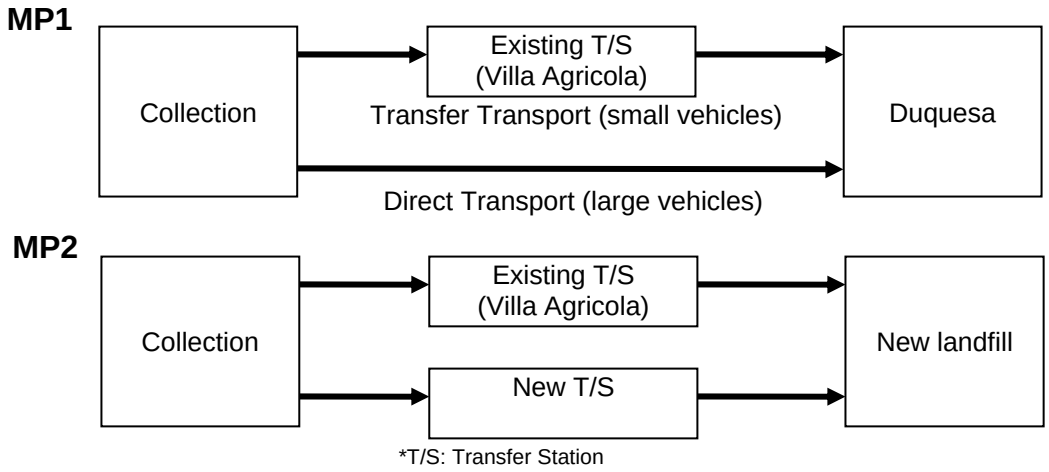
Goal 4: Subsidy / Cost Rate 30 – 50%

75% of the actual dependency rate on subsidy is reduced to 30 – 50% by increasing the efficiency of the operation and increasing the fare receipts.

These four goals are challenging taking into account the current MSWM in the National District.

Goal 1, a collection rate of 100%, is considerably challenging taking into account the current situation where waste is accumulated and scattered everywhere. In particular, it will be difficult to establish a proper collection system in the marginal area in which it is difficult for collection vehicles to pass. This issue will be the key for attaining the goal.

As for Goal 2, it is uncertain if Duquesa could receive waste and operate until 2015. Therefore, The M/P prepares two scenarios. MP1 assumes to use Duquesa until 2015. The other, MP2, supposes to use Duquesa until 2011 and to operate a new landfill from 2012.



Goal 3, 15 % minimization rate, is also a considerably challenging goal, taking into account the current situation where almost no official recycling activities are practiced. However, there is a need for waste minimization from the viewpoints of reducing burdens on the MSWM and of resource conservation, as the waste generation rate per person in the Study Area exceeds 1.5 kg per day which is at the level of industrialized countries.

The rate of dependence to the subsidy is set to 30 – 50% by Goal 4. The reason why there is such a range is due to disagreement among the basic data of the Census, Triple A and others such as number of families. It is recommendable to continue data collection and analysis and to review the goal during the implementation of the M/P.

The Master Plan sets its goals as shown in the table below.

Table 7-1: Goals of the Master Plan

Item	1st stage 2008	2nd stage 2011	3rd stage 2015
Collection rate	95%	100%	100%
Final Disposal	Improved operation at Duquesa	Improved operation at Duquesa	Improved operation, at Duquesa or a new sanitary landfill
Waste Minimization	8%	10%	15%
Financial soundness	30-50%	30-50%	30-50%

Selection of MP1 or MP2

As described in the "Minutes of Meetings on the Draft Final Report" the Dominican side will establish evaluation items by the end of January 2007, then choose one of them by the end of June 2007, although the Dominican side considers the MP2 as a priority scenario.

It is recommendable to take into account the followings for establishing the evaluation items.

1. Environmental Impact Declaration

The Consortium Duquesa presented an Environmental Impact Declaration to the Secretariat of State for the Environment and Natural Resources in June 2006 with the purpose of regularizing the situation of the final disposal site and expanding its useful life. However, the operation was transferred from the Consortium to the Municipality of Santo Domingo Norte in September 2006 while the Secretariat was evaluating the EID. ADN should clarify if the EID was approved by the Secretariat.

2. Topographic Survey

There not exists a reliable topographic map so as accurately to estimate a remaining capacity of the landfill. A topographic survey should be carried out to obtain a map having a measuring scale between 1/1,000 and 1/2,500.

3. Landfilling Plan

A detailed landfilling plan should be prepared on the map mentioned above and taking into account characteristics of foundation, stability of waste mass, required capacity for leachate storage, etc. as mentioned in the Action Program 401. Then, a remaining capacity should be calculated and a useful life should be established on the basis of the map and the plan.

4. Isabela Airport

The distance between the Duquesa and the Isabela Airport is too short to comply with the requirement established in the law, "Norma para la Gestion Ambiental de Residuos Solidos (NA-RS-001-03)." It should be clarified if this point may influence the useful life of the Duquesa.

It always takes a long time to construct a new landfill for establishing a consensus among stakeholders, funding, planning, designing, etc. Therefore, it is recommendable to seek for a site for a future landfill as early as possible, even if the MP1 would be chosen. The Action Program 402, "Landfill Site Selection", can be of assistance to find an adequate site for a new landfill.

e. The Master Plan

The Master Plan is summarized in the table below.

Table 7-2: Draft of the Master Plan

Phase	Present	Phase 1	Phase 2	Phase 3
Components	(2005)	(2008)	(2011)	(2015)
0. Population	980,653	1,023,176	1,067,543	1,129,706
I Principal Indicators				
Collection rate in weight	95%	98%	100%	100%
Collection rate in population	90%	95%	100%	100%
Collection service quality	Low	High	High	High
Final disposal	Duquesa	Duquesa	Duquesa	Duquesa (New)
Minimization	7%	8%	10%	15%
II Waste Stream (ton/day)				
1 Generation potential	1,529	1,595	1,664	1,761
2 Generation control	0	16	33	53
3 Generation	1,529	1,579	1,631	1,709
4 Discharge	1,489	1,538	1,547	1,527
5 Self-disposal	7	7	7	8
6 Recycling at source	33	34	77	174
7 Collection	1,412	1,499	1,546	1,526
81 Transport - direct	996	1,057	1,094	1,053 (0)
82 Transport - transfer	416	442	452	440 (1,492)
9 Direct haul	1	1	1	1
10 Clandestine dumping	76	38	0	0
111 Compost in	0	0	20	51
112 Compost residue	0	0	7	18
113 Compost product	0	0	2	5
114 Compost reduced	0	0	13	33
12 Haulage into disposal site	1,413	1,500	1,534	1,494
13 Recycling at disposal site	69	72	33	0
14 Final disposal	1,344	1,428	1,501	1,494
15 Minimization	109	129	164	268
III Discharge, Collection and Transport				
a. Nos. of containers				
Urban area	-	2,969	3,043	2,962
Marginal area	-	1,906	1,953	1,901
b. Nos. of collection vehicles (compactor)				
Ordinary Area 20yd3	-	63	65	63 (53)
Marginal Area 6yd3	-	40	41	40 (40)
c. Transfer station	1 (existing)			1 (2)
VI Public area cleansing				
a. Sweeping	Manual	Manual		
b. Street trees pruning	-		Prevention of hurricanes	
V Final Disposal				
a. Operation quality	Low	Middle	Middle	High
VI Minimization				
a. Generation control	-	-	Environmental education, application of weight/volume based tariff	
b. Recycling at source	-	-	In operation	In operation
c. Composting	-	-	In operation	In operation
VII Cost				
a. Cost per year (1,000US$)	-	24,943	25,829	25,603 (29,693)

Numbers in parenthesis are MP2.

f. Waste Steam

This section presents the waste flows of the Master Plan; present (2005), 2008, 2011 and 2015.

2005

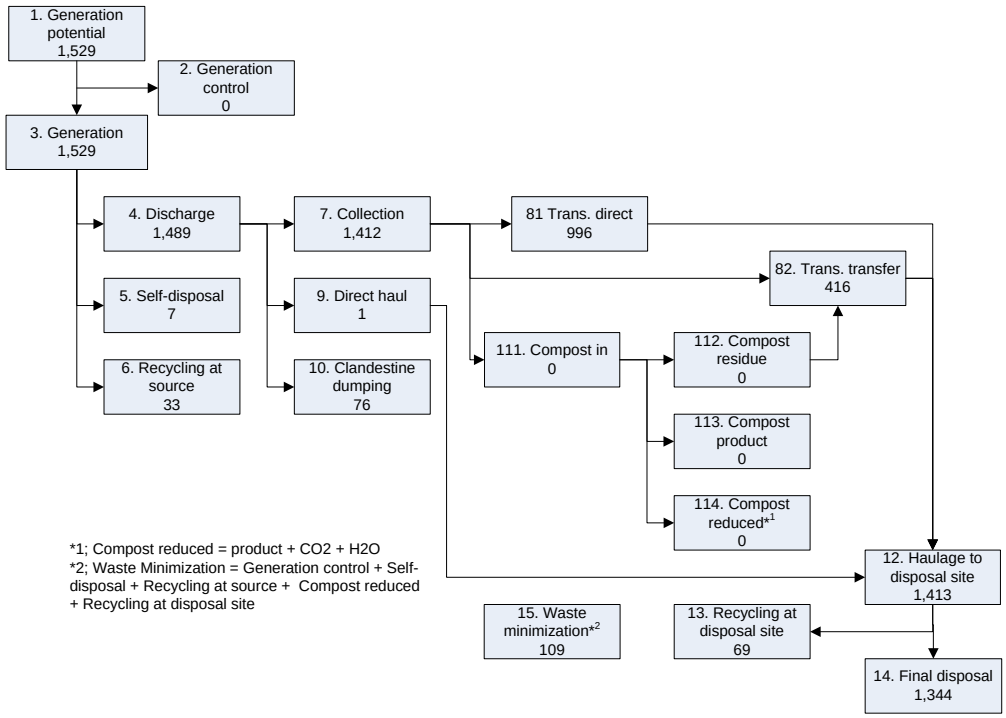


Figure 7-2: Waste Stream at Present (2005)

2008

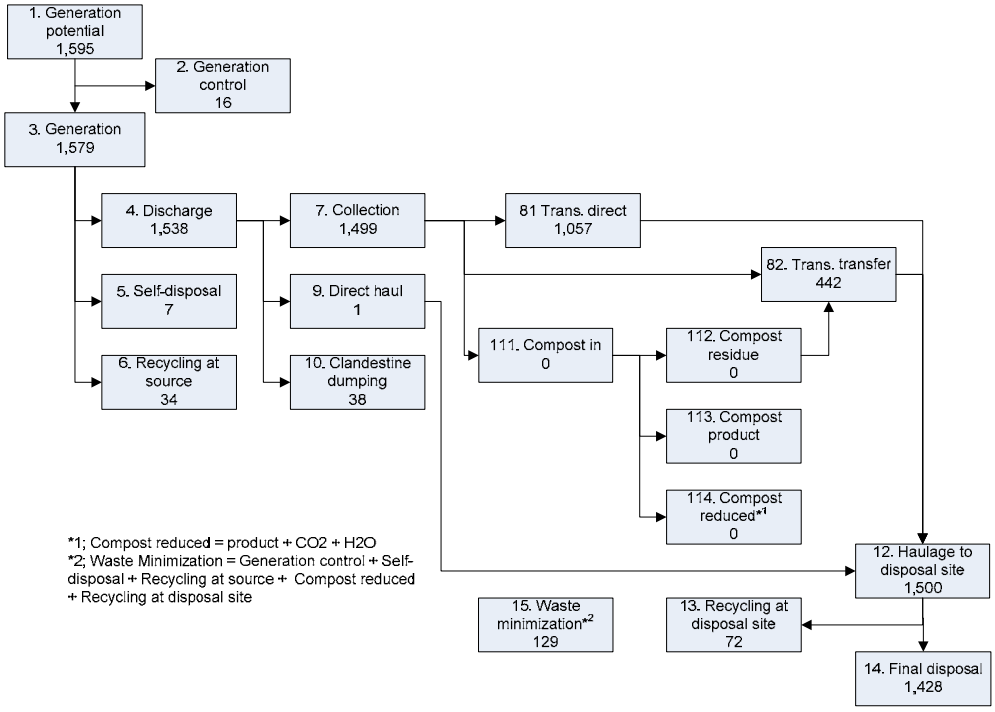


Figure 7-3: Waste Stream in 2008

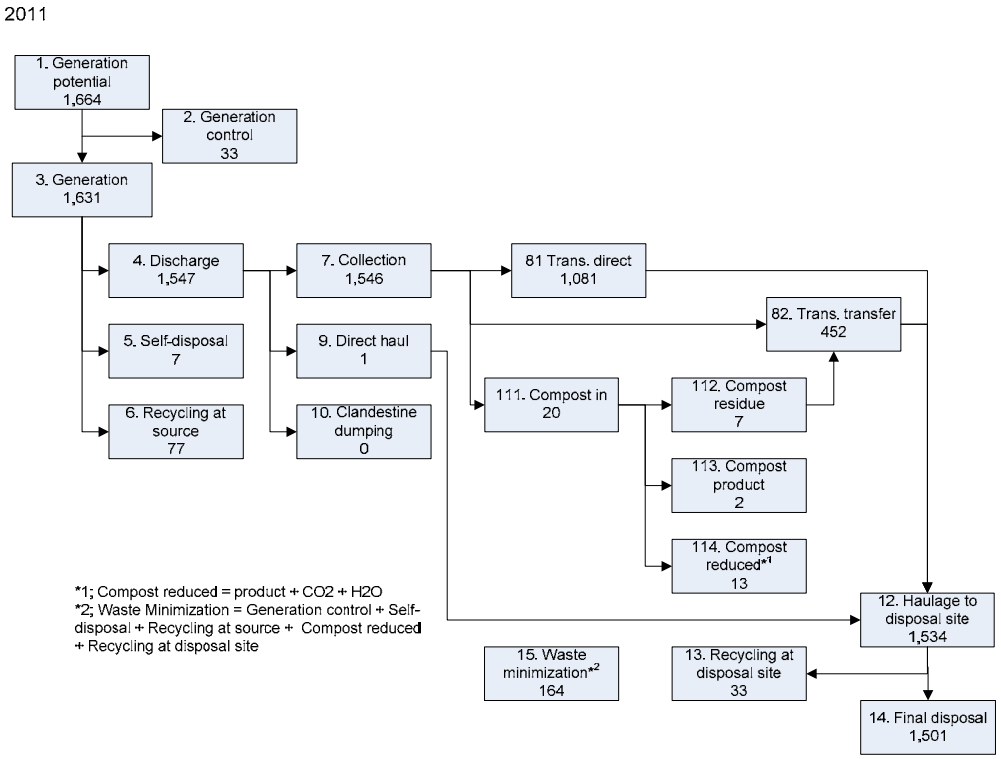


Figure 7-4: Waste Stream in 2011

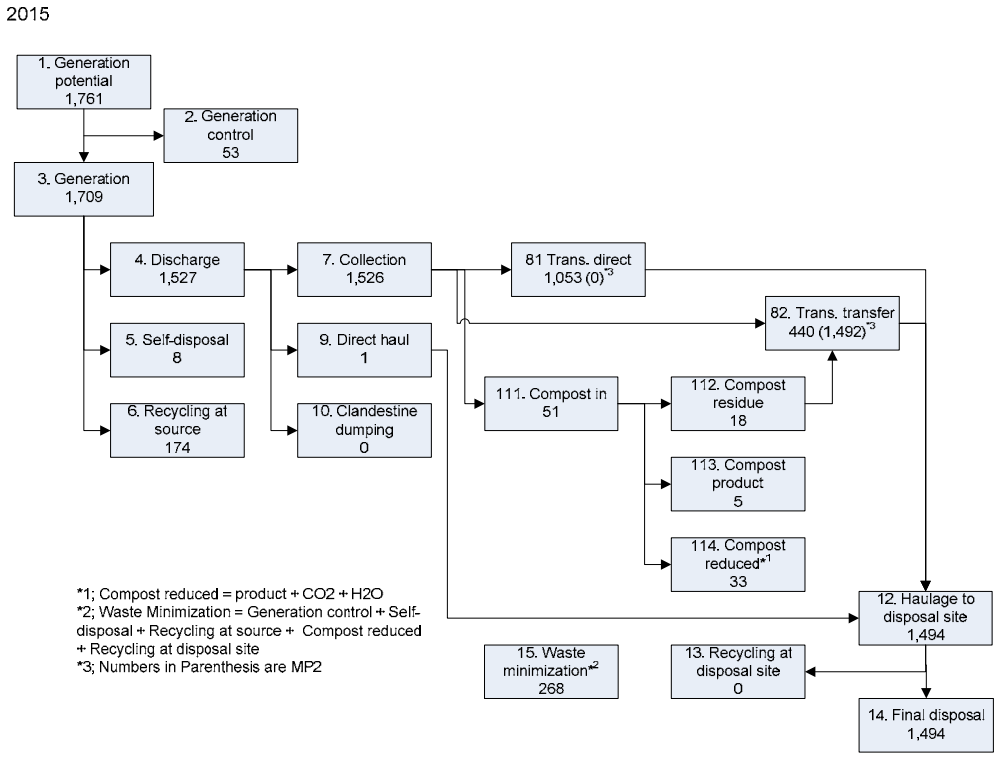


Figure 7-5: Waste Stream in 2015

7.2 Strategies

The following six strategies are recommended to attain the M/P Goals.

Strategy 1: To establish legal infrastructure
Strategy 2: To strengthen organization
Strategy 3: To establish order in the collection service market
Strategy 4: To built a consensus among the municipalities in the Metropolitan Area
Strategy 5: To begin the 3Rs and to apply the principle of Extended Producer Responsibility
Strategy 6: To apply the Polluter Pay Principle, but to consider the poor

Strategy 1: To establish legal infrastructure

To establish an infrastructure that legally supports the M/P.

Strategy 2: To strengthen the management organization

To strengthen the functions of ADN so as to properly manage the MSWM system, in which various actors, such as the citizens as waste dischargers and the private companies as SW service operators, are elaborately related each other.

Strategy 3: To establish order in the collection service market

To establish order in the collection service market where various SW service operators including ADN are currently working in a disorderly manner.

Strategy 4: To built a consensus among the municipalities in the Metropolitan Area

To built a consensus among the municipalities about final disposal such as improvement of Duquesa and construction of a new landfill which are issues for the whole Metropolitan Area.

Strategy 5: To begin the 3Rs and to apply the principle of Extended Producer Responsibility

In order to encourage waste minimization, to conduct environmental education for the 3Rs and to practice waste minimization, such as pet-bottle recycling with the initiative of manufacturers.

Strategy 6: To apply the Polluter Pay Principle, but to consider the poor

To ask for payment corresponding to the cost of the MSWM to business entities and the citizens who have the ability to pay applying the Polluter Pay Principle, but use the subsidy for citizens who do not have the ability to pay for the cost.

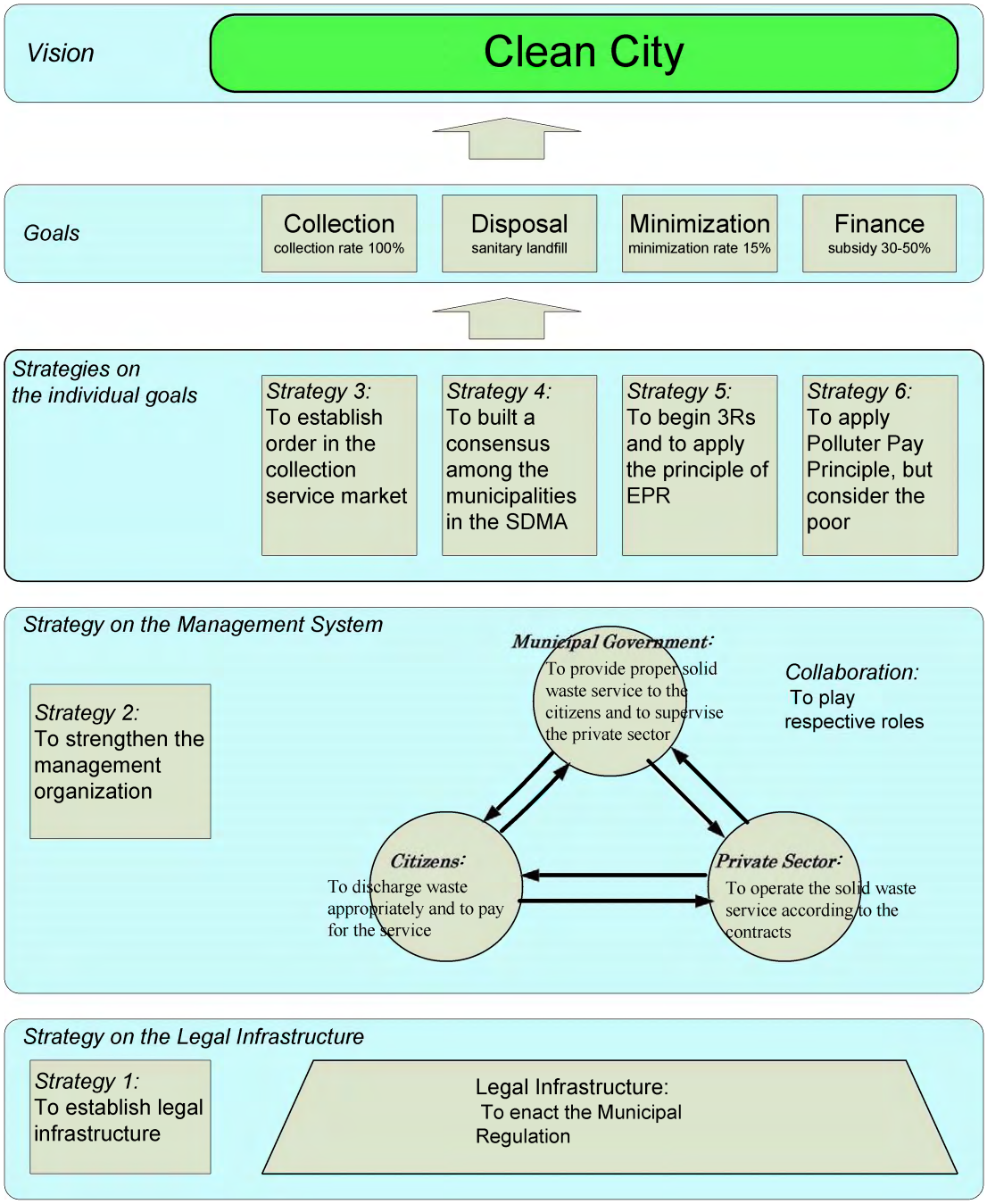


Figure 7-6: Strategies of the Master Plan

7.3 Institutional System

This section presents recommendations concerning the legal system, organization, public-private partnership, financial management, and communication with the community residents.

7.3.1 Legal System

No state policy exists concerning solid waste management; however, attempts at dictating a few policy guidelines through laws and norms have been published.

These regulations have been used as a basis to structure a new municipal regulation setting guidelines and conditions for an integral solid waste management.

The regulation's objective is to govern relationships between the City Hall (ADN), citizens, clients and private service lenders retained or authorized in the public service of integral solid waste management and in maintaining the city clean.

This table contains the norms on which the municipal regulation has been prepared.

Table 7-3: The Current Legal System

Norms	Jurisdiction	Objective
General Health Law (Congress Resolution Nr. 42-01 of March 8, 2001)	SESPAS	In coordination with SEMARN, prepare official norms regulating solid waste management hazardous to the population's health. Health establishments are ordered to have systems ensuring proper handling of medical waste and severe sanctions due to law infringement are established.
General Environmental and Natural Resources Law (Law Nr. 64-00)	SEMARN	Establish environmental and natural resources conservation, protection, improvement and restoration standards ensuring their sustainable use.
Law Nr. 120-99 Published in the Official Gazette 10033 of December 31, 1999	SESPAS	To protect health, preserve the nation's clean image, ban and severely sanction waste dumping, enforce fulfillment of waste collection according to frequency and schedule, establishes competence of Municipal Peace Courts and Peace Courts to know and judge regarding violations to this law.
Rule for the Environmental Solid Waste Management (NA-RS-001-03) NOGAR	SEMARN	To protect human health and people's life quality, as well as, promote environmental preservation and protection, establishing guidelines for non-hazardous municipal solid waste management. Specifies sanitary conditions to be observed in storing, collecting, transport and final disposal, as well as, general resolutions for reduction, reuse and recycling.
Environmental Rule for the Integral Medical Waste Management	SEMARN	Regulate all activities in Medical waste management from generation to final destination, including segregation, bottling or packing, internal moving within the establishment, transitory storage, collection, external transportation, treatment and final disposal actions.
ADN Municipal Resolutions	ADN	The Municipal Congress agreements deriving in statutes

a. Municipal Regulation for Cleansing

A new municipal regulation, Municipal Regulation for Cleansing was established under the jurisdiction of ADN with the cooperation of JICA in August 2006. This Regulation will regulate relations among the Municipality, their citizens, clients and lenders of the private sector hired or authorized, in the public service of the integral solid waste management and in the cleaning maintenance of the National District.

The Regulation will facilitate the achievement of the following:

- Establish norms regarding the service, costs and tariff, which are "rules of the game" that will be useful as guide for the interaction of all the actors
- Formulate an administrative structure that facilitates the performance of the actors to gain efficiency
- Fulfill the existing legislation in the country related to the Political Constitution, General Law of Environment and Natural Resources, General Law of Health, Law No. 120-99, Non Hazardous Solid Waste Management Norm, Municipal Resolutions
- Provide and encourage high levels of health protection and environmental preservation
- Assure that administrative procedures will be available to cover or sanction the infractions
- Prevent waste generation, find value in waste
- Promote harmonized participation of the organizations, which compose the social capital of ADN and structure the Special Commission of the Integral Solid Waste Management
- Encourage the big generators of solid waste to appreciate their responsibility, "Polluter Pays Principle"
- Regulate the participation of the private sector to achieve adequate service quality and reasonable price through contests that assure a total transparency
- Structure a communication system with the clients of the service to meet their demands and receive their suggestions
- Encourage the creation of Ornate and Cleansing Commissions in each Neighbors Committee
- Subsidize the families identified as being under the poverty line in the payment of their invoices for the service provided
- Protect the personal security and health of the public servants that attend the service.

Full text of the Municipal Regulation for Cleansing is found in the Supporting Report, Volume III.

b. Other Laws to be Considered

After the approval of the regulation, the establishment of specific regulations should be considered attending to the following:

- Establish shared responsibility of the producers, importers, exporters, traders, consumers and authorities in order for the integral waste management to be environmentally sound, technologically viable and economically feasible
- Regulate private sector participation providing the service
- Set tariffs based on the real cost of the service and their differentiation regarding the generation, income level, type of waste and the business activities
- Establish procedures to grant the subsidies
- Guarantee that the judicial, quasi-judicial and administrative procedures, according to the valid legislation, are available to cover or sanction the infractions.

7.3.2 Organization

a. Organizational Strengthening of ADN

The enforcement of the newly established Municipal Cleansing Regulation requires ADN to strengthen its organization. This applies to two levels. One level refers to the cooperation among Directorates within ADN, while the other refers to the strengthening of EMUCD, the office in charge of implementing the MSWM. Further, the Regulation recommends the creation of a Advisory Committee in order to improve the transparency of SWM.

a.1 Directorate Level

The Table below indicates the main roles of the different Municipal Directorate offices with regards to MSWM.

Table 7-4: General Functions of ADN Directorates

Directorate	General Functions regarding MSWM
Institutional Commission of the Strategic Plan	Incorporate the "Integrated Solid Waste Management Plan in Santo Domingo de Guzman, National District, Dominican Republic" prepared with the cooperation of JICA as part of the strategic axis of the Environmental Quality Management in the Strategic Plan of Santo Domingo City.
Juridical Advisory Directorate	Advisory, elaboration and/or revision of the aspect and juridical process in the institutional strengthening of the ADN associated with the integral solid waste management.
Human Development Directorate	Facilitate and achieve the citizen participation in the provision of the service of the integral solid waste management.
Planning and Institutional Development Directorate	Guide the strengthening process of the administrative capacity of ADN in the integral solid waste management.
Quality Management Directorate	Establish and keep the evaluation and quality control system of the integral solid waste management service.
Audit Directorate	Inspect the financial and administrative operations associated to the lenders of the solid waste management services, considering what is stipulated in the Non hazardous Solid Waste Management Regulation, in other regulation applicable, in the contract subscribed by the private sector, the internal norms of the government audit and the specialized provisions of the General Controllership of the Republic.
Technology and Information Directorate	Give technical support to the different administrative units that participate in the solid waste management.
Financial Directorate	Assure the correct registration of the financial movements, establish the real cost of the service and the allocation of the financial resources for the provision of the solid waste management service.
Urban Planning Directorate	Incorporate in the urban planning process the requirement of the integral solid waste management.
Human Resources Directorate	Strengthen the personnel aptitude for the solid waste management through the application of the measures guided to improve the performance, protect the health and keep the best labor climate.
Equipment and Transport Directorate	Achieve the higher level of use of the vehicles assigned to the solid waste management service.
Environmental Management and Urban Cleansing Directorate and its Dependencies	The EMUCD will manage the integral solid waste management generated in the National District. This Directorate shall take initiative in communication among Directorates regarding MSWM.

a.2 EMUCD

EMUCD organization is composed of the following five Departments: Urban Cleansing, Ornament and Public Embellishment, Prevention and Reduction of Vulnerability, Environmental Quality and Contamination Prevention, and Environmental Information

Center.

The Urban Cleansing Department is responsible for MSWM. The Master Plan makes the following recommendations concerning the organization structure and functions of the said Department.

a.2.1 Urban Cleansing Department

The Urban Cleansing Department is to be organized into the following four Units: Administration and Development Unit, Operation and Inspection Unit, Customer Service Unit – Triple A, and Health Care Waste Unit. Staff requirement for each Unit is indicated below.

Table 7-5: Staff Requirement for EMUCD

Unit	Section	Number
Administration & Development	Contract Administration	1
	Accounting	2
	Planning	1
	Human Resources	2
Operation & Inspection	Main Office	4
	Audit	25
	Urban Area Collection	3
	Marginal Area Collection	2
	Special Service	2
	Large Generators	2
	Street Sweeping	3
	Machinery & Equipment Maintenance	2
	Transfer Transport	2
Customer Service		2
Health Care Waste		2

Administration and Development Unit

The Administration and Development Unit is to provide administrative and control support to the operating units through the administrative sections functioning under this Unit but staffed by personnel belonging to other Directorates. This Unit is to be structured by the following four Sections: Quality Control and Contracts Administration; Accounting, Costs and Systems; Planning and Engineering; and Human Resources. The main functions of each Section are indicated in the Table below.

Table 7-6: General Functions of Administration and Development Unit

Section	General Function
Quality Control and Contracts Administration	Control and evaluate if the service is provided according to the quality levels established in the regulation and in the contracts with third parties.
Accounting, Costs and Systems	Assure the correct registration of the financial movements, establish the real cost of the service and provide financial resources for solid waste management service.
Planning and Engineering	Program the activities to make the service fulfill development necessities such as urban planning of the city and generation and features of the solid waste.
Human Resources	Ensure the occupational safety and the health of the worker, through the permanent training and by supplying the personal protection equipment.

Operation and Inspection Unit

This Unit is to be in charge of operation and inspection of various kinds of collection service conducted by the municipality or the private firms. The Unit is to consist of the following eight (8) Sections: Inspection, Urban Area, Marginal Area, Special Service, Institutions-Commerce-Industries Service (ICIs), Public Area Cleansing, Equipment and Maintenance, and Transport Service.

Customer Service Unit - Triple A

This Unit promotes active participation and collaboration of clients and fulfills their satisfaction for the quality of the service chiefly through Triple A, which is a private company having a contract with ADN for billing and collection of SWM service fee.

Health Care Waste Unit

This Unit is to contribute to the health and environment improvements of the National District citizens through the reduction of risks by hazardous waste generated in the health care centers.

a.2.2 Other Departments

Of the other Departments within EMUCD, close coordination with the Urban Cleansing Department will be required of the Environmental Information Center on matters relating to restraining the generation of solid waste, and the Vulnerability Prevention Department on matters relating to the management of disaster waste.

a.3 Advisory Committee

The Municipal Regulation for Cleansing stipulates creation of the Advisory Committee for the Integral Solid Waste Management that will initially consist of 16 (sixteen) organizations, of which the majority are participating in the elaboration of the Strategic Plan of Santo Domingo City.

These organizations are: Secretariat of State for Public Works and Communications; Secretariat of State for Tourism; Secretariat of State for Public Health and Social Assistance; Secretariat of State for Environment and Natural Resources; National Commission of Emergencies; Union of the Neighbors Committee of District 1; Union of the Neighbors Committee of District 2; Union of the Neighbors Committee of District 3; Union of the Neighbors Committee of the Historical Zone; Autonomous University of Santo Domingo; Dominican School of Engineers, Architects and Surveyor, National Council of the Private Company; Hotels Association of Santo Domingo; Commerce and Production Chamber of Santo Domingo; Dominican Chamber of the Construction; National Organization of the Commercial Companies ONEC.

The general function of the Committee is to encourage harmonized and structured participation of the citizenship and of their social organizations to cooperate with the Municipality in the achievement of economic and social profitability in the integral solid waste management.

a.4 Organization Structure and Relation

The coordination among Directorates within ADN, the structure of EMUCD, and the relationship with the Advisory Committee are indicated in the Figure below.

A detailed description of the responsibilities and functions of each office are presented in the Annex.

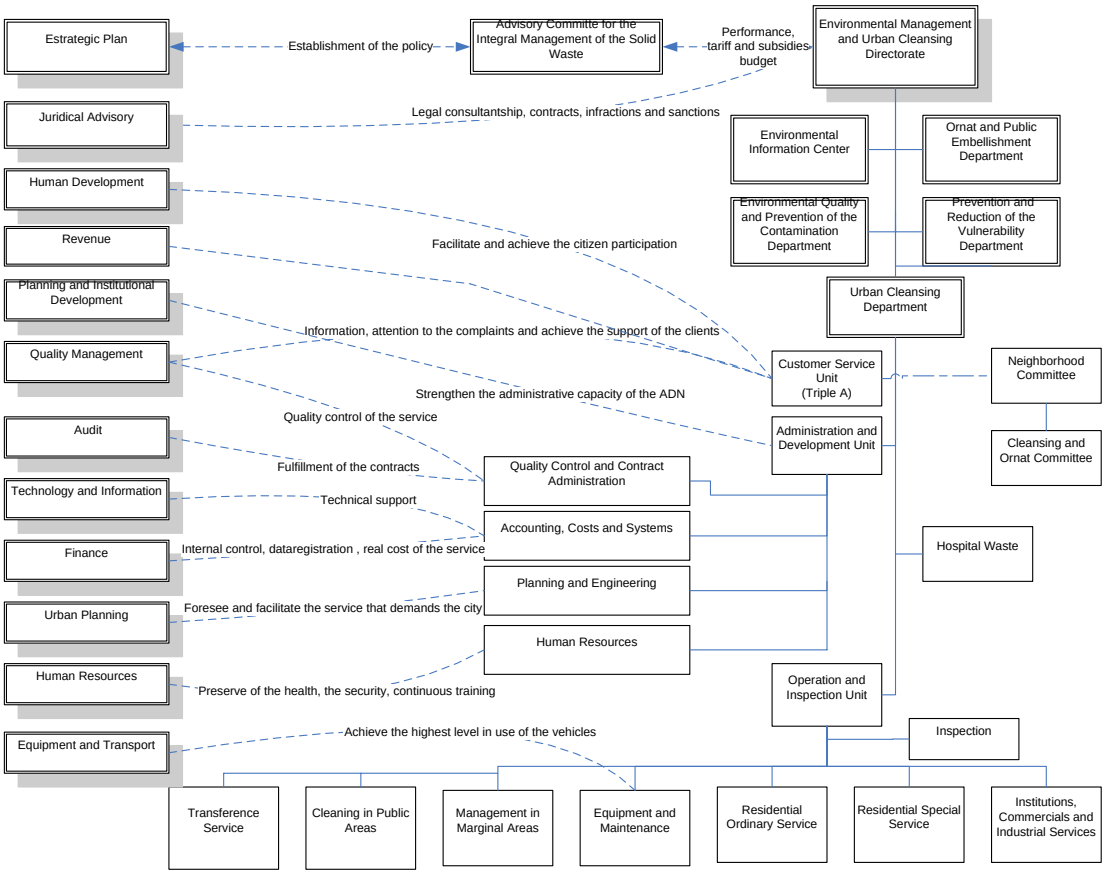


Figure 7-7: Organization Structure and Relation of ADN regarding MSWM

b. Establishment of Municipal Company

Participation of the civil society in the MSWM is vital. The Municipal Regulation for Cleansing stipulates creation of an Advisory Committee. This is the first step for the incorporation of the civil society.

The formation of a stock corporation is proposed, whose main shareholder will be the National District Municipality, of indefinite duration, of private rights, own patrimony, administrative and financial autonomy. Its Administrative Council and General Assembly is to represent the civil society of the National District.

The purpose of the company is to efficiently carry out the integral solid waste management service targeting non hazardous waste generated in the National District territory. The Urban Cleansing Department of EMUCD will be transformed to the Municipal Company.

c. Communication with other Institutions

ADN must maintain permanent coordination with several public and private, national and foreign, academic, financial, professionals, community entities of diverse nature, since the solid waste management service intervenes in almost all human activities.

However, it is necessary to prioritize the relation with the municipalities of the metropolitan region with the purpose of ordering the use of the territory. Site selection for a future landfill and establishment of a common policy on the prevention of waste generation will be topics in coordination with those municipalities.

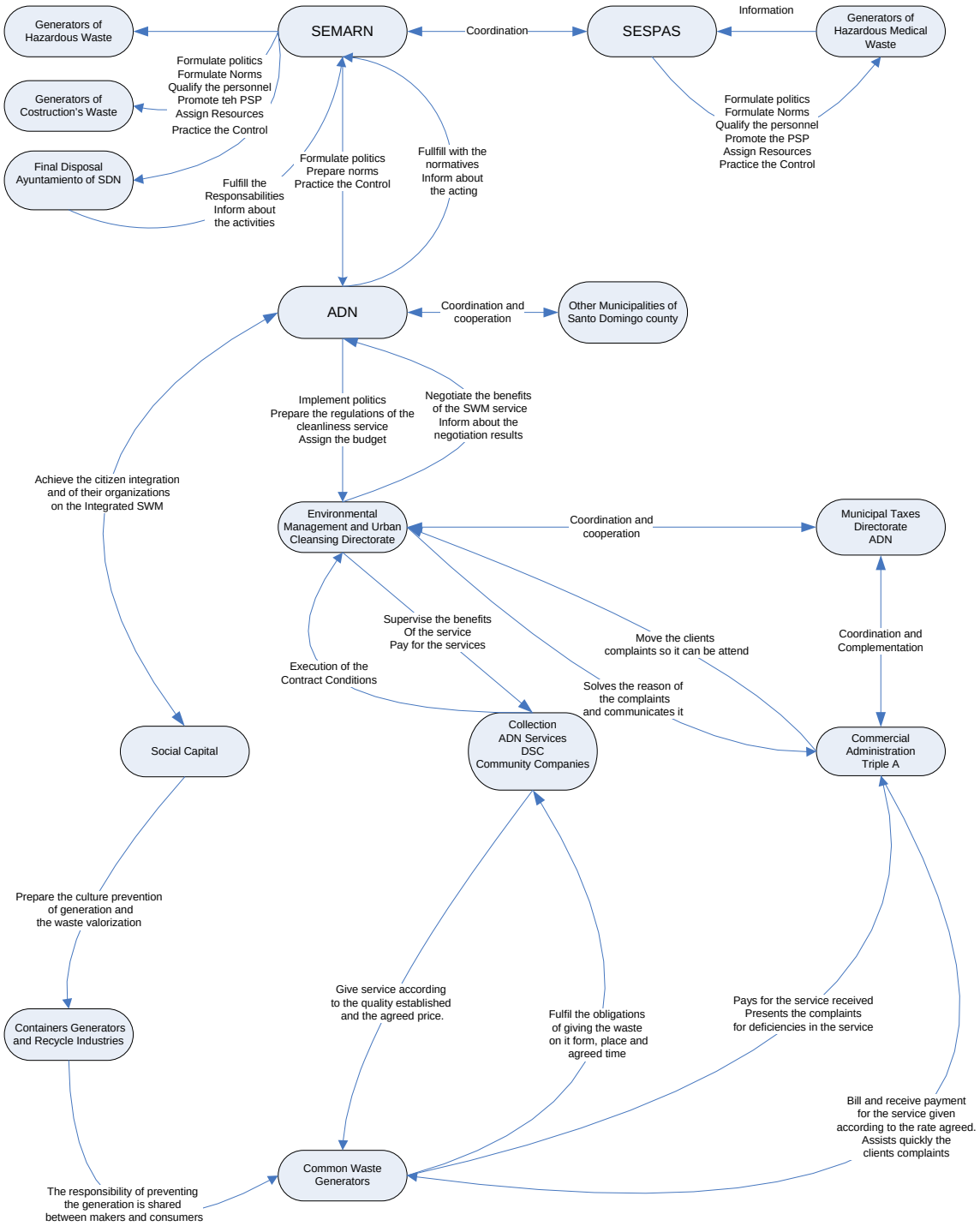


Figure 7-8: Relationships among the different actors of the MSWM

7.3.3 Public-Private Partnership

Most of the solid waste collection service in Santo Domingo, National District, is done by private service providers. However, it has to be admitted that the service quality is low. This low service quality is caused by diverse factors, such as the absence of clear rules, insufficient capacity of private service providers to formulate collection plans as well as their insufficient administrative capacity, and insufficient capacity on the side of ADN to control and guide the private service providers. The existing collection service market is characterized by disorder. The Master Plan aims to establish order in this disorderly market of SW collection service.

For the purpose of setting order in the collection service market, the differing characteristics of collection area and solid waste dischargers will be categorized and defined. Then, the contract type most appropriate to each collection service category will be selected, and the corresponding contract prices will be indicated as reference for contract negotiations. Also, the contract administration system will be recommended.

a. Categorization and Definition of Collection Services

The categories and definitions of solid waste collection service are indicated in the Table below. In this classification, hazardous waste does not fall under the jurisdiction of ADN. The practical application implies the need for appropriate adjustments.

Table 7-7: Categorization and Definition of the Collection Service

Type of Waste	Categorization of the Services	Definition of the Services
Non Hazardous	Urban Area	This service targets waste generated in the urban area, with constructions of one or more floors, with wide avenues and secondary streets that in most cases allow the traffic of large size compactor trucks without inconvenience. This service is found in the three Circumscriptions.
	Marginal Area	This service targets waste generated in the marginal area, with a high population density, constructions of not more than three floors that are located in the adjacent area to the rivers Ozama and Isabela, they present narrow streets that in most cases don't allow the traffic of compactor vehicles, except the avenues that surround it. The houses are located around narrow canyons which hinders collection of the waste.
	Big Generators	This service targets big generators such as the big commercial centers, supermarkets, hotels, institutions, and industries. Construction waste and non hazardous waste generated from hospitals are included in this category. The waste of condominiums or high rise buildings is assumed as residential waste. Such waste is not included in this category.
	Municipal Markets	This service targets municipal markets located in the National District (5 at the present time), where trade of such products as meat, vegetables, fruits, etc. is carried out.
	Sweeping waste	This service targets waste generated in the activities of streets, avenues, parks and other public areas.
	Special Service	This service targets waste generated by the pruning activities, garden remains, construction debris, appliances and other devices, furniture generated from houses.
Hazardous	Hospital Waste	This service targets infectious waste generated from the practice of the health centers. The transport, treatment and final disposal should be guided by the existent laws, on which SEMARN and/or other authorities have jurisdiction.
	Hazardous waste	This service targets waste that SERMAN defines as explosive and toxic. The transport, treatment and final disposal should be guided by the existent laws, on which SEMARN and/or the authorities have jurisdiction.
Disaster waste		It corresponds to the waste generated in big quantities by the hurricanes, earthquakes and/or tsunamis. Their management requires urgent measures.

b. Selection of Contract Types

The Table below presents the contract types that are recommended for each category of collection service, which were described above.

Table 7-8: Selection of Contract Types

Service Category	Contract Type
Residential Urban Area	Lump sum contract (monthly fixed), contract duration 5 years.
Residential Marginal Area	Unit price based per ton of waste, contract duration 5 years.
Big Generators	Direct contract between private operators and clients with operation license granted by the municipality, being able to be of lump sum or of unit price, depending on the negotiation among them. The operation license as well as the user's classification as big generator is granted by the Municipality who also verifies that the private operator has the technical and financial capabilities to carry out the service.
Municipal Markets	Lump sum contract (month value fixed), contract duration 5 years.
Sweeping waste	Lump sum contract (monthly fixed), contract duration 5 years.
Special Waste Collection	Contract based on unit price with a minimum value per month, contract duration 5 years.

c. Basic Contract Prices

The contract price will be decided upon between the interested parties as the result of public bidding or negotiations. The following are the proposed basic contract prices, taking into account the cost items needed for the stable provision of high quality service, including reasonable profits for the service providers.

c.1 Assumptions for the Calculation of Basic Contract Prices

The main assumptions for the calculation of basic contract prices are indicated in the Table below.

Table 7-9: Assumptions for the Calculation of Basic Contract Prices

Item	Assumption
0. Basic assumptions	
1) Useful life	Collection vehicles 5 years、containers 3 years、transport vehicles 7 years, transfer station 30 years
2) Loan conditions for equipment acquisition	Repayment period is the equipment useful life, interest rate 20% per year, zero residual value
3) Tax	16%
4) Operation & maintenance	20% of direct cost
5) Profit	15% of direct cost + O&M cost
6) Exchange rate	US$1.00 = RD$33.00
1. Urban area	20yd3 compactor trucks, containers for 20% of collection quantity
2. Marginal area	6yd3 compactor trucks, containers for 33% of collection quantity
3. Large generators	20yd3 compactor trucks, containers
4. Market	20yd3 compactor trucks, containers
5. Special service	2ton dump trucks
6. Street sweeping	Manual system, collection with 6yd3 compactor trucks

c.2 Collection & Transport Systems

The collection and transport systems for both MP1 and MP2 (2012-2015) are indicated below. MP1 assumes the use of the Duquesa final disposal site until the year 2015. On the other hand, MP2 assumes the same collection and transport system as MP1 until the year 2012, but thereafter assumes the use of a different final disposal site 40km away. Detailed explanations are presented in the Section on technical systems.

Table 7-10: Collection & Transport System for MP1

Service	Collection	Transfer Station	Transport
1. Urban area	20yd3 compactors	－	Direct transport
2. Marginal area	6yd3 compactors	Existing	Trailers（85yd3）
3. Large generators	20yd3 compactors	－	Direct transport
4. Markets	20yd3 compactors	－	Direct transport
5. Special service	2ton dump trucks	Existing	Trailers（85yd3）
6. Street sweeping*	6yd3 compactors	Existing	Trailers（85yd3）

* Manual sweeping under ADN direct administration

Table 7-11: Collection & Transport System for MP2 (2012-2015)

Service	Collection	Transfer Station	Transport
１．Urban area	20yd3 compactors	New	Trailers（85yd3）
２．Marginal area	6yd3 compactors	Existing	Trailers（85yd3）
３．Large generators	20yd3 compactors	New	Trailers（85yd3）
４．Markets	20yd3 compactors	New	Trailers（85yd3）
５．Special service	2ton dump trucks	Existing	Trailers（85yd3）
６．Street sweeping*	6yd3 compactors	Existing	Trailers（85yd3）

* Manual sweeping under ADN direct administration

c.3 Basic Contract Prices

The Tables below present the basic contract prices that were calculated by applying the above assumptions.

Table 7-12: Basic Contract Prices for MP1

Unit: US$/ton

Service	Collection	Transfer Station	Transport
1. Urban area	33.80 (Transport included)	-	-
2. Marginal area	22.08	(ADN direct administration)	4.86
3. Large generators	30.42 (Transport included)	-	-
4. Markets	33.80 (Transport included)	-	-
5. Special service	19.05	(ADN direct administration)	4.86
6. Street sweeping	19.05	(ADN direct administration)	4.86

Table 7-13: Basic Contract Prices for MP2 (2012-2015)

Unit: US$/ton

Service	Collection	Transfer Station	Transport
1. Urban area	24.26	623,662（year）	8.79
2. Marginal area	22.08	(ADN direct administration)	8.79
3. Large generators	21.84	623,662（year）	8.79
4. Markets	24.26	623,662（year）	8.79
5. Special service	19.05	(ADN direct administration)	8.79
6. Street sweeping	19.05	(ADN direct administration)	8.79

d. Contract Management System

d.1 Bidding

The bids can be open or specified competitive. In the case of open bids, the Municipality, by means of public call, invites bidders, while in the case of specified competitive bids the Municipality invites companies that are generally inscribed in the contractor registrations of the Municipality.

d.1.1 Bidding Process

In most cases, the contracts for collection and transport service are the result of a bidding process. Administrative and technical conditions are fixed through the bidding process. The following table shows the most outstanding aspects to consider in a bidding process. The whole bidding process should be monitored by the Juridical Consultancy Legal Counsel of ADN in order to verify the legal validity of the process.

Table 7-14: Bidding Process for Collection and Transport Services

Activities	Specifications
Diagnostic	Before making the bid document for the collection service, it is necessary to evaluate the current situation of the service, as for: coverage of service / serviced population, collection frequency, characteristic of the vehicles and equipments, quantities and volumes of waste collected and transported, characteristic of this waste, etc.
Decision Making	With the evaluation of the current situation, the decision on service conditions should be made, and at the same time service quality should be established. In the evaluation, whether it is necessary to pass the activity over to the private sector should be considered.
Estimate the Service Costs	The costs of the service to bid will be considered with the purpose of evaluating the proposals. It should be also considered whether the Municipality could afford the costs of the service. If not, the conditions and quality of the service should be modified to reach a value that is adjusted to the budget of the Municipality that assures the sustainability of the service.
Elaboration of the administrative and technical documents	Once the decision of the characteristics of the service is made, the administrative and technical documents for bidding should be elaborated. The elaboration of strict and adjusted administrative document will allow the Municipality to have a mechanism that assures the recruiting of a solid company. In this sense, the administrative document should define the juridical, economic and technical conditions of the companies. On the other hand, it defines the legal framework and the applicable jurisprudence, the duration of the contracts, the evaluation mechanisms of the proposals, the tickets, the guarantees, procedures of recruiting etc. With regards to the technical document, it should be elaborated requesting to specify details of the types, models and technical data of the vehicles and equipments, details of the operation plan, organization chart of the company, administrative structures, maintenance programs and prevention of risks, budget and communication plan with the community, etc.
Establishment of the Inspection System	According to the characteristics of the service subject to bidding, the inspection program of the contract should be designed, for both the technical and administrative aspects.
Bidding of the Service	Once the bases are made, the bidding process begins and includes the following activities: invitation to companies or competition call, sale of bases, reception and opening of offers, evaluation of the offers, award, contracts signing, setting and implementation of the services.

d.1.2 Bidding Documents

The following are the minimum required documents for the bidding.

Administrative Document

General Aspects

- Objectives of the bid,
- Description of the applicable juridical normative
- Acceptance of preconditions
- Knowledge of the land or project
- Acquisition of bid document and consultations (for open bid)
- Duration of the contract
- Budget
- Description of the questions and answers process to the bidding document
- Jurisdiction and Domicile

Form of Proposal

- Requirements that the bidder should complete to participate in the process
- Documents that demonstrate the experience, capital and financial state of the bidder
- Bid bond
- Duration of the proposal
- Truthfulness and sufficiency of the offer
- Way of presenting the proposal

Award Process

- Process of opening of the proposal
- Analysis and evaluation procedures of proposal
- Award procedures
- Contract signing
- Contract guarantees
- Surrender, Transfer, Association and Sub-contracting

Execution of the Contract

- Documents that regulate the contract
- Initiation and execution of the works
- Increases or decreases of the works
- Sanction and penalty
- Claim procedure in front of sanctions and penalty
- Technical and administrative responsibility
- Insurance, indemnity
- Service payment, readjustments, contract increase
- Taxes, rates and contributions

Ending of the Contract

- Extinction, suspension and handover of the contract

Technical Bases

General Aspects

- Description of the services
- Definitions of terms used in the bases
- Description of the waste that is subject of the contract
- Minimum quantity of waste to collect monthly

Technical Aspects

- Area and sectors of service:
  - boundaries of total area and sectors covered by the service

  - waste composition
  - estimation of trips and tons collected monthly
  - destination of the waste
  - property of the waste collected
- Modality of the service
- Frequency, schedules and days of attention
- Daily work programs
- Explanation of how should be organized and develop the works that are part of the service
- Minimum requirements of the operations plan that the bidder should present in its proposal
- Equipments, definition, requirements, quantity of plant and reserves, useful life, etc.
- Description of the facilities (workshops, offices, etc.)
- Personnel assignment
  - number of drivers and collectors per truck,
  - reserve personnel
  - salaries,
  - training plans,
  - labor security,
  - service inspection system, etc.
- Procedure for implementation and starting up of the service
- Registration system and reports

Documents of the Technical Proposal

- Detailed description of technical proposal

Annexes

- Plans and any other outstanding information for the elaboration of the proposal should be submitted.

Once awarded the contract, the bidding document (administrative and technical), the questions and answers and the awarded bidder's offers become part of the contract.

d.2 Contract Coverage

The contract should contain provisions on the service quality, the contract audit, penalties in the case of failures, and other relevant aspects, which are described in the Table below.

Table 7-15: Contract Coverage of Collection and Transport Service

Administrative Aspects	
Identification:	The parties to sign the contract should be clearly identified, that is, ADN and the Contrctor.
Definitions:	Definitions used in the contract should be included in the contract document, in order to avoid ambiguities and conflicts of interpretations. The terms to be defined include: Contractor or operator; Municipality; Generator or User; service value; contract; service area; technical responsibility; juridical responsibility; month; day; guarantee; infraction; correction; sanction; fines; and technical terms such as collection modality, route, frequency, schedules, containers, collector truck, final disposal site, transfer station, etc.
Service Type	The type of service that is contracted should be clearly specified, including waste type, service area, etc. (e.g. "The service that is contracted corresponds to the collection of residential waste of the District I, and transport to Duquesa sanitary landfill, collection and washing containers").
Duration of the contract:	Indicate the beginning and duration of the contract and if this is renewable, for what period and under what conditions.
Description of the applicable juridical	Indicate the legal normative, regulation and other documents to which the contract will be subjected.

normative	
Obligations of the Contractor and of the Municipality	Specify in general terms the Contractor's obligations as for the execution and quality of the service and the application of changes, the obligations of the Municipality in relation to the payment, transfer information and territory exclusivity.
Performance bond	In order to ensure the correct provision of the services, ADN will demand the Contractor to submit a performance bond or other similar documents as guarantee of the quality of the contracted service. The performance bond will stay valid for the whole contract period, independent of the status of ADN payments to the contractor. The performance bond will be made effective in the case of reiterated non-fulfillment, abandonment of the services, or premature termination of the contract on the part of the Contractor. In the case of readjustments of the contract price, the performance bond will be readjusted in the same proportions.
Sanction and Penalty:	Clauses should be clearly established granting the necessary right to ADN for the application of sanctions and penalties on non-fulfilling contractors, amount of the fine, and claim procedures.
Payments for Services:	Stipulation should be clear on how the services will be paid, either lump sum (value per month) or based on unit prices. Payments will be monthly, starting the necessary process as soon as the data for the month are complete. These data refer to the service details of the month in the case of unit price contract, data on entry to Duquesa or another landfill, and EMUCD reports on the performance of the service during the month. The maximum period to make the payments should be established, as well as surcharges in the case of late payments attributable to ADN responsibility. Likewise, provisions should exist to make effective the bonds in the case of non-fulfillment of the contractor.
Readjustment and increase of the service:	Procedures to be followed in contract readjustments should be established, specifying the index or parameter for readjustment, the value of the index, the variation period, and the date the readjustment is to become effective. Also, for lump sum contracts, the procedures to be followed in the case of increase of service should be established.
Insurance and Indemnity:	The type of insurance required of the contractor during the contract period should be indicated, such as insurance against damages to third parties. Also, the way to respond in case of damages to third parties, and how to indemnify their personnel should be indicated.
Taxes, rates and contributions:	The taxes, rates and contributions of the contract according to Law or effective regulation should be indicated.
Provisional Obligations:	The social security obligations of the contractor with its personnel, and proof of compliance of the contractor with the corresponding monthly payment, should be presented to ADN every month, by attaching the payroll details of the previous month to the documents showing the service provided during the month.
Contract terms:	Clauses should be established to give right to ADN to terminate the contract or to temporarily suspend it.
Technical Aspects	
Type of waste:	The type of waste to be collected by the service should be speciefied, as well as the maximum quantity per user in the case of residential collection (if the generation of a house or a user exceeds the quantity indicated in the Cleansing Regulation, the contractor should inform ADN, so that the particular user can be investigated and transferred to the category of Large Generators).
Service Modalities:	The manner of how the collection service is to be executed should be indicated, for example "collection door to door or point to point with compactor trucks of 20 yd^3, until the end of the year 2006."
Service Area:	The boundaries of the service area within the National District should be specified, and the serviced population should be duly informed well ahead of the start of the service.
Service Characteristics:	For the urban and marginal residential collection, the characteristics of the service should be indicated, including frequency, day and time of service, discharge site of the waste, graph of collection route, and the control points where inspection is to take place. It is important to mention that the design of the service should be carried out directly by the Municipality, clearly describing the collection routes and the resources used in the service. All the technical documents of design will become part of the contract, and the indicators of

	quality will become part of the inspection system. In the case of market waste, the service characteristics to be indicated include frequency, day and time of service, discharge site of the waste, the type, capacity and number of containers, fumigation and sanitizing plan, washing of containers and storage area, drawing of each market indicating location of containers, storage area, streets to sweep, and area to wash.
Service quality:	The contract should clearly indicate the quality that is expected to reach with the service, incorporating the use of quality indicators.
Characteristics of the vehicles and equipments:	The quantity of vehicles and reserves should be clearly indicated, as well as their useful life, capacity and technical characteristics of collector trucks, containers and other equipment. The maintenance plan should also be indicated, including the location of maintenance facilities and the parking site of the company.
Personnel:	The number of personnel for the service should be indicated, including drivers, collection workers, supervisors, and the reserve personnel. Also, the personnel training program should be specified, as well as the uniform and tools to be provided to the service personnel.
Operating Aspects:	The contract should indicate how the service will be implemented under normal conditions, and when breakdown of vehicles occurs, or under emergency. It also should indicate the way to improve communication with the community residents, the cleaning program to wash the trucks, containers and other equipment, the way to deal with users' complaints, etc.
Inspection of the Service:	The contract should clearly state that ADN has every right to inspect the service, establishing the procedures to investigate and control the service, and indicating the data and reports that the contractor should submit to ADN. The aspects to be investigated should be specifically detailed because those will be the aspects that when not fulfilled will lead to the application of sanctions and penalties.

d.3 Contract Auditing

Once the contract is signed, the Municipality should pursue the execution of the contract. The Environmental Management and Urban Cleansing Directorate through the Administrative and Development Unit, specifically the Quality Control and Administration of Contracts section, will coordinate with all the Directorates concerned with the Municipality to look after the execution of the contract. The Operations and Inspection Unit will be in charge of monitoring and evaluating the execution of the service, establishing evidence of infractions for non fulfillment of the contract, and elaborating the monthly report in relation to the service so that the Municipality proceeds with the payment and apply penalties if they exist. The aspects that should be monitored and controlled are the following.

d.3.1 Monitoring of the Administrative Aspects of the Contract

Performance bond

The validity of the performance bond will be verified and its change in the event of expiration or for application of readjustments to the contract value. This control should be carried out by Accounting, Costs and Systems of the Administration and Development Unit.

Sanctions and Penalties

According to what was informed by the Operations and Inspection Unit in relation to the non execution of the technical specifications of the service, they should proceed with the application of sanctions and penalties based on what is specified in the contract, making discounts to the invoice corresponding to the month when non fulfillment takes place. This activity should be carried out by the Administration and Development Unit in coordination with the Finance Directorate which will verify whether the discounts are applied and the Juridical Advisory will verify whether no laws are violated.

Service Payment

Payment will be monthly, after verifying that the billing or collection of the service was made according to the contract provisions. The aspects to be verified or revised are the following.

When presenting the invoice, the Administration and Development Unit of the EMUCD should review that the value of the service corresponds to what is indicated in the contract. In the case of lump sums, only the value should be verified. If the contract is based on the unit prices, the quantity of waste collected during the collection period should be verified. For this purpose, the contractor should submit the documents of entrance registration to Duquesa (or a new sanitary landfill) or to the Transfer Station. Information should be compared with the control that is directly carried out by the Audit Directorate at the location where the waste is discharged. At the same time, it will be verified that the unit value of the service is indicated in the contract and the monthly value of the service will be calculated. In both cases the operation of collection should be revised and taxes, rates, and discounts should be verified in order to correspond to real values.

In the event that the contract is subject to readjustments, the Administration and Development Unit of the EMUCD will calculate the new value of the contract or unit price and inform it to the Finance and Juridical Advisory Directorates to upgrade the contract. At the same time EMUCD will calculate the new value of the performance bond and inform it to the Finance Directorate so EMUCD will require the contractor to change the performance bond according to the new amounts.

If there are infractions to the contract in the collection period, the Administration and Development Unit of the EMUCD will establish penalties according to what is indicated in the contract, and inform it to the Administration and Development Unit so they can proceed with the sanctions.

The Administration and Development Unit of the EMUCD will verify if the contractor fulfills the requirements with those documents such as invoice entrance vouchers to Duquesa or the transfer Station (independently that the contract is or not of unit price), vouchers of payment of the provisional obligations, etc. The information contained regarding the execution of the service will be compared with the monthly report of inspection of the service elaborated in the Operations and Inspection Unit.

Readjustment and Increase of the Service

The Administration and Development Unit, through the Accounting, Cost and System section will take the control of readjusting the contracts, informing the Finance Directorate and the EMUCD of when these should be made and to what percentage.

Insurance and Indemnifications

The Juridical Advisory will be in charge of verifying if the insurance mentioned in the contract is effective and corresponds to requirement. In the same way, it will be responsible to ensure the contract fulfills all related indemnifications and to clarify the responsibility of the company regarding damages to third parties, etc.

Provisional Obligations

As a part of the approval process of the payments for the services, the Administration and Development Unit will verify monthly whether the private company fulfills the provisional obligations regarding its employees considered in the service by checking the corresponding payment vouchers submitted the contractor every month, together with the collection document of the service. The numbers and identifications of employees will be submitted to the Operations and Inspection Unit.

Ending of the Contract

The inspection of the ending, extinction, suspension and handover of the contract will be the responsibility of the Juridical Advisory and the EMUCD will be in charge of informing if these events are required.

Information Activity Plan

The Operations and Inspection Unit together with the Customer Service Unit will be in charge of verifying the execution of the information activity established in the contract, and check their effectiveness.

d.3.2 Monitoring the Technical Aspects of the Contract

Monitoring of the correct execution of the collection service is the responsibility of the Operations and Inspection Unit, the Inspection Section supported by the other sections of the Unit is in charge of the continuous inspection on the site, verifying the quality of the service, registering all the record of the services, generating the daily and monthly reports and submitting them to the different Units of the EMUCD. On the other hand, the responsibility of evaluating the service through monitoring the quality indicators rests with the Administration and Development Unit, specifically in the sections of Quality Control and Contracts Administration and Planning and Engineering.

The main technical aspects of the contract that need to be monitored are as follows.

Characteristic of the Waste

The characteristics of the waste collected will be inspected randomly to verify whether they correspond to those indicated in the contract. This inspection can be made in the places where waste is discharged as well as on route. Waste that is not subject to the contract generally constitutes a serious violation of the contract and therefore it should be a reason for penalty.

Service Area

It will be verified whether or not each operator carries out the service within the limits assigned in the contract

Characteristics of the Service

The execution of 100% of the routes will be verified every day; inspecting the trips according to the route map, frequency, schedules, days of attention. In the route design the control points will be settled, which will be clearly indicated in the map. The inspectors will use these control points to verify whether the routes are executed in the established schedule.

The exit of collection trucks on the established schedule will be controlled at the parking area daily, whether the number of vehicles meet the agreement, whether the mechanical conditions are correct, whether the vehicles are cleaned up, whether the number of personnel assigned to each truck corresponds to the contract and whether they have uniform and required tools. In the event that some vehicles are not operative, its replacement should be verified, informing it to the section in charge of the control of this service. In the same way, it will be verified whether 100% of the vehicles are available to assure the service in all collection routes.

In the case that the contract includes installation and operation of containers, the physical or mechanical state and execution of cleaning and fumigation programs of the containers will be verified.

If the non fulfillment of the terms of the contract is previously detected as a result of inspections, the inspectors will register these anomalies in the routes sheet or keep a record,

which will be signed by the driver of the truck that has made the infraction or by the supervisor of the contractor. This document will be used later on in the sanction process and application of penalty.

In this inspection program, it will be confirmed whether the waste is discharged in the places indicated in the contract. The information will be compared with the entrance controls to Duquesa or Transfer station.

Characteristics of the vehicles and equipments

It will be verified whether the collection trucks, boxes, equipments, containers, etc. meet the technical specifications, and whether those have the insurance, permits and technical revisions established by Law and the contract. Those will be informed to the EMUCD so that they request the substitution of the units that do not meet the requirements of the contract. In case the contractor does not comply with the request, the sanctions specified in the contract will be applied and make effective the performance bond and terminate the contract. Such measures should be indicated in the contract.

Later on, the mechanical condition of the vehicles, boxes, lifting device of containers and any other equipment will be inspected as well, so as to verify their cleanliness. These controls will be made as much on route as at the exit of the parking place.

The sections Marginal Area, Urban Area, Special Residential Service and Public Area Cleaning (sweeping) will keep the registration of the maintenance programs of the vehicles and equipment assigned to the services, of the program given by the operator and of verification of their execution. They will also be in charge of verifying the upgrade of the permits, insurance and other documents that are required in the contract.

Personnel

As for the personnel, it will be verified whether each truck has workers indicated in the contract, and whether they have uniform and protection equipments.

During the execution of the service it will be verified whether the behavior of the workers is correct, such as not requesting gifts for the service.

The sections of Marginal Area, Urban Area, Special Service, Public Area Cleaning (sweeping) will keep personnel registrations (operation and reserve) assigned to the contracts.

Service Evaluation

Starting from the daily information gathered on the site and the registrations of entrance control of waste in Duquesa and transfer station, the Administration and Development Unit will evaluate the quality indicators and verify whether these fulfill the indicators in the contract. If such indicators are not satisfied, the same Unit will request necessary records from the Operations and Inspection Unit to determine the cause and take corrective measures.

d.3.3 Inspection of the Service of Big Generators

For the case of the collection and transport of waste of big ICIs generators, the contracts are settled directly between the generator and the private company. The Municipality does not have the responsibility of investigating its execution. However, the municipality shall promote competition to ensure provision of an opportune and appropriate service.

The responsibilities of the Municipality are as follows.

Identification of Big Generators

The Municipality should establish the conditions so that a user of the collection service is considered as a big generator, and at the same time authorize it to have the option to contract a particular service.

The municipality supports inspection of the contracts between users and private companies. It allows the Municipality to know the characteristics of the contracted service such as the established rates and/or fixed amounts that tell how much the private company should pay to the municipality for operation of its service. The identified big generators will be exempt from the collection service carried out by the Municipality.

Operation License

It is the responsibility of the Municipality to grant an operation license to private companies for the collection and transport of ICIs waste. Modalities of service will be declared; as well as the infrastructure, equipment and human resources and maximum volume of waste to manage monthly. Those will be verified by the Municipality through the ICIs Section before granting or rejecting the license.

Service Inspection

During the valid period of the license, the Municipality will investigate whether the private company fulfills the contract and whether the modalities of service are correct according to the application of the operation license. The private company will not be able in any case to maintain contracts for the collection of a bigger volume of waste than the one authorized. The Audit Directorate jointly with the ICIs Section verifies the registration of waste to Duquesa.

The Inspection section will make inspection visits to the big generators to verify the execution of the service in time and in form. In the event of non fulfillment, it will notify to the ICIs Section which will register this situation. In the event of reiterated non fulfillments, the license will be cancelled.

Registration System

The ICIs Section in coordination with the Customer Service Unit will keep an up-to-date registration of the big generators and of the operators with licenses to offer the service, consigning the contractual relationships between them and the quantity of waste collected. Such information will be submitted monthly to the Customer Service Unit and to the Finance Directorate with the purpose of establishing the amounts to charge to each operator of the ICIs service and to identify the users exempted from the ordinary waste collection service charge.

7.3.4 Financial Management

a. Financial Policy

The goal in ADN solid waste management service over the Master Plan period is to approach the efficiency and effectiveness comparable to a well run private sector business. However, given the existing lopsided deficit situation (income equals about one-fourth of expenditures), financial equilibrium or surplus will not be the overriding concern during the Master Plan period. Rather, the concern will be on setting up a reliable SWM service that can earn the trust of the service users and may lead to increased willingness to pay for the service.

Taking into consideration the deficient starting situation and the improvements that need to be introduced in all aspects of the solid waste service, seeking financial self-sufficiency from the outset may be frustrating. The initial goal, then, will be to set up the conditions needed to achieve financial improvement as a result of better service quality, in order to maintain the pace with the technical and organizational improvements that are being introduced.

It follows from the above that improvement measures in financial aspects should go hand in hand with improvements in other aspects of solid waste management. It should be pointed out, however, that there is nothing new concerning financial improvements, as costs should be reduced and controlled, while income should be increased, if financial improvements are to take place. As an illustration, the total income from solid waste management in 2005 amounted to about 140 Million RD$, while the budget executed by EMUCD in 2005 was approximately 407 Million RD$, which ballooned to about 544 Million RD$ when some expense items included jointly in the budgets of other municipal offices were prorated and added. It can be seen that the income from solid waste management amounted to about one-fourth of total expenses, thereby requiring about 400 Million RD$ (approximately US$12 Million) from other income sources.

In order to reduce costs, obviously the first need is to precisely gauge where and how the money is spent in the SWM service. Without this information, it is extremely difficult to control costs. It follows that accurate records of costs should be kept for all items of the SWM service. When the cost structure becomes clear, actions can be taken to effectively reduce costs, starting with the cost components that weigh heaviest on the total cost of the service.

In order to increase income, efforts are required to increase bill collection and stop leakages that may occur at every stage of the cash flow. Income can be increased through the expansion of the base of paying service users, and through the improvement of the bill collection ratio. Also important are the information campaigns designed to increase the users` willingness to pay for the solid waste service. And it is important to ensure that households and other users of the solid waste service make their payments in officially designated places, so that such payments reach the municipal coffers. Also the oversight of franchise companies in charge of big generators service should be tightened as their contribution to ADN income was less than 0.5% of income from SWM service in 2005.

Discussions with the Financial Manager of ADN, clarified the following concerns that are to be incorporated as basic components of the financial policy.

a.1 Expansion of Customer Base without Tariff Increase

The ADN position is to earn the trust of the users of the SWM service by providing a reliable service. Hence, the first priority is to provide a reliable service of good quality, while simultaneously trying to expand the number of SW service users who actually pay for the service. This is because in March 2006, only 20% of billed households paid the equivalent of 45% of the amount billed to households. These percentages were better for other categories

of service users: commercial, industrial and official.

A tariff increase is not ruled out, but would become a last resort for solving the financial imbalance of SWM. Implementation of a tariff increase would come under consideration only when the SWM service has been improved, and, further, when such improvements have been perceived as such by the service users.

a.2 Subsidy to Households without the ATP and to cover the Financial Imbalance

The lack of significant financial sources under direct control of ADN, such as land tax and commercial patents, is somewhat compensated for by provisions of Law 166-03 which is regarded as a safe source of financial resources for many years to come. Hence, the subsidy for households without the capacity to pay would come from Law 166-03 on the basis of the bottom 20% of households and the lowest tariff of 50 RD$ per month. Likewise, the income differential required to balance the financial disequilibrium of SWM service would come also from Law 166-03. In 2005, this income differential was estimated at around 400 Million RD$, or about US$12 Million.

The uses of the fund provided by Law 166-03 are to be duly identified, so as to comply with the provisions of the law concerning the allocation of the fund use: investment 40%, service operation 35%, and personnel payroll 25%.

b. Income and Expenditures

b.1 Income

As explained above, income is to be improved by expanding the base of paying service users, by improving the bill collection rate, and by controlling leakages that may occur throughout the different stages of cash flow within the solid waste service.

Billing and bill collection on behalf of ADN has been done by AAA Dominicana since June 2004, on the basis of a four year contract. The fee paid by ADN to AAA Dominicana for this commercial service has two components: a fixed fee based on the number of invoices, and variable fee based on the surplus of collected income in excess of the fixed fee. The cost of this commercial service was estimated at around US$3 per ton. These fees should be the subject of negotiation at the time of the extension of the contract, taking into account the improvements in service quality and the resulting improvements in the willingness to pay of the service users.

The sources of income in ADN solid waste management are the following.

b.1.1 Households

Households as solid waste service users need to be educated on the importance of appropriate solid waste management, and the cost required for providing such a service. Hence, households should be made aware of the obligation of each service user to pay for their share in generating the solid waste that causes such management costs. This is a fair way of producing income from the solid waste service, as a function of the contamination each user causes. Therefore, the solid waste service fee should be based on the cost of providing the service.

It should be pointed out that many businesses operate from households. This means that households generate solid waste as the result of normal activities of households *per se*, and also as businesses operating in the households. The waste flow analysis showed that the tonnage of solid waste generated by households was equally divided between households *per se*, and households as businesses. The solid waste generated by households *per se* would be paid for by households on the basis of the set monthly fixed tariff that depends on the

socioeconomic stratum of each user, while the solid waste generated by households as businesses would be paid on the basis of the generated tonnage, according to provisions established in the new Reglamento de Aseo.

In March 2006, households accounted for 77% of the number of paying service users, and 64% of the payment amount. However, bill collection efficiency based on the number of households was 20%, since the households billed (excluding SABAMAR) were 86,653, while paying households were 17,363. On the other hand, bill collection efficiency based on monetary amount was 45%, since billing amounted to 21.5 Million RD$, while payments amounted to 9.7 Million RD$. There is room for improvement.

b.1.2 Industry, Commerce, Institution (ICI)

The industrial, commercial and institutional users of the solid waste service are assumed to have the ability to pay for the service tariff, and they are assumed to pay 100% of the SW service cost on the basis of the estimated cost per ton, according to provisions established in the new Reglamento de Aseo. In the terminology of AAA Dominicana, "official" entities would be equivalent to an "institution". ADN, through AAA Dominicana, keeps billing these large solid waste generators which have not signed contracts with the authorized private service providers.

These service users deserve to be constantly informed of the solid waste service cost, as they are expected to pay tariffs that vary as a function of the generated quantity of solid waste, that is, the "polluter pays principle" is to be applied in the case of ICI.

In March 2006, ICI accounted for 23 % of the number of paying service users, and 36% of the payment amount. However, bill collection efficiency based on the number of commercial, industrial and official entities was 41%, since the entities billed (excluding SABAMAR) were 12,305, while paying entities were 5,083. On the other hand, bill collection efficiency based on monetary amount was 88%, since billing amounted to 6.3 Million RD$, while payments amounted to 5.5 Million RD$. This is better than households, but there is still room for improvement.

b.1.3 Private Service Providers to Big Generators

Authorized private companies provide a customized service, based on private contracts signed between the service users and the service provider. The private company is also in charge of billing and bill collection, and has the obligation to pay 20% of their income to ADN, but this amounted to only 621,048 RD$ in 2005, a meager 0.44% of the income from the solid waste service. Obviously, there is an urgent need to improve the oversight and control of these companies in order to stop the leakage of potential income. Application of a combination of measures may be necessary, such as a hefty license fee, performance bonds, and quantitative control of tonnage and accounting records, if access to such records is permitted.

b.1.4 Subsidy as Income

The largest source of ADN income, around 80%, has been the funds from Law 166-03 by which the Central Government allocates a percentage of their income to the municipal governments as a function of the population in each municipality. The fund is channeled through the Dominican Municipal League. If the income as payments from the users does not suffice to cover the cost of solid waste management, part of the funds from Law 166-03 should be earmarked for such a purpose. The same thing can be said about the need to cover the payments corresponding to the solid waste service users who do not have the financial capacity to pay.

b.2 Expenditure

On the expenditure side, the steps required would start with the precise calculation of the cost of the service, followed by the control, through constant monitoring, of significant cost items that were identified.

b.2.1 Clarification of Cost Structure and Amount

At present, the budget control system does not permit a precise calculation of the cost incurred in the solid waste service. Clarification of cost structure of solid waste service will require a systematic identification and record keeping of all cost items incurred in the service. ADN took the initiative in 2006 to improve the identification of cost items in the solid waste service that were obviously misplaced in other municipal offices, such as the case of plastic bags in the budget of the Administrative Directorate. The same identification procedure may be applicable to all cost items in the SWM service. Such effort should be continued and completed in the 2007 budget period, and perhaps complemented with a special cost accounting system for the solid waste service, as an addition to the existing budget control system.

b.2.2 Monitoring and Control of Specific Cost Items

Once the solid waste cost structure is clarified and the major cost items are identified, decisions can be made on the actions that can be taken on major cost items in order to reduce these costs in the most effective way. Naturally, actions should start with the cost items that weigh heaviest in the total cost of solid waste management.

The budget executed by EMUCD in 2005 indicated Personnel Services as having a relative weight of 38%. As in many other cities, it should be possible to reduce the personnel and their cost without affecting the level of the service provided. A useful tool to guide this effort is the performance indicators for Latin America, as presented in “Indicadores para el Gerenciamiento del Servicio de Limpieza Pública” published by CEPIS of PAHO/WHO. The indicators cover the range from operation to finance, for example, kilometer of street sweeping per sweeper per day, cost per service user, cost of collection service, etc. In due time, ADN could develop its own indicators for its service on the basis of accumulated own data. To the extent that data collected by ADN allows calculation of such indicators, a comparison with the indicator values in the CEPIS Manual will indicate the direction and magnitude of the required improvements.

The calculation and constant update of solid waste management cost will also be an effective tool to supervise and control the service provided by private companies. Opportunities can be opened to re-negotiate the contracts with these private service providers, making it possible to introduce more precise specifications of the service quality and other desired conditions.

b.2.3 Subsidy as Expenditure

As already mentioned above, the need may arise for an additional expense item as the subsidy that should be granted to the solid waste service users who do not have the financial capacity to pay the service tariff. The fund for this subsidy will have to come from Law 166-03, and probably should be earmarked before the fund is transferred from the Dominican Municipal League to ADN.

c. Accounting

Obviously, the budget control system of a municipal government does not allow an accurate calculation of the SWM cost because that is not its purpose. The budget allocated and executed by the municipal office in charge of the SW service does not always include all the cost items of the SW service.

In the case of ADN in 2005, the budget executed by the Environmental Management and Urban Cleansing Directorate (EMUCD) amounted to around 407 Million RD$, but some expenditures of the SWM service were included in other municipal offices. A rough estimation of these cost items included in other municipal offices resulted in a total SWM cost of approximately 544 Million RD$, which was about 33% higher than the budget executed by EMUCD. The amount estimated as the total cost of SWM was equivalent to around 44% of the budget executed by ADN in 2005.

The brand new Solid Waste Regulation, Reglamento de Aseo Urbano prepared as part of this Study, states that the SW service tariff should be based on real costs of the service. It follows that there is a need to calculate the SW service costs as accurately as possible. This requires systematic record keeping of all cost items incurred in the SW service. ADN has already taken steps in 2006 to achieve a more precise identification of the cost items of the SWM service. This effort is commended and encouraged to be continued during preparation and execution of the 2007 municipal budget.

If the method of identification of SWM cost items initiated by ADN turns out to be insufficient, a very useful complement may be the introduction of a special solid waste cost accounting system. The accounting method is to be applied only to the solid waste service, in order to keep a systematic track and control of the costs of the service. Examples of software include “Costos de Servicios Prestados” (COSEPRE) of CEPIS/PAHO/WHO, which is also made available in the English language by the World Bank as “Costs of Urban Cleaning Services”, and “Full Cost Accounting” of the US Environmental Protection Agency (EPA).

7.3.5 Citizens' Participation

Citizens' participation in the MSWM is indispensable. The Master Plan proposes manners of communicating with citizens regarding collection service and minimization.

a. Communication regarding Collection Service

The following actions are necessary to get the citizens' participation in the efficient waste collection.

1. Establishment of waste discharge rules and collection days
2. Informing the public of waste discharge rules and collection days
3. Monitoring whether the rules are observed
4. Receiving complains from citizens and surely responding to them

A series of these activities improve the work efficiency, make the effects appear and cultivate the reliance between citizens and ADN.

a.1 Establishment of waste discharge rules and collection days

The duties of ADN and citizens have to firstly be established regarding the collection service. The Municipal Regulation for Cleansing has been formulated in the process of this Study for this purpose. Based on the Regulation, detailed rules such as manner of waste discharge, collection times, collection days, etc, have to be established.

a.2 Informing the public of waste discharge rules and collection days

The table below summarizes dissemination measures for the rules regarding the collection service. Their effectiveness has been proved through implementation of the Pre-Pilot Project and the Pilot Project.

Table 7-16: List of Effective Dissemination Measures

Activity	Description
Distribution of leaflets, information through verbal communication	Distribution of leaflets to all households is an effective information measure because all citizens can read it and keep it at home.
Announcing the rule with speakers	Some people may not read leaflets distributed. To supplement this problem, announcing information using speakers is effective.
Posters	Putting posters that give information about waste discharge rules at pharmacies and colmados is effective. In addition, installation of posters along roads gives messages to many people.
Meetings with Junta de Vecinos leaders and residents	Junta de Vecinos are traditional community organizations, which exist in many places in the study area, although their capacities vary. This social capital is effective not only for dissemination of the information to residents but also to promote residents. Before and during the implementation of new services, a series of meetings with Junta de Vecinos' members of the target area should be carried out.

a.3 Monitoring if the rules are observed

ADN has to monitor the waste collection contractor's performance in order to enforce them to comply with their duties. As for citizens, ADN has to supervise all citizens to comply with their duties to minimize the violation cases. Urban Cleansing Department is in charge of this matter.

a.4 Receiving complains from citizens and surely responding them

As it is too difficult for ADN to completely watch the contractors' performance, the citizens' complain of informing the contractor's defaults are very understandable. ADN must force the

contractor to take rectifying actions immediately.

Execution of a series of above said actions will cultivate the reliance between citizens and ADN, and the strengthened reliance will encourage citizens' participation. This strategy can be applied not only for the improvement of the waste collection service but also for the empowerment of various technical and institutional systems.

b. Communication regarding Waste Minimization

b.1 Fostering people's ecological mentality

The people's way of life in the ND is rapidly changing with economic growth and the trend is heading toward a resource demanding society, which is characterized as a "mass-production, mass-consumption, mass-disposal" society. People, children in particular, are rapidly losing the important mentality of saving and it has geared the increase in waste generation.

There are many waste issues, which cannot be sufficiently overcome by imposing sanctions, because some waste issues are closely related to people's way of life, habits and preference. To cope with these issues, an effective strategy is to change citizens' attitude toward environmental protection by cultivating their awareness for the environment by providing education. In particular, this is effective for reducing or preventing an increase in the waste generation amount by cultivating peoples' sense of saving goods, mind of "mottainai". The table below summarizes the effective fostering measures of the ecological mentality.

The effects of these activities will take many years, and you cannot get effects unless you start. It should be, therefore, started as early as possible. The table below shows measures for fostering the ecological mentality.

Table 7-17: List of Effective Fostering Measures of the Ecological Mentality

Effective Activity	Description
Environmental Information Center	The environmental information center in ADN has not only an information system but also education materials and a seminar room. This resource should be utilized for this purpose.
Visiting SWM facilities	People actually see the waste collection workers, collection trucks, a transfer station and disposal site to understand how their waste is collected, transported and disposed of. The site visit study shows them the necessity of SWM work as a social system. It may foster people to have the cooperation mind for SWM.
School recycle	Pupils are requested to bring recyclable garbage from their homes such as empty aluminum cans, PET bottles, etc. and separate and keep them in the store houses. Once they have been accumulated, they are sold to a middleman and the school buys school equipment with the income. This project aims to cultivate children's ecological mentality to save, "mottainai".
Ecological campaign	People who are keen for environmental protection demonstrate together to appeal public the importance of the environmental preservation to raise their awareness.
Catchphrase, environmental logo, symbol marks	The symbol of environmental protection for ADN is created and shown on all items for environmental education. Generally, people never repeatedly read the education leaflet. However, if people remember the environmental logo when they read the leaflet, they are reminded of the importance of environmental protection when they see the logo. An attractive environmental logo shown in many places in the town can motivate people to protect the environment.
Voluntary clean up activity	Students learn the spirit of "Loving our home town" through experiencing voluntary clean up for public space. It helps to stop them to discard waste in the public space.
Young Office in ADN	High school students are obliged to do voluntary activities for 60 hours and ADN has the Young Office is in charge of providing them with opportunities. It should be utilized for cultivating the ecological mentality.
Leaflets, TV, Radio	Subjects which all citizens should learn for example, the spirit of "What a waste" and the spirit of the beautification of public space.

b.2 Effective Utilization of the Environmental Information Center

The Environmental Education center should have two main tasks for the education of waste. One is to prepare the educational materials, which reflect the locality of ADN for providing them to schools and citizens, and the other is to make it necessary for schoolteachers to teach about waste issues and what people should do about waste as a member of the society in the ND.

The educational materials to be prepared should deal with the following subjects.

- Current condition of SWM work in ND
- Current problems related to solid waste
- Importance of ecological mentality of saving, in other word waste minimization
- What you can do for the cooperation.

b.3 Other possible measures

There are some possibilities to try some measures which are already experienced in other countries. The table below shows them.

Table 7-18: List of Other possible measures

Measures	Description
Tariff system of collection service for households in accordance with waste discharge amount	The waste collection charge system in accordance with waste discharge amount urge people to minimize waste amount by giving them the economic incentive to the reduction of waste discharge amount. Although this is effective to reduce the waste amount, it might bring people to dispose of their waste illegally as well. Therefore, the introduction of this measure must associate with the strong supervision measure to prevent the illegal waste dumping. To avoid illegal waste dumping, the municipality simultaneously should provide alternatives for households to encourage reducing the waste amount, such as giving grant for house composting and encouraging separation and collection of recyclable materials (can, glass and PET bottles etc…).
Induction for refrain using the plastic bags to consumers when shopping	Plastic shopping bags given at supermarkets are generally used only once and they are not recycled. In order to reduce the plastic bag waste amount, various measures are taken in other countries. The most common measure is to charge plastic shopping bags to urge customers to bring their own bags. As a replacement of plastic shopping bags, the supermarkets sometimes make customer available the returnable plastic boxes with a small money deposit. In this system, customers carry their shopped items in plastic boxes to their homes and bring them back to the supermarkets when they visit next time. The box is easier for customer to carry shopped items than plastic shopping bags. In addition, the supermarkets can get repeating customers with this system. Cooperation of those supermarkets is required.
Encouraging setting “buy-back center” at the super markets	Recycle of plastic pet bottles, aluminum cans and bottles which have high value as raw material are not active in the ND. The supermarkets set up and operate the buy back kiosks for some recyclable items which are generated by goods sold at the supermarket. Customers bring these items to the buy back kiosk to get stamp. When the number of stamp reaches a certain number, they can get money or some items. ADN can give some incentives to the supermarkets or those who own the kiosks to operate them. To do this measure, ADN also should prepare the system “after collection at the kiosks”, that is transporting the collected materials to the material recycling companies.

b.4 Promotion of Waste Exchange

This is to provide citizens with participation opportunities of waste exchange. The general definition of waste is material which has no or negative value. However, the value of the material depends on the person, and someone may want a thing which another person does not want. Communication among them can be established, trade of waste occur and the waste amount can be reduced. The table below shows measures for promoting waste exchange.

Table 7-19: List of Effective Waste Exchange Measures

Measures	Description
Charity collection of recyclable goods	This is often executed for charity purpose. In some European countries, NGOs distribute large plastic bags in unique color to high and middle-income households with a message card. The message card asks them to put their unnecessary good items such as clothes, which should be used, and to discharge of it on the specified day. For example, children's used clothes are often unnecessary even if they are still good quality because children grow quickly. Electric appliances often become unnecessary even if they work after purchasing new ones. Some people are willing to discharge these items. NGOs collect these items and sell them at recycle shops. NGOs use the income for their social activities. People understand their participants indirectly contribute for the charity activity and that fact encourage people for participation.
Public garage sale	ADN provides citizens with trading opportunities for their unnecessary items. ADN organizes this recycle market where anybody can sell and buy. ADN's role is to organize the recycle market and to disseminate the information to citizens to promote their participation.
Public recycle shop	ADN will set up a recycle shop and commission the operation to an NGO. People will bring their unnecessary items to the shops and ask the shop to sell them. After it is sold, the shop will inform the provider of the item to get the income. The shop gets a certain percentage of the income as commission. In order to facilitate customers to check which items are available, the shop should show the inventory list and each item with picture on its web site so that the customer can find the necessary items even at home.
Internet sale and auction	The trading of used items through internet is popular in developed countries. Anybody can sell and buy at the internet shop unnecessary items. ADN should subsidize the private company to operate an internet shop.

c. Implementation Strategy

The following strategies to achieve the goal are to be adopted.

1) From spots to wider areas. From the front yard to public space.

It is too difficult to get make the whole of the ND clean at once. A practical measure is to target the spots firstly and gradually widen and increase the target areas. The spot should be the nearest place where the person has astronger ownership feeling.

2) Targeting various age groups by different approaches

Environmental education should target the whole population at the same time to make it effective. The project, therefore, will be split into several programs according to the target groups.

3) Utilization of volunteers

In order to maximize the sustainability of the project, the available **volunteers** shall be fully utilized for the execution of the project. The potential **volunteers** are Junta de Vecinos and Young office in ADN,

4) From easier cooperation to heavier cooperation

The required cooperation must be affordable for the majority of people. ADN should ask people for easy cooperation at the beginning stage and after sometime ask them for slightly more difficult cooperation.

d. Implementation Schedule

The measures mentioned above are to be conducted according to the schedule below.

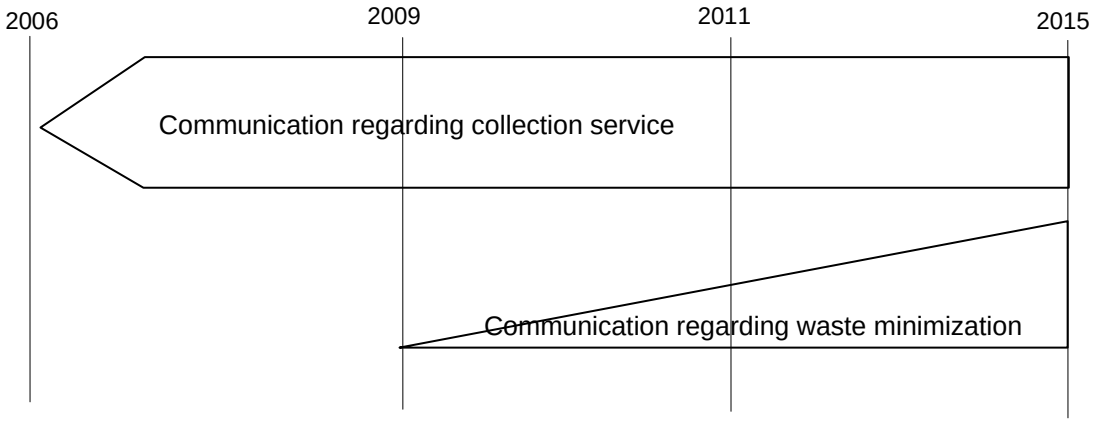


Figure 7-9: Conceptual Implementation Schedule

7.4 Technical System

The proposed technical systems are summarized in the Tables below. MP1 assumes the use of the Duquesa final disposal site up to the year 2015, whereby there is no need for transfer stations even in the case of using large size compactor trucks, implying that direct transport will be used. MP2, on the other hand, assumes the use of a new final disposal site located 40km away. This means that even using large size compactor trucks, the transfer and transport system will be economically more favorable. Street sweeping is to be done with the manual system. Composting will be introduced as a waste minimization measure, using pruning waste from roadside trees, and market waste.

Table 7-20: MP1 Technical System

Service Type	Urban/Big Generator/Market	Marginal/Special/Sweeping
Storage/discharge	Storage/discharge according to characteristics of each discharger	
Collection/transport		
Collection	Large compactor trucks（20yd3） Collection using containers （560L）targeting 20% urban area waste	Small compactor trucks（6yd3） Small dump trucks（2ton） Collection using containers （560L）targeting 33% of marginal area waste
Transfer station	-	Existing transfer station（500ton/day）
Transport	-	Trailers（85yd3、20ton）
Final disposal	Duquesa final disposal site（18km away）	
Street sweeping	Manual system	
Waste minimization	Composting with pruning waste of roadside trees and market waste	

Table 7-21: MP2 Technical System (2012-2015)

Service Type	Urban/Big Generator/Market	Marginal/Special/Sweeping
Storage/discharge	Storage/discharge according to characteristics of each discharger	
Collection/transport		
Collection	Large compactor trucks（20yd3） Collection using containers （560L）targeting 20% of urban area waste	Small compactor trucks（6yd3） Collection using containers （560L）targeting 33% of marginal area waste
Transfer station	New transfer station（1300ton/day）	Existing transfer station（500ton/day）
Transport	Trailers（85yd3、20ton）	Trailers（85yd3、20ton）
Final disposal	New final disposal site（40km away）	
Street sweeping	Manual system	
Waste minimization	Composting with pruning waste of roadside trees and market waste	

7.4.1 Storage & Discharge

At present, there are no regulations for the storage and discharge system. Therefore, residents take the solid waste out of their houses at any time in whatever container. Not having a defined time for the discharge of solid waste causes disorder, especially because solid waste remains in the streets for a long time, and most of the time solid waste is scattered by animals or persons searching for recyclables. This affects directly the cleanliness of the streets and the collection service.

On the other hand, the most common containers for solid waste are small plastic bags from supermarkets and 200 liter metal drum cans. Both containers make SW collection difficult, increasing the collection time, because of the large number of plastic bags and the heavy weight of the 200 liter drum cans, especially after rainfall. The discharge points complicate

SW collection because containers known as “zafacones” are oriented toward the sidewalk, not toward the street. Worse yet, in some cases they are buried, and solid waste is placed directly and in bulk, without being bagged or placed in smaller containers. These situations demand greater efforts of the collection personnel, thereby affecting their productivity and their occupational health.

The Master Plan proposes to regulate both activities according to the following scheme.

Table 7-22: Storage & Discharge

One family residence (1 or 2 stories buildings)	
Storage	Plastic bags of 120 liter Plastic receptacles of 120 l to 240 liter For the storage of solid waste bagged in plastic bags
Discharge	In front of the residence, only on the established day and time for SW collection
Multi-family residence (high-rise)	
Storage	Plastic containers of 120 to 500 liter capacity, in which SW bagged in plastic bags is stored.
Discharge	Containers should be kept on the premises, taking them out into the street only on collection days within the established time frame. In the case of insufficient space in the property, these containers can be placed in the public area if they do not obstruct the traffic. The stored solid waste should never exceed the capacity of the container. These containers should be kept covered at all times. It is the responsibility of owners to keep the surrounding areas of containers free of solid waste, either in bags or in bulk.
Colmados or Shops in the Household	
Storage	Plastic containers of 120 to 360 liter capacity, in which SW bagged in plastic bags is stored.
Discharge	Containers should be kept at the exit of “colmados” so that clients of these shops can discharge the waste generated by the goods purchased or consumed. When the plastic bags are full, they should be taken away and stored on the premises, before discharging them at collection time. Containers should be kept covered at all times. It is the responsibility of owners to keep the surrounding areas of containers free of solid waste, either in bags or in bulk.
Large Generators	
Storage	Plastic containers of variable capacity depending on the volume generated, or containers with in situ compaction
Discharge	The facilities should set aside spaces for the exclusive location of containers, from where private collection service providers will take away.
Hospitals and Health Care Centers	
Storage	Plastic containers of 120 liter capacity, in which SW bagged in plastic bags is stored. Only non-hazardous waste can be stored. Infectiour or contagious waste should be handled independently.
Discharge	The facilities should set aside spaces for the exclusive location of containers, which will be taken out into the public area only on collection day and time.
Municipal Markets	
Storage	Plastic containers of 120 to 360 liter Plastic containers of 120 to 360 liter Solid waste is to be stored in bulk, directly in the containrs.
Discharge	The tenants will haul the plastic containers or containers, as they get full, to the storage points (boxes or containers of larger capacity) that are to be defined for the market collection service. Under no cirumstances, the tenants will be allowed to discharge solid waste directly onto the floor.

It is recommended to get rid of any type of “zafacon”, as they only foster uncontrolled discharge of solid waste, and responsibilities cannot be pinned on a specific user or users.

7.4.2 Collection & Transport

a. Collection

Approximately 28% of solid waste comes from sectors where the poverty index indicates that 40% to 70% of households under the poverty line. This situation is particularly grave along the rivers of Ozama and Isabela, which lack an adequate road infrastructure, thereby preventing implementation of the traditional collection system. Therefore, and in order to achieve 100% service coverage, the Master Plan considers implementation of the collection system under two schemes, namely, Urban Sector Collection and Marginal Sector Collection. The following Figure shows the distribution of areas under each service modality.

In addition to Urban Sector Collection and Marginal Sector Collection, recommendations are made for collection systems for Large Generators, Markets, Special Service, and Street Sweeping. The corresponding future solid waste generation was estimated as presented in the Table below.

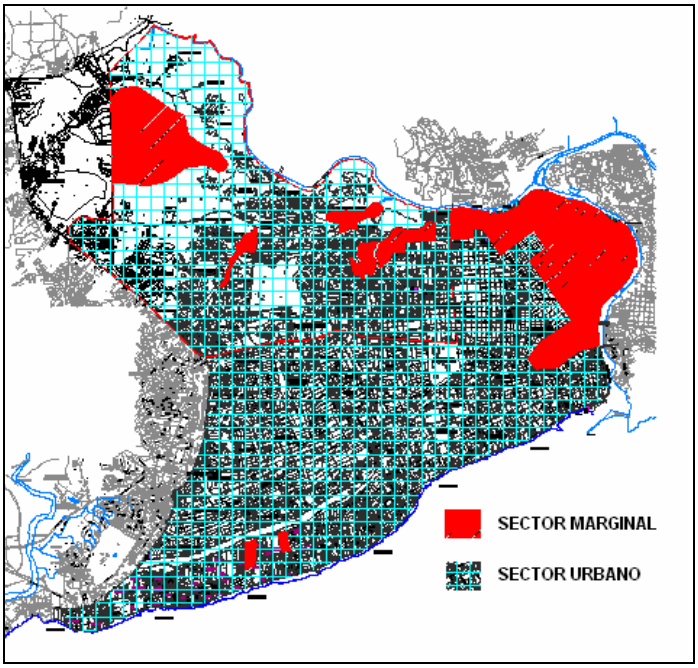


Figure 7-10: Distribution of Areas by Modality of Collection Service

Table 7-23: Future SW Generation by Collection Service Modality

Unit: ton/day

Service type	2007	2008	2009	2010	2011	2012	2013	2014	2015
Residential	1,201	1,237	1,234	1,250	1,265	1,263	1,250	1,243	1,231
Urban	865	890	889	900	911	909	900	895	886
Marginal	336	346	346	350	354	354	350	348	345
Big generators	72	74	74	75	76	76	75	75	74
Markets	90	92	92	93	94	94	93	93	92
Special service	10	11	11	11	11	11	11	11	11
Sweeping	82	85	85	86	87	87	86	85	85
Direct haulage	1	1	1	1	1	1	1	1	1
Total	1,457	1,500	1,497	1,515	1,534	1,532	1,516	1,508	1,493

a.1 Modality of Collection Service

Presented below are the modalities of the collection service, namely, urban sector, marginal sector, large generators, markets, special service, and street sweeping.

a.1.1 Urban sector collection

The characteristics of the urban sector collection service are summarized in the Table below.

Table 7-24: Summary of Urban Sector Collection Service

Items	Description
Waste Characteristics	Residential waste generated in the urban sector, corresponds to residential waste (it includes single family housings and high-rise buildings), small commercial business, schools, institutions and industries.
Generation area Characteristics	Urban areas, with constructions of one or more floors, net of roads conformed by wide avenues and secondary streets that mostly allows without more inconveniences the traffic of compactors vehicle of up to 20 yd^3. There are some sectors with narrow streets, but that allow the traffic of vehicles such as compactors of 6 yd^3. It involves the three Circumscriptions.
Characteristic of the Collection Service	The collection service should be carried out according to a collection route map with compactors trucks of up to 20 yd^3 and compactors trucks of 6 yd^3 for sectors of narrow streets. The service should be door to door. In the sectors, preferably residential of constructions up to 4 floors, the frequency should be daily distributed in two shifts (morning and afternoon). In the sectors with constructions of more than 5 floors, with a high percentage of commercial and institutional areas the frequency should be daily or three times per week, the schedules for the residential area should be during the day distributed in two days (morning, afternoon), for the sectors mainly commercial and big avenues the schedule of service should be at night (service starting from the 20:00 hr.). Morning shifts should begin at least at 07:00 hr, to avoid the transfer of the truck to the beginning point of the collection coinciding with the hour of increased vehicular congestion. The waste transport is carried out directly to the final disposal site, except for the compactor trucks of 6yd^3, which make the discharge in the transfer station. For residential areas with constructions of up to 4 floors of height, the storage of the waste should be carried out in plastic bags of 120 L, properly closed disposed in plastic containers of up to 200 L. In the other areas the waste should be disposed in plastic bags and stored in plastic containers with a capacity of 120 to 500 L. The characteristics of the service such as frequency, schedules and days of service should be announced thoroughly to the community by the service operator.
Operator	Service is contracted out to private operators by means of a bid process and later contract signature for a period no longer than 5 years (time of useful life of the trucks operating in two shifts). At least two operators should be considered to avoid the monopoly. Each operator should service an exclusive area in order of avoiding the overlapping of operators in one area; the territory can be assigned according to the political distribution, which is to say by Circumscriptions.

a.1.2 Marginal sector collection

The characteristics of the marginal sector collection service are summarized in the Table below.

Table 7-25: Summary of Marginal Sector Collection Service

Items	Description
Waste Characteristics	Residential waste generated in the marginal sector, corresponds to domiciliary waste coming from single family and multifamily housings, small commercial business (groceries), schools, organizations.
Generation area Characteristics	Marginal area, with a high population density, constructions of not more than three floors that are located in the adjacent area to the rivers of Ozama and Isabela, they present narrow streets that in most cases do not allow the traffic of compactor vehicles, except by the avenues that surround it. The housings are located around narrow canyons that further hinder the collection of waste.
Characteristic of the Collection Service	The collection service should be carried out according to collection route maps with compactor trucks of 6 yd^3. The service should be door to door, or direct delivery by the user or by storing points (containers stored in the streets at the exit of the neighborhoods). The frequency should be daily from Monday to Saturday, in two shifts (morning, afternoon). The waste should be stored in bags of 120 L, which will be contributed by the service operators to the community. The storing points will have plastic or metallic containers of capacity no smaller than 500 L. The users will take out their waste in bags in front of their home in the schedules indicated for the service, in the case that the collection vehicle passes in front of your home, or transfer them to the container in the storing point. In case that the collection truck cannot reach the service area due to the narrow streets and there are no storing points, the collection personnel will collect the waste manually disposing them in wheelbarrows to transfer them later on to the collection truck. The transport of waste is carried out directly to the Transfer Station that is located in the Circumscription III. The characteristics of the service such as frequency, schedules and days of attention, collection method, location of containers on the storing point, should be announced thoroughly to the community by the service operator and by the Municipality, by means of the distribution of flyers, discussions and training courses to the entities or organizations that are located in the area.
Operator	Micro-enterprises or foundations created through the SABAMAR project and that correspond to: FUNDEMAPU which assists the neighborhood La Puya in the Circumscription II, FUNSACO with coverage in the neighborhoods Gualey, Simón Bolívar, 24 de Abril and Las Cañitas; ESAZURZA with coverage in the neighborhood La Zurza; ESCOBA with coverage in the neighborhood Capotillo; and ECOSAGUACIGUA with coverage in the neighborhoods 27 de Febrero, Los Guandules and La Ciénaga, all them in the Circumscription III. Small Trucks Association that cover the marginal neighborhoods that are not serviced by the micro-enterprises. Each operator should service an exclusive area in order to avoid the overlapping of operators. The service is contracted out to the micro-enterprises or foundations through service contracts with duration no longer than 5 years. For the case of the Association the service is awarded by means of a bid process and later contract signing for a period no longer than 5 years (time of useful life of the trucks operating in two shifts).

a.1.3 Big generators

The characteristics of Big generators collection service are summarized in the Table below.

Table 7-26: Summary of Big Generators Collection Service

Items	Description
Waste Characteristics	Municipal waste generated in great volume, coming from big commercial centers, hotels, institutions, and industries.
Generation area Characteristics	They are generated mainly inside the urban area, where there are no problems for the movement of the collection vehicles.
Characteristic of the Collection Service	It corresponds to a private collection service, punctually directed to generators, and how it is carried out depends directly on the characteristics and volume of the waste generation. The collection service is not provided by specified area but by generator, which should request authorization to the Municipality to contract the collection service directly with a private company. Responsibility of the Municipality is to verify whether the user is classified as a big generator, whether the company to give the service is authorized, and to investigate the execution of the collection of the waste in time and form. The municipality supports inspection of the contracts between users and private companies. It allows the Municipality to know the characteristics of the contracted service such as the established rates and/or fixed amounts that tell how much the private company should pay to the municipality for operation of its service. Those identified big generators will be exempt from the collection service carried out by the Municipality. The collection frequency responds to the necessities of the big generator, being more frequent where the waste might decompose in situ. It will be verified by the Municipality. The service is point to point, with storage in containers with or without compacting in situ. Vehicles are either with compaction box, or roll on roll off type. The vehicles should avoid the fall and scattering of waste or the leakage of liquid during the transport. Waste is transported and directly discharged in the final disposal site. As it is a particular clear service, the Municipality does not have any responsibility on their costs. Those are matter of the contract between the private company and the big generator, however, the Municipality should charge to the private company directly a canon for the license and execution of the service.
Operator	Private contract takes place between the big generator and the private company. The contract should settle the characteristics of the service and a copy should be submitted to the Municipality. The private company that wants to enter the activity, must request the Municipality an operation license, informing in this event the way the services will be developed, that is to say, what modalities of service will offer to the big generators, the infrastructure with which they have to execute it, equipments and human resources that will be used and the maximum volume of waste to manage monthly. Before granting the license, the Municipality will verify whether the private company has the reported resources.

a.1.4 Markets

The characteristics of markets collection service are summarized in the Table below.

Table 7-27: Summary of Market Collection Service

Items	Description
Waste Characteristics	Waste generated in the markets located in the National District.
Generation area Characteristics	Municipal market located in the National District, where commercialization takes place with diverse products such as meat, vegetables, fruits, etc.
Characteristic of the Collection Service	The collection service includes: - Installation of containers of 120 to 360 L in the service points of the market. - Transfer and discharge from the containers to the collection trucks conditioned to receive and contain liquids or boxes. - Sweeping the market and surrounding streets. - Washing of streets, washing and fumigation of containers, boxes and installation area. - Fumigation and sanitization of the area according to the program approved by the Municipality. - Transport and discharge of waste in the final disposal site. Frequency of the service is daily, schedules of service according to the generation of market waste. At the end of the day 100% of the waste should have been collected and discharged in the sanitary landfill, and carried out the sweeping defined previously.
Operator	Service is contracted out to private operators by means of a bid process and later contract signing for a period no longer than 5 years (useful life of the vehicles). The service can be carried out by only one operator.

a.1.5 Special service

The characteristics of special collection service are summarized in the Table below.

Table 7-28: Summary of Special Collection Service

Items	Description
Generation area Characteristics	The whole National District
Characteristic of the Collection Service	It corresponds to a private collection service, requested directly by the Municipality. The collection service is carried out with small dump trucks conditioned to avoid the fall and scattering of the waste during the transport. The personnel of each truck is conformed by a driver and two operators who have tools (shovels, rakes, wheelbarrow) to carry out the loading and unloading of the waste. The service is carried out fulfilling a collection route that is daily submitted by the Municipality to the operator, and which responds to the requests formulated previously by the users. For the pruning waste, volume will be reduced by means of chipping. Some vehicles will have equipment for chipping. The waste is directly transported to the transfer station located in the circumscription III. Service frequency is daily, service schedule in two shifts (morning and afternoon).
Operator	Service is contracted out to private operators by means of a bid process and later contract signing for a period no longer than 5 years (useful life of the trucks).

a.1.6 Street sweeping

A summary of the street sweeping service is presented in the Table below, specifically concerning collection of solid waste resulting from street sweeping. The street sweeping activity in itself will be explained in a later Section.

Table 7-29: Summary of Collection of Street Sweeping Waste

Items	Description
Waste Characteristics	Waste generated in the activities of sweeping of streets and avenues carried out by the Municipality.
Generation area Characteristics	Includes the whole National District, urban and marginal sector.
Characteristic of the Collection Service	The collection service should be carried out according to the route map. The vehicles used for the service are compactor trucks of 6 yd³, the waste should be disposed by each sweeper in bags and collected at the points established in the sweeping program. Frequency and schedule of the service should be on the basis of the sweeping program. The service should consider the collection of 100% of the sweeping waste which will be stored in bags. The collection must be carried out during the sweeping day.
Operator	Service contracted out to private operators by means of a bid process and later contract signing for a period no longer than 5 years (useful life of the trucks). The service can be carried out by only one operator.

a.2 Necessary Equipment

The numbers of vehicles and containers needed in each service are indicated in the Tables below. The number of vehicles differs for MP1 and MP2, but the number of containers does not change.

Table 7-30: Number of Vehicles Necessary for MP1

MP1 nos.

Service type	Truck	2007	2008	2009	2010	2011	2012	2013	2014	2015
Residential										
Urban	20yd3 compactor	61	63	63	64	65	65	64	64	63
Marginal	6yd3 compactor	39	40	40	41	41	41	41	41	40
Big generators	20yd3 compactor	6	6	6	6	6	6	6	6	6
Markets	20yd3 compactor	7	7	7	7	7	7	7	7	7
Special service	2ton flat truck	3	3	3	4	4	4	4	3	3
Sweeping	6yd3 compactor	10	10	10	10	11	10	10	10	10

* inc. 10% of reserve

Table 7-31: Number of Vehicles Necessary for MP2

MP2 nos.

Service type	Truck	2007	2008	2009	2010	2011	2012	2013	2014	2015
Urban	20yd3 compactor	61	63	63	64	65	54	53	53	53
Marginal	6yd3 compactor	39	40	40	41	41	41	41	41	40
Big generators	20yd3 compactor	6	6	6	6	6	5	5	5	5
Markets	20yd3 compactor	7	7	7	7	7	6	6	6	6
Special service	2ton flat truck	3	3	3	4	4	4	4	3	3
Sweeping	6yd3 compactor	10	10	10	10	11	10	10	10	10

* inc. 10% of reserve

Table 7-32: Number of Necessary Containers (MP1, MP2)

Required number of containers nos.

Service	Spec.	2007	2008	2009	2010	2011	2012	2013	2014	2015
Urban	560L	2,889	2,975	2,969	3,006	3,043	3,038	3,007	2,990	2,962
Marginal	560L	1,854	1,909	1,906	1,929	1,953	1,950	1,930	1,919	1,901
Total		4,743	4,884	4,875	4,935	4,996	4,988	4,937	4,909	4,863

b. Transfer Station

At present, large compactor trucks transport the collected solid waste directly to the Duquesa final disposal site, which is located 18km away. On the other hand, small trucks use the existing transfer station in Villa Agricola, located on the northeastern side of the city.

MP1 will basically continue using the existing transportation system. On the other hand, MP2 assumes the use of a new final disposal site located 40km away starting in the year 2012. MP2 also assumes the construction of a new transfer station because transfer and transport would be more economical even using large compactor trucks.

Transfer and transport for MP1 and MP2 are shown in the Tables below.

Table 7-33: Tonnage of Transfer & Transport (MP1)

ton/day

Transfer station	2007	2008	2009	2010	2011	2012	2013	2014	2015
Existing (365 days)	429	442	441	446	452	451	447	444	440
Existing (299 days)	524	539	538	545	552	551	545	542	537

Table 7-34: Tonnage of Transfer & Transport (MP2)

ton/day

Transfer station	2007	2008	2009	2010	2011	2012	2013	2014	2015
Existing (365 days)	429	442	441	446	452	451	447	444	440
New (365 days)						1,079	1,068	1,062	1,052
Existing (299 days)	524	539	538	545	552	551	545	542	537
New (299 days)						1,318	1,304	1,297	1,285

b.1 Existing transfer station

The existing transfer station is located in Villa Agricola, on the northeastern side of the city. The transfer station completed vast improvement works in August 2006, thanks to assistance from the EU. The capacity of the transfer station is 500 tons per day, operating under a direct dump and mostly handling solid waste generated in the nearby marginal area.

The Master Plan calls for the same use of the transfer station, handling solid waste from the marginal area, the special service, and street sweeping. The capacity of the transfer station, 500 tons per day, is slightly lower than the planned transfer and transport of 550 tons per day, but the difference can be offset by improved efficiency or longer operation hours of the transfer station.

b.2 New Transfer Station

b.2.1 Location

The optimum location of the transfer station would be the center of gravity of the total amount of waste collected in the coverage area. The area, where the center of gravity is found, is in a high income area where land cost is high. Consequently, it has been decided that the Transfer Station site will be relocated to the west. The area proposed for the location of the transfer station is shown in the following figure.

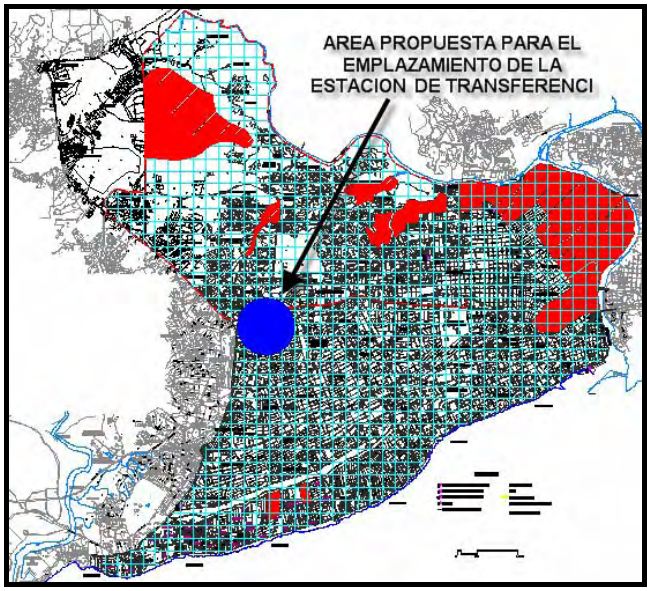
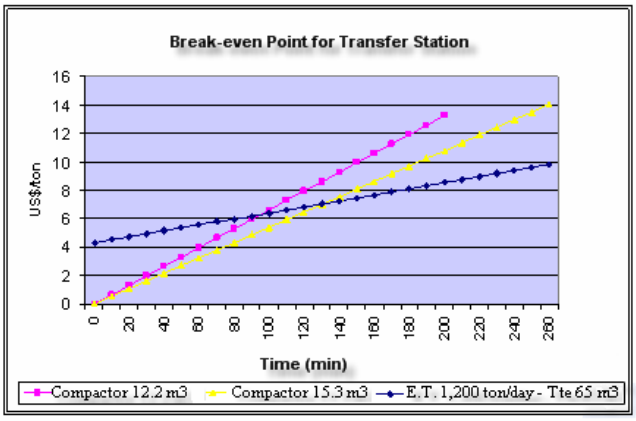


Figure 7-11: Proposed Area for Location of Transfer Station

Study on Transfer & Transport

The calculation of break-even points for the transfer station on the basis of 1,300 tons per day, transportation vehicles of 85yd3, and 3 sizes of compactor trucks: 16 yd3, 20yd3 and 25 yd3, gave as results 14km, 16km and 19km, respectively. This means that in the case of the present final disposal site Duquesa, located 18km away, transfer and transport would be desirable for compactor trucks of 16yd3 and 20yd3, while direct transport would be appropriate for compactor trucks of 25 yd3. However, the street conditions in the collection area indicate that compactor trucks of 25yd3 are too big as collection vehicles. The break-even point for compactor trucks of 20 yd3 was 16km, a mere 2km difference from the 18km to Duquesa, well within the admissible margin of error. Therefore, compactor trucks of 20 yd3 were the recommended collection vehicles.



b.2.2 Transfer system

There are several types of transfer stations to be considered. Those are:

- Direct dump station,
- Pit or platform non-compaction station,
- Hopper compaction station, and
- Push pit compaction station.

The advantages and disadvantages of the different systems are shown in the following table. There is already a transfer station in the National District which operates as direct discharge. Therefore, the implementation of the direct discharge type of transfer station is recommended for the new one as well, taking into account such experience.

Table 7-35: Advantage and Disadvantage of Transfer Station Type

Type	Outline	Advantage	Disadvantage
Direct dump station	Waste is dumped directly from collection vehicle into waiting transfer trailers.	• Little hydraulic equipment is used, a shutdown is unlikely. • Minimizes handling of waste • Relatively inexpensive construction cost • Drive-through arrangement of transfer vehicle can be easily provided	• Requires larger trailer than compaction station • Dropping bulky item directly into trailers can damage trailers • Minimizes opportunity to recover materials • Number and availability of stalls may not be adequate to allow direct dumping peak period
Pit or platform non-compaction station	Waste is dumped into a pit or onto a platform and then loaded into trailers using waste handling equipment	• Convenient and efficient waste storage area is provided • Un-compacted waste can be done by bulldozer in pit or platform • Top-loading trailers are less expensive than compaction trailers • Peak loads can be handled easily • Drive-through arrangement of transfer vehicles can be easily provided • Simplicity of operation and equipment minimizes potential for station shutdown • Can allow recovery of materials	• Higher capital cost, compared to other alternatives, for structure and equipment • Increased floor area to maintain • Requires larger trailers than compaction station
Hopper compaction station	Waste is unloaded from the collection truck, through a hopper, and loaded into an enclosed trailer through a compactor	• Use smaller trailers than non-compaction station • Some compactors can be installed in a manner that eliminates the need for a separate, lower level for trailers	• If compactor fails, there is no way to load waste onto the trailer • Weight of ejection system and reinforce trailer reduces legal payload • Capital costs are higher for compaction trailers • Compactor capacity may not be adequate for peak inflow • Cost to operation and maintain compactors may be high
Push compaction station	Waste is unloaded from the collection truck into a push pit, and then loaded into an enclosed trailer through a compactor	• Pit provides waste storage during peak period • Increased opportunity for recovery of materials • All advantage of hopper compaction station	• Capital costs for pit equipment are significant • All other disadvantage of hopper compaction stations

sources : Decision-Makers' Guide To Solid Waste Management, Volume II, 1995, US EPA

b.2.3 Conceptual design of the transfer station

The new transfer station is to have a capacity of 1,300 tons/day, the solid waste coming in on 20yd3 compactor trucks and going out on 85yd3 trailer trucks.

The transfer station is to have two truck scales, and nine hoppers where solid waste will be dumped. The conceptual layout and design are indicated below.

Table 7-36: New Transfer & Transport System

Component	Characteristics
Transfer Station	Capacity 1,300 ton/day Direct discharge
Transfer transport	Tractor-truck and trailer of 85yd3
Collection Service	Compactor truck of 20yd3

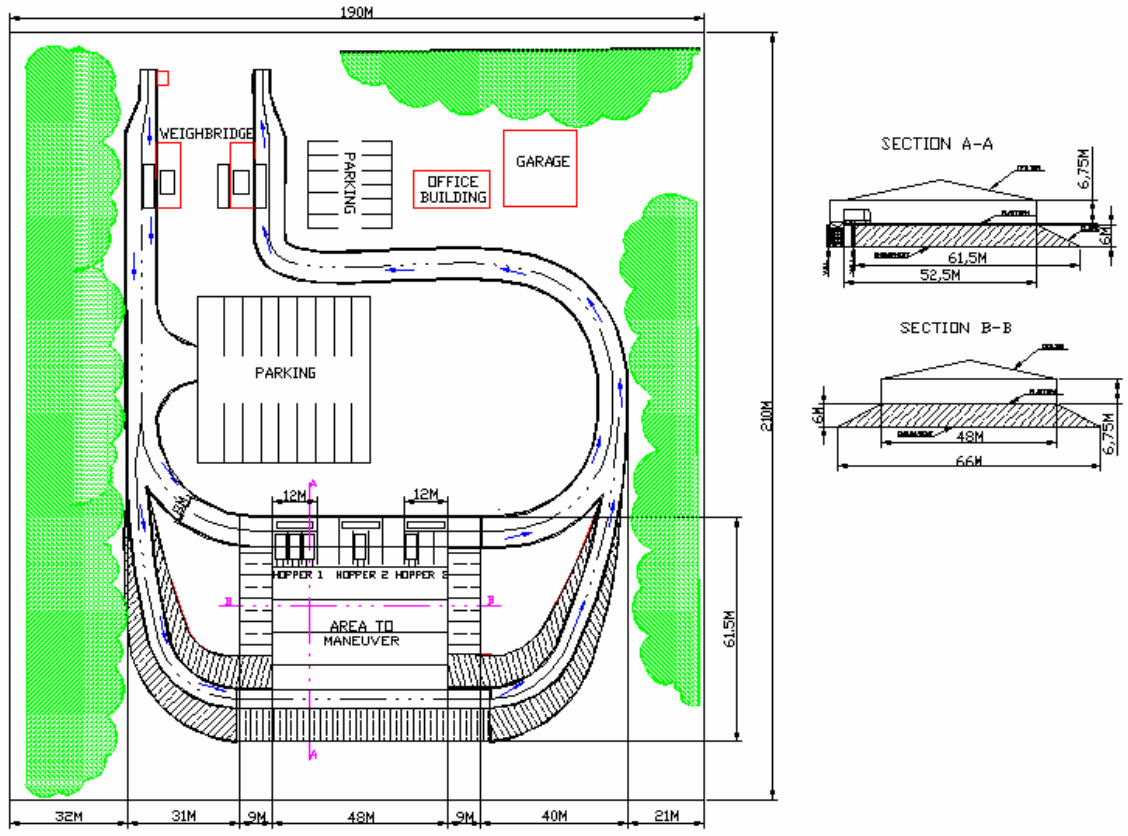


Figure 7-12: Lay Out for the Transfer Station

Table 7-37: Summary for the Conceptual Design of the Transfer Station

Item	Detail	Unit	Quantity
Land Procurement		m2	40,000
Construction of the Transfer Station			
Platform	Reinforce concrete	m2	2,500
Ceiling and Platform Closure		m2	2,500
Office		m2	210
Garage		m2	420
Weighbridge		m2	76
Pavement for Access to Platform	Concrete	m2	899
Pavement for Access Roads and On-ramp	Asphalt	m2	2,319
Parking pavement	Asphalt	m2	3,208
Green Areas		m2	4,000
Embankment platform and access		m3	5,448
Platform landfill		m3	15,264
Retaining wall		m3	104
Fence	h=2.0m	ml	760
Gate	wide=10.0m	unit	2
Total Structure			
Equipment			
Weighbridge	60ton	unit	2
Hoppers	Steel, 12m x 5m	unit	9
Ventilation Facility		unit	9
Generator	230 kW	unit	2
Car washing	120 L/hr	unit	2
Electrical facility		unit	1
Wheel loader	100kw	unit	1
Pick-up		unit	2
Mobile Workshop Truck		unit	1
Drainage Facility		unit	1
Garage tools		unit	1

c. Transport

The proposed transport system consists of a combination of 300-350hp tractors and 85yd3 trailers. The number of transport vehicles required for MP1 refers to the use of the existing transfer station. On the other hand, MP2 foresees a new transfer station, whereby the number of required transport vehicles is indicated for both the existing and the new transfer stations.

Table 7-38: Required Number of Transport Trucks for the Existing Transfer Station (MP1)

nos.

Item		2007	2008	2009	2010	2011	2012	2013	2014	2015
Tractor	300-350 hp									
transport		5	5	5	5	5	5	5	5	5
reserve		1	1	1	1	1	1	1	1	1
total		6	6	6	6	6	6	6	6	6
Trailer	85yd3									
transport		5	5	5	5	6	6	5	5	5
for waiting		3	3	3	3	3	3	3	3	3
reserve		1	1	1	1	1	1	1	1	1
total		9	9	9	9	10	10	9	9	9

Table 7-39: Required Number of Transport Trucks for the Existing Transfer Station (MP2)

nos.

Item		2007	2008	2009	2010	2011	2012	2013	2014	2015
Tractor	300-350 hp									
transport		5	5	5	5	5	8	8	8	8
reserve		1	1	1	1	1	1	1	1	1
total		6	6	6	6	6	9	9	9	9
Trailer	85yd3									
transport		5	5	5	5	5	8	8	8	8
for waiting		3	3	3	3	3	3	3	3	3
reserve		1	1	1	1	1	1	1	1	1
total		9	9	9	9	9	12	12	12	12

Table 7-40: Required Number of Transport Trucks for the New Transfer Station (MP2)

For the new transfer station nos.

Item		2007	2008	2009	2010	2011	2012	2013	2014	2015
Tractor	300-350 hp									
transport		-	-	-	-	-	19	19	19	19
reserve		-	-	-	-	-	1	1	1	1
total		-	-	-	-	-	20	20	20	20
Trailer	85yd3									
transport		-	-	-	-	-	19	19	19	19
for waiting		-	-	-	-	-	9	9	9	9
reserve		-	-	-	-	-	2	2	2	2
total		-	-	-	-	-	30	30	30	30

7.4.3 Street Sweeping

a. Design of the service

In order to re-design the service, the conditions for the service were considered to be the following.

- ADN will directly provide the service.
- The street sweeping service will be conducted manually.
- Street sweeping will at least meet the performance indicators recommended by CEPIS. This means that the expected productivity will be as indicated in the following Table.
- The service will be provided in two daily shifts, Monday through Saturday.
- The solid waste resulting from street sweeping will be collected using 6yd3 compactor trucks exclusive for this activity.

Table 7-41: Standards considered for the Design of Street Sweeping Service

Variable	Productivity	Expected Value
Consumption of plastic bags per km swept per day Number of plastic bags/sweeper/day	7 to 9 plastic bags/sweeper/day (black colored bags, of low density polyethylene, 120 liter capacity, 0.002" thickness, service on paved streets, 2 shifts/day, frequency: 60% daily and 40% every other day)	9
Consumption of brooms per sweeper per km swept Number of brooms/sweeper/km	0.02 to 0.04 brooms/km swept (service on paved streets, brooms made of fiber and wooden base of 45cm long, 6cm wide and 11cm of fiber visibility)	0.03
Km swept per sweeper per day Km/sweeper/day	1.3 to 1.5 linear km/sweeper/day (sidewalk + gutter, paved streets, sweeper aged 35 years, average height 1.63 for men and 1.53 for women, weight: 5 additional kilogram over the height for men, and 7 kg for women)	1.4

In order to meet the indicated values, the assigned personnel must meet the physical conditions required for street sweeping tasks. The following base parameters were considered for the design of the service.

Table 7-42: Base Parameters

Variable	Unit	Value
Number of shifts	Shift/day	2
Sweeper productivity	Km/sweeper/day	1.4
Plastic bag requirement	Bags/sweeper/day	9
Broom requirement	Broom/sweeper/km	0.03
Volume per bag	Liter	120
Density	Ton/m3	163
Ton/bag	Ton	0.02
Numer of sweeper/crew	Nº	20
Number of crew/supervisor	Nº	5
Vehicle/supervisor/shift	Nº	1

b. Personnel requirement in street sweeping service

The number of personnel for the service was determined using the above considerations.

Table 7-43: Number of Personnel for Street Sweeping

Year	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sweeping	Ton/day	82	85	85	86	88	88	87	87	86
Sweeping (299 working days)	Ton/day	101	104	104	105	107	107	106	106	106
Sweeping	1000/ton/year	31	32	32	32	32	32	32	32	32
Km swept	Km/day	787	810	810	818	833	833	825	825	825
Personnel										
Number of sweepers	Nº	562	578	578	584	595	595	589	589	589
Reserve sweeper	Nº	29	29	29	30	30	30	30	30	30
Total of sweepers	Nº	591	607	607	614	625	625	619	619	619
Crew leader	Nº	29	29	29	30	30	30	30	30	30
Substitute crew leader	Nº	2	2	2	2	2	2	2	2	2
Total of crew leaders	Nº	31	31	31	32	32	32	32	32	32
Supervisor	Nº	6	6	6	6	6	6	6	6	6
Substitute Supervisor	Nº	1	1	1	1	1	1	1	1	1
Total of Supervisors	Nº	7	7	7	7	7	7	7	7	7

c. Requirements of materials and inspection vehicles for street sweeping

The following requirements of materials for the service were determined.

Table 7-44: Requirements of Materials & Inspection Vehicles for Street Swwping Service

Año Year	Unid Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Materials & Vehicles										
Plastic bags	1000 Nº	1,510	1,555	1,555	1,570	1,600	1,600	1,585	1,585	1,585
5% reserve	1000 Nº	76	78	78	79	80	80	79	79	79
Total	1000 Nº	1,586	1,633	1,633	1,649	1,680	1,680	1,664	1,664	1,664
Brooms	1000 Nº	7	7	7	7	7	7	7	7	7
5% reserve	1000 Nº	1	1	1	1	1	1	1	1	1
Total	1000 Nº	8	8	8	8	8	8	8	8	8
Inspection vehicles										
Plant	Nº	3	3	3	3	3	3	3	3	3
10% reserve	Nº	1	1	1	1	1	1	1	1	1
Total	Nº	4	4	4	4	4	4	4	4	4
Purchase of initial needs	Nº	4	-	-	-	-	-	-	-	-
Annual increase	Nº	-	-	-	-	-	-	-	-	-
Total investment	Nº	4	-	-	-	-	-	-	-	-
Replacement useful life 1	Nº	-	-	-	-	4	-	-	-	-
Purchase program	Nº	4	-	-	-	4	-	-	-	-
Operating vehicles	Nº	3	3	3	3	3	3	3	3	3

7.4.4 Waste Minimization

Waste minimization is currently the central problem of Solid Waste Management. Developed countries have taken the lead in waste minimization so far. However, other countries are also expected to tackle it, as waste minimization is one of the most effective measures to preserve natural resources, to prevent the global warming, to reduce hazardous substances and to lower SWM cost.

a. Concept of Waste Minimization

Waste minimization has a broad sense, which includes Generation Control, Discharge Control and Resource Recovery as shown in the figure below.

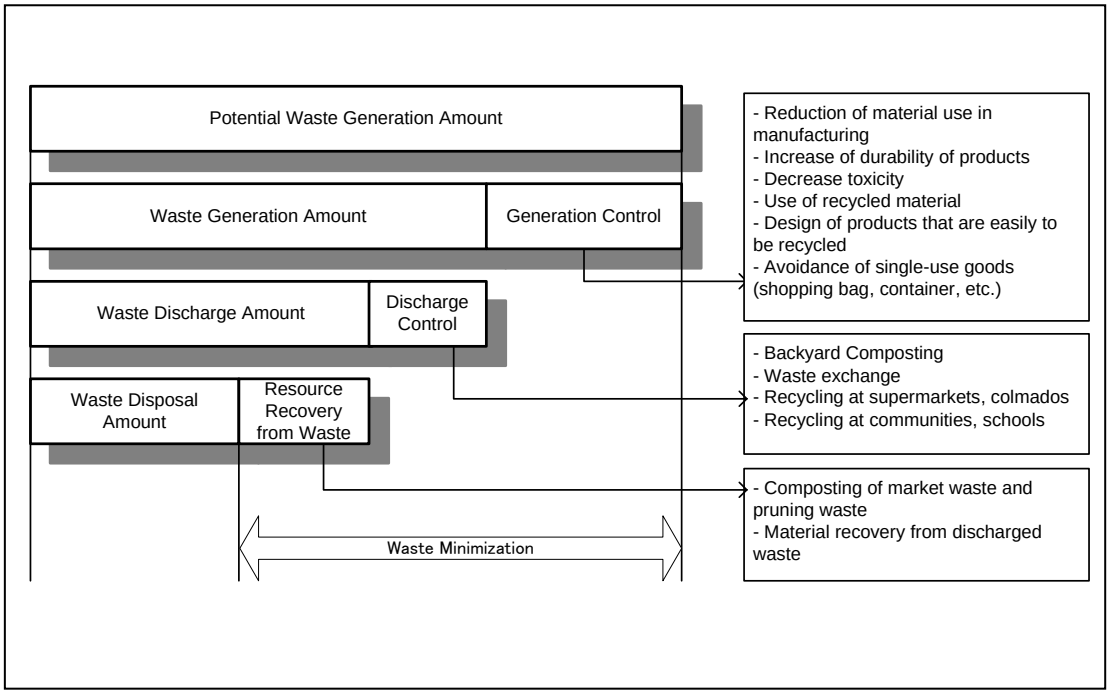


Figure 7-13: Concept of Waste Minimization

It is common knowledge around the world that the priority order of SWM policy is 1) to "Reduce," 2) to "Reuse" and 3) to "Recycle."

"Generation Control" is the same as "Reducing." It should be given first priority. "Discharge Control" practices "Reusing" and/or "Recycling" at waste generation sources. As both measures aim to reduce the amount of waste discharged from the generation source, they are called "Source Reduction."

"Resource Recovery" indicates activities which aim to recover resources from discharged waste. It is generally called "Recycling." It is often divided into "Material Recovery" and "Energy Recovery."

b. Generation Control

The waste generation amount is scheduled to be reduced by 3% in 2015 as shown in the table below.

Table 7-45: Generation Control

Year	Generation control %	Generation potential ton/day	Generation control ton/day	Generation ton/day
2007	1	1,573	16	1,557
2008	1	1,595	16	1,579
2009	2	1,618	32	1,586
2010	2	1,641	33	1,608
2011	2	1,664	33	1,631
2012	3	1,688	51	1,638
2013	3	1,712	51	1,661
2014	3	1,737	52	1,685
2015	3	1,761	53	1,709

Measure 1: Environmental Education

Environmental education is to be conducted in schools and communities, with the aim of disseminating the importance of generation control as well as appropriate waste discharge manners. The Environmental Information Center will be in charge of this measure.

Measure 2: Tariff by Volume for ICIs

The tariff for ICIs is to be set by volume which gives them an incentive to reduce the waste amount. The fee collection company, AAA, will take this measure.

c. Discharge Control

20% of households and 40% of ICIs other than municipal markets are scheduled to participate in waste exchange, recycling at supermarkets, colmados, communities and schools. This discharge control is encouraged in line with market principles and environmental education. The target materials are shown in the table below.

Table 7-46: Target Materials for Discharge Control

Generation Source	Target Materials
Households	paper, textile, plastic, metal, bottles/glass
Restaurants	plastic, bottles/glass
Other commerce	paper, textile, plastic, metal, bottles/glass
Institutions	paper, plastic

Measure 1: Environmental Education

Environmental education is to be conducted to disseminate the importance of discharge control and to instruct on how to cooperate with recycling activities at supermarkets, colmados, communities and schools. The Environmental Information Center is to be in charge of this measure.

Measure 2: Waste Exchange

Waste exchange at sources, especially in ICIs, is to be encouraged by provision of appropriate information. Entities that want to sell and ones that want to buy or receive certain materials can register with the Environmental Information Center. Then, the center will provide such information to relevant entities.

Measure 3: Recycling at Supermarkets and Colmados

Containers of merchandise such as glass bottles and PET shall be recycled under the principle of Extended Producer Responsibility. The Secretariat of State for Environment and Natural Resources (SEMARN) shall take the initiative in this field. Under the initiative by the SEMARN, the ADN will communicate with companies concerned to encourage this measure.

Measure 4: Recycling at Schools and Communities

Along with the environmental education at schools and communities, recycling activities such as paper recycling are to be conducted. The ADN will act as a catalyst among schools, communities and recycling organizations.

Note: Most of the activities are expected to be conducted in line with market principles. Then, costs and benefits are supposed to be balanced. Costs that the ADN incurs are assumed to be covered by the administration cost.

d. Resource Recovery

Composting is planned as a measure of resource recovery.

Measure 1: Composting

Market waste and sweeping waste include a large portion of biodegradable materials that are suitable for composting. 70% of the municipal markets are to participate in a composting program. In addition, 30% of sweeping waste, i.e., pruning waste, will be brought to the program in 2015.

Table 7-47: Composting Program

Year	Market	Sweeping	Compost in ton/day	Compost residue ton/day	Compost product ton/day	Waste reduced ton/day
2007	0%	0%	0	0	0	0
2008	0%	0%	0	0	0	0
2009	10%	2%	6.2	2.2	0.6	4.1
2010	20%	5%	12.9	4.5	1.3	8.4
2011	30%	10%	20.2	7.1	2.0	13.2
2012	40%	15%	27.5	9.6	2.8	17.9
2013	50%	20%	35.2	12.3	3.5	22.9
2014	60%	25%	43.1	15.1	4.3	28.0
2015	70%	30%	51.2	17.9	5.1	33.3

Procedure

The following is the procedure to begin composting.

- to conduct a feasibility study along with site selection
- to introduce separate waste storage in the municipal markets
- to begin the composting program targeting biodegradable waste (biodegradable and grass/woods) generated from the municipal markets and pruning waste, and to expand the program

Required equipment and manpower

Required equipment and manpower for the composting are summarized in the tables below.

Table 7-48: Required Number of Equipment for Composting

Amount (299days-basis)

Item		2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste Amount										
compost in	ton/day	0	0	7.6	15.8	24.7	33.6	43.0	52.6	62.5
compost residue	ton/day	0	0	2.7	5.5	8.7	11.8	15.0	18.4	21.9
compost product	ton/day	0	0	0.8	1.6	2.5	3.4	4.3	5.3	6.3
waste reduced	ton/day	0	0	5.0	10.2	16.1	21.8	27.9	34.2	40.6
required number of equipment										
wheel loader	unit	0	0	1	1	2	2	3	4	4
shredder	unit	0	0	1	1	2	2	3	4	4
screen	unit	0	0	1	1	2	2	3	4	4
operative vehicle										
wheel loader	unit	0	0	0	1	1	2	2	3	4
shredder	unit	0	0	0	1	1	2	2	3	4
screen	unit	0	0	0	1	1	2	2	3	4
purchase of equipment										
wheel loader	unit	0	0	1	0	1	0	1	1	0
shredder	unit	0	0	1	0	1	0	1	1	0
screen	unit	0	0	1	0	1	0	1	1	0

Table 7-49: Required Manpower for Composting

Equipment	Capacity	Manpower
Wheel loader	1.5 m3 of bucket	1 driver for each
Shredder	20 m3/hour	1 operator and 3 workers for each
Screen	20 m3/hour	1 operator and 3 workers for each

Type of composting

Windrow is recommendable for this composting program.

7.4.5 Final Disposal

Master Plan 1 supposes the continued use of the Duquesa final disposal site, whereby no plan was included for final disposal. However, improvements are needed in the existing final disposal site, for which the necessary measures were detailed in the corresponding action plan. On the other hand, MP2 assumes the operation of a new final disposal site starting in the year 2012. The necessary measures to be taken for the construction of a new final disposal site were also detailed in the corresponding action plan.

Master Plan 1 (MP1): Use of Duquesa up to the year 2015

Master Plan 2 (MP2): Use of Duquesa up to the year 2011, and a new final disposal site located 40km away starting in the year 2012

7.5 Preliminary Cost Estimate

This section presents estimated costs of MP1 and MP2.

a. Key Data for Cost Estimate

The following are key data for cost estimating.

Table 7-50: Key Data for Cost Estimate

Key data	value
Exchange rage	RD$33.00/US$1.00
Working days	299 days/year
Useful life	
collection vehicles	5 years
containers	3 years
transport vehicles	7 years
transfer station	30 years
Borrowing rate	20%
Borrowing period	the same as the useful life
Administrative cost for the private sector	20%
Interest for the private sector	15%
Administrative cost for ADN	10%

b. Cost Estimate of Transport and Collection of MP1

The unit contract price of each service type has been established. Then, the cost per year is obtained by multiplying the unit contract price by the yearly waste amount as shown below.

Table 7-51: Unit Contract Price for MP1

Service type	2006-15	
Residential		
Urban	33.80	US$/ton
Marginal		
Collection	22.08	US$/ton
Transfer station	379,665	US$/year
Transport	4.86	US$/ton
Big generators	30.42	US$/ton
Markets	33.80	US$/ton
Special service	19.05	US$/ton
Sweeping	99.71	US$/ton
Direct haulage	0	US$/ton

Table 7-52: Waste Amount of MP1 (ton)

Service type	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Residential	438,320	451,381	450,505	456,071	461,646	460,936	456,224	453,677	449,383	4,078,142
Urban	315,590	324,994	324,364	328,371	332,385	331,874	328,481	326,647	323,555	2,936,262
Marginal	122,730	126,387	126,141	127,700	129,261	129,062	127,743	127,029	125,827	1,141,880
Big generators	26,337	27,122	27,069	27,403	27,738	27,696	27,413	27,260	27,002	245,039
Markets	32,733	33,708	33,643	34,059	34,475	34,422	34,070	33,880	33,559	304,548
Special service	3,762	3,875	3,867	3,915	3,963	3,957	3,916	3,894	3,857	35,006
Sweeping	30,099	30,996	30,936	31,318	31,701	31,652	31,329	31,154	30,859	280,044
Direct haulage	376	387	387	391	396	396	392	389	386	3,501
Total	531,627	547,469	546,406	553,157	559,920	559,058	553,343	550,253	545,045	4,946,278

Table 7-53: Estimated Cost of MP1 (1,000 US$)

Service type	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Residential										
Urban	10,667	10,985	10,963	11,099	11,235	11,217	11,103	11,041	10,936	99,246
Marginal										
Collection	2,710	2,790	2,785	2,819	2,854	2,849	2,820	2,805	2,778	25,210
Transfer station	298	298	298	298	298	298	298	298	298	2,682
Transport	597	615	614	621	629	628	621	618	612	5,555
Big generators	801	825	823	834	844	843	834	829	821	7,454
Markets	1,106	1,139	1,137	1,151	1,165	1,163	1,152	1,145	1,134	10,292
Special service										
Collection	72	74	74	75	75	75	75	74	73	667
Transfer station	9	9	9	9	9	9	9	9	9	81
Transport	18	19	19	19	19	19	19	19	19	170
Sweeping										
Collection	3,001	3,091	3,085	3,123	3,161	3,156	3,124	3,106	3,077	27,924
Transfer station	73	73	73	73	73	73	73	73	73	657
Transport	146	151	150	152	154	154	152	152	150	1,361
Direct haulage	0	0	0	0	0	0	0	0	0	0
Total	19,498	20,069	20,030	20,273	20,516	20,484	20,280	20,169	19,980	181,299

c. Cost Estimate of Collection and Transport of MP2

Estimated costs of MP2 are shown below.

Table 7-54: Unit Contract Price for MP2

Service type	2006-11	2012-15	
Residential			
Urban			
Collection	33.80	24.26	US$/ton
Transfer station	-	623,662	US$/year
Transport	-	8.79	US$/ton
Marginal			
Collection	22.08	22.08	US$/ton
Transfer station	379,665	379,665	US$/year
Transport	4.86	8.79	US$/ton
Big generators	30.42	21.84	US$/ton
Markets	33.80	24.26	US$/ton
Special service	19.05	19.05	US$/ton
Sweeping	99.71	99.71	US$/ton
Direct haulage	0	0	US$/ton

Table 7-55: Waste Amount of MP2 (ton)

Service type	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Residential	438,320	451,381	450,505	456,071	461,646	460,936	456,224	453,677	449,383	4,078,142
Urban	315,590	324,994	324,364	328,371	332,385	331,874	328,481	326,647	323,555	2,936,262
Marginal	122,730	126,387	126,141	127,700	129,261	129,062	127,743	127,029	125,827	1,141,880
Big generators	26,337	27,122	27,069	27,403	27,738	27,696	27,413	27,260	27,002	245,039
Markets	32,733	33,708	33,643	34,059	34,475	34,422	34,070	33,880	33,559	304,548
Special service	3,762	3,875	3,867	3,915	3,963	3,957	3,916	3,894	3,857	35,006
Sweeping	30,099	30,996	30,936	31,318	31,701	31,652	31,329	31,154	30,859	280,044
Direct haulage	376	387	387	391	396	396	392	389	386	3,501
Total	531,627	547,469	546,406	553,157	559,920	559,058	553,343	550,253	545,045	4,946,278

Table 7-56: Estimated Cost of MP2 (1,000 US$)

Service type	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Residential										
Urban										
Collection	10,667	10,985	10,963	11,099	11,235	8,053	7,971	7,926	7,851	86,750
Transfer station						525	525	525	525	2,100
Transport						2,918	2,889	2,872	2,845	11,524
Marginal										
Collection	2,710	2,790	2,785	2,819	2,854	2,849	2,820	2,805	2,778	25,210
Transfer station	298	298	298	298	298	298	298	298	298	2,682
Transport	597	615	614	621	629	1,134	1,123	1,117	1,106	7,556
Big generators										
Collection	801	825	823	834	844	605	599	595	590	6,516
Transfer station						44	44	44	44	176
Transport						244	241	240	237	962
Markets										
Collection	1,106	1,139	1,137	1,151	1,165	835	827	822	814	8,996
Transfer station						54	54	54	54	216
Transport						303	300	298	295	1,196
Special service										
Collection	72	74	74	75	75	75	75	74	73	667
Transfer station	9	9	9	9	9	9	9	9	9	81
Transport	18	19	19	19	19	35	34	34	34	231
Sweeping										
Seeping	3,001	3,091	3,085	3,123	3,161	3,156	3,124	3,106	3,077	27,924
Transfer station	73	73	73	73	73	73	73	73	73	657
Transport	146	151	150	152	154	278	275	274	271	1,851
Direct haulage	0	0	0	0	0	0	0	0	0	0
Total	19,498	20,069	20,030	20,273	20,516	21,488	21,281	21,166	20,974	185,295

d. Summary

The total costs and unit costs corresponding to MP1 and MP2 are presented below. In addition to the collection and transportation costs detailed above, the SWM total cost includes the composting cost, final disposal cost, and administrative cost. In regard to the final disposal cost, if operations in Duquesa are improved, the cost is assumed to be US$5.00/ton, while the unit cost of a new final disposal site is assumed to be US$10.00/ton. As ADN will require funds for the plan implementation, 10% of the direct costs were added as the administrative cost.

The total cost of MP1 between 2007 and 2015 was estimated at UD$228 Million, or about US$25 Million per year. Likewise, the total cost of MP2 was estimated at US$245 Million, and the yearly cost was estimated at US$25 Million while using Duquesa up to the year 2011, and at around US$30 Million when using a new final disposal site starting in the year 2012. The unit costs were estimated at US$46/ton for MP1, and US$50/ton for MP2.

It should be pointed out that these costs were based on the contract prices with private service providers, and these contract prices included a 20% interest rate on loans for the acquisition of vehicles and equipment, 16% tax, 20% administrative cost of private companies, and 15% profit. If these figures were to change during re-negotiation of the terms and conditions of the contracts, or before signing new contracts, then it may turn out to cause changes in the total costs as well as the unit costs.

Table 7-57: Total Cost Estimated of MP1 (1,000 US$)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Collection and Transport	19,498	20,069	20,030	20,273	20,516	20,484	20,280	20,169	19,980	181,299
Composting	0	0	70	143	226	305	390	479	570	2,184
Final Disposal	2,529	2,606	2,621	2,679	2,739	2,795	2,767	2,751	2,725	24,212
Administration 10%	2,203	2,268	2,272	2,310	2,348	2,358	2,344	2,340	2,328	20,771
Total	24,230	24,943	24,993	25,405	25,829	25,942	25,781	25,739	25,603	228,466

Table 7-58: Total Cost Estimated of MP2 (1,000US$)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Collection and Transport	19,498	20,069	20,030	20,273	20,516	21,488	21,281	21,166	20,974	185,295
Composting	0	0	70	143	226	305	390	479	570	2,184
Final Disposal	2,529	2,606	2,621	2,679	2,739	5,591	5,533	5,503	5,450	35,251
Administration 10%	2,203	2,268	2,272	2,310	2,348	2,738	2,720	2,715	2,699	22,273
Total	24,230	24,943	24,993	25,405	25,829	30,122	29,924	29,863	29,693	245,003

Table 7-59: Unit Cost Estimated of MP1 and MP2

Unit: US$/ton

Item	MP1	MP2
Collection and Transport	36.65	37.46
Composting	0.44	0.44
Final Disposal	4.89	7.13
Administration 10%	4.20	4.50
Total	46.19	49.53

7.6 MSWM Technical System Development Schedule

In order to achieve a 100% collection rate, procurement of 20yd3 compactor trucks for the urban area will commence in 2007 for both MP1 and MP2. In the case of MP2, a 1300 ton/day transfer station will operate from 2012. Meanwhile, 6yd3 compactor trucks will be procured from 2007 for the marginal area and operation of the existing transfer station will continue.

This Master Plan does not include a plan for final disposal. However, it recommends improving the current operation of Duquesa and supposes that a new landfill would operate from 2012 for MP2.

As for waste minimization, the environmental education on waste will commence in 2007. Recycling at supermarkets, colmados and schools will be implemented in 2009 as well as the composting targeting market and pruning waste.

The table below shows the MSWM Technical System Development Schedule of both the MP 1 and MP2.

Table 7-60: MSWM Technical System Development Schedule (MP1)

	Improvement	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
I	Collection and Transport										
1	Urban area										
11	Collection		Procurement of 20yd3 compactor trucks								
12	Transport		Direct transport								
3	Marginal area										
31	Collection		Procurement of 6yd3 compactor trucks								
32	Transport		Continuous operation of the existing 500 ton/day transfer station								
II	Final Disposal										
1	Duquesa		Improvement of the current operation								
III	Waste Minimization										
1	Generation control		Environmental education and collection service charge by weight/volume								
2	Discharge control				Recycling at supermarkets, colmados and schools						
3	Composting		Preparation		Operation						

Note: Preparation work for a composting plant would require a feasibility study, detailed design, construction and supervision. In addition, initial environment examination (IEE) and/or environmental impact assessment (EIA) would be included, if necessary.

Table 7-61: MSWM Technical System Development Schedule (MP2)

	Improvement	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
I	Collection and Transport										
1	Urban area										
11	Collection		Procurement of 20yd3 compactor trucks								
12	Transport					Preparation		Operation of 1300 ton/day transfer station, 85 m^3 trailer			
3	Marginal area										
31	Collection		Procurement of 6yd3 compactor trucks								
32	Transport		Continuous operation of the existing 500 ton/day transfer station								
II	Final Disposal										
1	Duquesa		Improvement of the current operation					Closure and post-closure care			
2.	New Landfill				Preparation			Operation			
III	Waste Minimization										
1	Generation control		Environmental education and collection service charge by weight/volume								
2	Discharge control				Recycling at supermarkets, colmados and schools						
3	Composting		Preparation		Operation						

Note: Preparation works for a 1300 ton/day transfer station; a new landfill and a composting plant will include feasibility studies, detailed design, construction and supervision. In addition, initial environment examination (IEE) and/or environmental impact assessment (EIA) would be included, if necessary.

7.7 Evaluation of the Master Plan

This Section presents the evaluation of the proposed Master Plan from the view of institutional and technical aspects, and the expected environmental and social impacts of the proposed actions. The evaluation will follow with an analysis of the financial viability and economic validity of the Master Plan. Using these evaluation results as measures for value judgment, the Master Plan will be subjected to an integral evaluation on the basis of the following criteria: relevance, effectiveness, efficiency, impact and sustainability.

7.7.1 Institutional Evaluation

a. Legal system

The Municipal Regulation for Urban Cleansing was proposed as the legal basis of the Master Plan. The contents of the Regulation include the existing legislation of the Dominican Republic, with special considerations for its application in the social system of Santo Domingo, National District. The Regulation also serves as a reference for other Municipalities. A clear indication of the acceptance of the Regulation by the National District society, and its appropriateness as guidelines, was given by its quick approval by the City Council and its enactment by the Mayor's Office before the end of the Study.

b. Organization

Whether or not the Master Plan is to be appropriately implemented having the Regulation as the legal basis, depends on the organization capacity of ADN. It has repeatedly occurred in the past that whenever the Mayor changed, the organization changed as well, along with all employees. As a result, knowledge and experience did not have the chance to accumulate in the ADN organization. Solid waste management is no exception. Accordingly, the Master Plan proposes coordinated action among Municipal Directorates related with solid waste management, strengthening of the executing office EMUCD, and the establishment of a municipal company which would be open to the citizen but would prevent unnecessary political interference in its management. These recommendations are understood by ADN as necessary measures for implementation of the Master Plan.

c. Public-private Partnership

Within ADN, one aspect of the capacity of the organization that should be developed refers to the public private partnership. Specifically, it refers to the capacity to plan the appropriate participation of the private sector in the collection service, the capacity to design the whole range of activities, and the capacity to manage and control the contracts, so that the contractor can demonstrate its abilities to fulfill the specified performance indicators. The Master Plan presents definitions of the collection service and the expected image of each service, indicating the design of the whole collection activities. Also, the Master Plan presents guidelines on bidding, like the order of bidding tasks, contents of the bidding, and contract auditing, as a set of activities for contract management. In this way, the Master Plan indicates the tools to develop the ADN capacity to effectively implement the public private partnership.

d. Financial Management

In order to provide a high quality solid waste service in a continued and stable way, it is necessary to secure the necessary income and use it effectively. For this purpose, the first step is the establishment of an accounting system to determine the cost structure of the solid waste management, followed by continued monitoring of the cost items and feedback for the operation improvement. At present, ADN is in the process of undertaking improvements in the budget control system, which are expected to result in more precise calculation of the

solid waste management cost. Furthermore, the Master Plan recommends the addition of an accounting system specific to solid waste management, if such a need is recognized. Proposed measures to increase the income from solid waste management include improving the accuracy of the number of billed customers, charging license fee and controlling more strictly the private companies providing service to large generators. On the other hand, measures recommended to reduce costs include the already mentioned improvement of cost estimation, continued monitoring of cost items, and re-negotiation of the commercial fees for billing and bill collection services. In addition, the use of subsidies is recommended for the residents of the city in the poverty group, while for those with the capacity to pay, the application of the Polluter Pays Principle is recommended as payment for the incurred cost. At present, three-fourths of the necessary SWM costs are financed by general financial resources, but the above measures are expected to reduce this percentage. This will mean improvements in the city finances, and it is expected to lead to the increasing sustainability of the solid waste management.

e. Citizens' Participation

The role of the citizens in solid waste management is great. The important roles expected of the citizens are: appropriate discharge necessary for achieving a high quality and efficient collection service, participation in waste minimization, and recognition of the solid waste service as a valuable service that deserves proper payments. The roles expected of the citizens can be duly performed only when the service provider disseminates the necessary information on a timely basis, and in a way that is easy to understand. The Master Plan indicates the items and methods of dissemination of the information on the collection service and waste minimization. These recommendations originated in the Pilot Project and are based on the lessons learned, whereby the probability of application and acceptance is high.

7.7.2 Technical Evaluation

a. Storage and Discharge

The reason why the city can look unclean can be found in the mismatch between storage/discharge and collection. There are no rules for storage containers, and nothing has been established for the collection service routes and frequency. As a result, solid waste stored in inadequate containers remains in the streets and public areas for a long time, where dogs, cats and scavengers have access, the waste id scattered by wind/rain, degrading the esthetics of the city and creating unsanitary conditions. The Master Plan recommends the appropriate storage and discharge methods by type of dischargers. These recommendations originated in the Pilot Project and are based on the lessons learned, whereby the probability of application and acceptance is high.

b. Collection and Transport

In the pursuit of a collection service market with order, the Master Plan divided the collection service into six categories, taking into account the road condition, quantity of waste discharged, and type of solid waste. It further indicates the types and quantities of equipment needed. These specific data indicate the image of the Master Plan achieving its goals. The types and quantities of equipment resulted from the time and motion survey, as well as the information and lessons learned in the Pilot Project, whereby the probability of application and acceptance is high.

Assuming that in the future the final disposal site would be constructed farther away, a study was conducted on the transfer and transport. Joint decision with the counterpart personnel assumed the new disposal site to be located 40km away, in which case the conclusion was that transfer and transport would be more economical. Therefore, the Master Plan includes a plan on transfer and transport. It can be said that the Master Plan includes a contingency plan

that gives flexibility to its implementation.

c. Public Area Cleansing

In the pursuit of efficient plan preparation and implementation in public area cleansing, the Master Plan includes such indicators as the lineal meters to be swept by a sweeper in one day and the necessary number of brooms and plastic bags. Further, the necessary number of sweepers and equipment are estimated, thereby making it easy to understand the overall image of public area cleansing.

d. Waste Minimization

In waste minimization, the differences and priorities are given for generation control, discharge control, resource recovery, followed by recommendations on environmental education, volumetric tariff, recycling based on the responsibility of large producers, and composting with the use of market waste and pruning waste. There is no plan for the construction of material recovery facilities, which presupposes separate collection. Rather, the recommendation takes into account the existing collection situation.

e. Final Disposal

The final disposal site is located in Santo Domingo Norte Municipality, out of the scope of this Study, whereby no plan has been formulated. However, measures are presented as action plans for the improvement of Duquesa, the existing final disposal site. Also, guidelines are presented for the event that a new final disposal site is needed, indicating in the corresponding action plan the measures needed for the selection of an appropriate site.

7.7.3 Environmental and Social Considerations

a. Esthetic and Hygiene Condition in the City

Waste scattered around the city degrades the esthetics and worsens the hygiene of the city. The Master Plan seeks to minimize the scattering of waste, thereby recovering the esthetics and improving hygiene conditions. Santo Domingo is a famous tourist destination, and the recovery and maintenance of the esthetics of the city should have very favorable effects on the tourist industry. Improved hygiene conditions are important for people's health, for instance limiting the incidences of dengue fever. The Master Plan is expected to have a true impact on the city esthetics and hygiene condition.

b. Income Disparity

Inequality is relatively high in the Dominican Republic as reflected by a Gini coefficient of 0.49 in 1992. The richest 20 percent of the population received about 57 percent of total income in 1992, while the poorest 20 percent received only 4.4 percent. The disparity might have worsened in the city where the vastly affluent people coexist with those in the poverty group.

The Master Plan takes due consideration of the economically weak, by recommending that those with the capacity to pay should do so with the application of the Polluter Pays Principle, while those without the capacity to pay should be beneficiaries of subsidy, so that all citizens can receive a basic public service like the solid waste service.

c. Waste-pickers

Waste-pickers are found on the streets and in the Duquesa landfill. Most of them are from outside of the metropolitan area, many from Haiti. They contribute to recycling however, they often damage the urban environment by scattering waste, and they hamper the operation

work at the Duquesa landfill. In addition, they expose themselves to health risks. Especially, contact with hazardous waste such as toxic and infectious waste is serious.

Neither one municipality nor a private company can solve this problem. Only the society can confront this issue. Although the Master Plan does not propose a concrete measure against this problem, it is expected that competent authorities will work together on this issue.

d. Impacts caused by the Proposed SWM Facilities

The Master Plan proposes the construction of a compost plant, and if necessary, a new final disposal site and new transfer station for transfer and transport. However, no specific sites have been chosen, and no construction and operation plans have been prepared. What was done in this Study was the Initial Environmental Evaluation, which indicated that some impacts may occur such as air pollution, water quality pollution, bad odor, and so on. Therefore, once the construction sites are defined, and construction and operation plans are prepared, an Environmental Impact Assessment is recommended, following the procedures established in the Dominican Republic. In the Contract for collection service, recommendations were made to include special provisions to prevent the leakage of leachate. It can be seen that the Master Plan has made efforts to include the necessary social and environmental considerations.

7.7.4 Financial Evaluation

Two versions of the Master Plan, MP1 and MP2, were formulated, depending on whether the Duquesa landfill would be used during the whole Master Plan period, or if a new final disposal site would become necessary before the end of the Master Plan period. This made it necessary to conduct financial analyses for each version of the Master Plan.

The financial evaluation of the Master Plan consists of the following three parts: justification of the Master Plan, analysis of the financial sustainability of the Master Plan, and the analysis of the affordability of the Master Plan cost from the viewpoint of households.

a. Justification of the SWM Master Plan

a.1 "With Master Plan" and "Without Master Plan"

Justification of the implementation of the SWM Master Plan was based on the analyses of the "with Master Plan" case and "without Master Plan" case, for both MP1 and MP2 versions. For this purpose, the cost of the relevant SWM Master Plan was analyzed vis-à-vis the cost of continuing with the existing SWM system. The latter consisted of the cost estimated according to the budget execution of 2005 plus the cost estimated to service large generators, which differed for MP1 and MP2, thereby resulting in two costs without the Master Plan. The added value was projected over the Master Plan period using the estimated economic growth rate and the population growth rate, because both, economic growth and population growth, have effects on SW generation. Yearly cost data during the 2007-2015 Master Plan Period are shown in Table 1 below.

Table 7-62: Financial Cost With & Without Master Plan

Year	Cost without MP1	Cost without MP2	Cost with MP1	Cost with MP2	Cost Differential MP1	Cost Differential MP2
	(Million US$)	(Million US$)	(Million US$)	(Million US$)	(Million US$)	(Million US$)
2007	19.52	19.52	24.23	24.23	-4.71	-4.71
2008	21.55	21.55	24.94	24.94	-3.39	-3.39
2009	23.65	23.65	25.00	25.00	-1.35	-1.35
2010	25.86	25.86	25.41	25.41	0.45	0.45
2011	28.15	28.15	25.83	25.83	2.32	2.33
2012	30.52	33.86	25.94	30.12	4.58	3.74
2013	32.95	39.77	25.78	29.92	7.17	9.85
2014	35.47	45.93	25.74	29.86	9.73	16.07
2015	38.03	52.28	25.60	29.69	12.43	22.59
Total	255.70	290.57	228.47	245.00	27.23	45.57
NPV (10%)					9.73	17.89

Table 1 above shows that the total costs over the Master Plan period would be lower for both MP1 and MP2 when compared with the cumulative cost of the existing SWM system. Also, Table 1 shows that the yearly cost of continuing with the existing SWM system would probably overtake the cost of both MP1 and MP2 around 2010.

In addition to the lower total costs with MP1 and MP2, the indicator computed to justify the implementation of the Master Plan was the net present value (NPV) discounted at 10% of the yearly stream of amounts resulting from the difference between the cost "with Master Plan" and the cost "without Master Plan". A summary is presented in Table 2 below.

Table 7-63: Financial Justification for the Implementation of the Master Plan

Cases	Master Plan 1 (Million US$)	Master Plan 2 (Million US$)
With Master Plan	228.47	245.00
Without Master Plan	255.70	290.57
NPV (10%)	9.73	17.89

The above Table 2 shows that the Master Plans, in both versions, are quite favorable to be implemented, as opposed to the "without Master Plan" case. The corresponding values of NPV in favor of the Master Plans were US$9.73 Million for MP1 and US$17.89 Million for MP2, both discounted at 10%.

Although difficult to quantify, due consideration should also be given to the huge environmental benefit resulting from enormous improvements in the SWM service quality. The quality of the SWM service would be vastly superior "with Master Plan" rather than "without Master Plan".

a.2 Financial Resources for Implementation of the Master Plan

The costs of the proposed Master Plan refer exclusively to the costs to be borne by ADN, although the initial stage of the M/P will require higher costs than what was spent in 2005 (the estimated M/P cost in 2007 is 24.2 million US$, meanwhile the cost spent in 2005 was 16.5 million US$, or 544 million RD$). In this regard, it is worth remembering the budget execution of ADN in 2005. The ADN budget in 2005 amounted to 1,924,697,048 RD$, while the execution amounted to 1,240,223,266 RD$, which was equivalent to 64.4% budget

execution. Then, the amount budgeted but not executed amounted to 684,473,782 RD$, or US$ 20, 741,630 at the exchange rate of 33 RD$ per US Dollar. This amount can be a financial resource for covering the additional cost of 7.7 million US$.

It is also worth remembering that nearly 80% of the ADN income relied on Law 166-03, which is scheduled to increase up to 12% of the Central Government income to be transferred back to municipalities according to the population of each municipality. Thus, it appears reasonable to consider that Law 166-03 is a safe source of income for ADN.

b. Analysis of the Financial Sustainability of the Master Plan

The financial sustainability of the Master Plans was analyzed on the basis of the potential SWM income and the cost of the relevant SWM Master Plan. Table 3 below shows a summary of the income estimation basis.

Table 7-64: SWM Income Estimation Basis

Income Sources	Income Calculation Basis	Bill Collection
SWM Service Users		
Residential		
Households	Tariff x Household Number (1)	90%
Business in Households	Cost/ton x Tonnage Generated	100%
Other Categories		
Large Generators	Cost/ton x Tonnage Generated	100%
Markets	Cost/ton x Tonnage Generated	100%
Special Service	Cost/ton x Tonnage Generated	100%
Subsidy	Gap between Income and Cost	

(1) Household number: population projection or billing; & Tariff distribution: POS or billing

Potential income sources were SWM service users classified as residential and other categories (large generators, markets, and special service), plus the subsidy from the Central Government.

The solid waste generated by residential users of the SWM service was assumed to consist, of equal proportions, of household or domestic solid waste, and solid waste generated by businesses operating in the households. The latter, that is, the solid waste generated by household businesses, was assumed to pay 100% of its cost on the basis of generated tonnage and the estimated cost per ton. The household contribution to SWM income was estimated using the existing fixed monthly tariff applied to the number of households in different income groups or socioeconomic strata, and assuming a 90% bill collection ratio. The distribution of the different tariff levels used, as reference, the results of the willingness to pay of households. The willingness to pay for the SW service was low, as indicated by the POS, and the income estimation reflected this situation. The low willingness to pay can be interpreted as a reflection of the low quality SW service provided at present, and is expected to increase as the quality of the SW service improves.

Variables in the estimation of income from households were the number of households, and the distribution of households into groups of income levels or socioeconomic strata. Scenarios or cases were set up to deal with these variables, because (1) the number of households varied depending on whether the population projection or the AAA billing data was used; and (2) the distribution of income groups or socioeconomic strata varied depending on whether the POS/Central Bank data or the AAA billing data were used. Although two sources of data were used, the number of households estimated from the population projection should be the relevant data to use, because SW generation was calculated on the

basis of per capita generation of the population projection.

Other categories of SWM service users were large generators, markets, and special service, which were assumed to pay 100% of the cost on the basis of generated tonnage and the estimated cost per ton.

There were six cases or scenarios of analyses, described as the following three for each version of the Master Plan.

Table 7-65: Summary of Cases for Financial analyses, MP1 & MP2

Case	Household Number	Socioeconomic Strata	Bill Collection
1	Population projection & average family size	POS & Central Bank data	90% over the MP period
2	Population projection & average family size	AAA billing data	90% over the MP period
3	AAA billing data	AAA billing data	90% over the MP period

All cases resulted in an income shortage, even under the optimum condition of using the number of households calculated from population projection data, and 90% bill collection ratio. This implies the need for other income sources, like a subsidy from the Central Government. Needless to say, less favorable conditions like using the number of households based on the billing by AAA resulted in larger income shortages, thereby requiring larger subsidies. Still, the required subsidy was less than the projection of the 2005 deficit amount (SW service expenditures minus SW income) during the Master Plan period. A summary of results is presented in the Table below, followed by a more detailed Table and discussion for each case.

Table 7-66: Summary of Analysis Results on Financial Sustainability of the Master Plan

Item	Unit	Case 1		Case 2		Case 3	
		MP1	MP2	MP1	MP2	MP1	MP2
Cost	Million US$	228.46	245.00	228.46	245.00	228.46	245.00
SWM service income	Million US$	149.83	150.54	162.11	162.83	125.60	126.31
Subsidy required	Million US$	78.64	94.46	66.35	82.18	102.87	118.69
Subsidy requirement without MP	Million US$	157.86	157.86	157.86	157.86	157.86	157.86
Reduced subsidy requirement	Million US$	79.22	63.38	91.50	75.69	54.98	39.16
SW Income/Cost	%	65.58%	61.44%	70.96%	66.46%	54.98%	51.56%
Subsidy/Cost	%	34.42%	38.56%	29.04%	33.54%	45.03%	48.44%

b.1 Case 1: Population Projection, POS Population Distribution, 90% Bill Collection

The number of households was calculated using data of population projection and the average family size, the distribution of households into different socioeconomic strata was made using data from POS and Central Bank, while bill collection was assumed to be 90% of billing over the entire Master Plan period.

b.1.1 Master Plan 1

Table 7-67: MP1 Case 1 Potential Income and Cost (Million US$)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	24.23	24.94	24.99	25.41	25.83	25.94	25.78	25.74	25.60	228.46
Income	24.24	24.95	24.99	25.40	25.83	25.94	25.78	25.75	25.59	228.47
Residential	13.97	13.89	14.35	14.55	14.74	14.83	14.85	14.91	14.93	131.02
Domestic	6.56	6.26	6.74	6.84	6.94	7.04	7.14	7.24	7.34	62.10
Business	7.41	7.63	7.61	7.71	7.80	7.79	7.71	7.67	7.59	68.92
Large generators	0.80	0.83	0.82	0.83	0.84	0.84	0.83	0.83	0.82	7.44
Markets	1.11	1.14	1.14	1.15	1.17	1.16	1.15	1.15	1.13	10.30
Special service	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	1.07
Subsidy	8.25	8.97	8.56	8.75	8.96	8.99	8.83	8.74	8.59	78.64
Households no ATP	0.86	0.87	0.88	0.89	0.91	0.92	0.93	0.95	0.96	8.17
Inc. differential	7.39	8.10	7.68	7.86	8.05	8.07	7.90	7.79	7.63	70.47
Projection 2005 deficit	13.91	14.76	15.63	16.54	17.47	18.42	19.38	20.37	21.38	157.86
Reduced subsidy	5.66	5.79	7.07	7.79	8.51	9.43	10.55	11.63	12.79	79.22

The above Table shows that even under favorable conditions, the potential income from Master Plan 1 would not be sufficient to cover the cost, or in other words, it would not be financially sustainable without supplementary income from subsidies. The required subsidy, to cover payments by households without the ATP and the income deficit with respect to cost, would fluctuate between 8 and 9 Million US$ per year, for a total of 78.64 Million US$ over the Master Plan period. Still, the required subsidy would be quite a bit lower than the projection of the 2005 income deficit in the SWM service, the reduced subsidy requirement fluctuating between 5.66 and 12.79 Million US$ per year, for a total of 79.22 Million US$, amount that ADN could devote to other uses.

If the potential income is realized, about two-thirds of the Master Plan cost would be paid for by the income to be derived from the SWM service, while about one-third of the Master Plan cost will have to come from subsidies. This is a considerable financial improvement over the existing SWM service, where income covers only between one-fourth and one-third of the SWM service cost.

b.1.2 Master Plan 2

Table 7-68: MP2 Case 1 Potential Income and Cost (Million US$)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	24.23	24.94	24.99	25.41	25.83	30.12	29.92	29.86	29.69	244.99
Income	24.23	24.96	24.99	25.40	25.83	30.12	29.92	29.88	29.69	245.02
Residential	14.04	13.97	14.43	14.63	14.82	14.91	14.93	14.99	15.01	131.73
Domestic	6.56	6.26	6.74	6.84	6.94	7.04	7.14	7.24	7.34	62.10
Business	7.48	7.71	7.69	7.79	7.88	7.87	7.79	7.75	7.67	69.63
Large generators	0.80	0.83	0.82	0.83	0.84	0.84	0.83	0.83	0.82	7.44
Markets	1.11	1.14	1.14	1.15	1.17	1.16	1.15	1.15	1.13	10.30
Special service	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	1.07
Subsidy	8.17	8.90	8.48	8.67	8.88	13.09	12.89	12.79	12.61	94.48
Households no ATP	0.86	0.87	0.88	0.89	0.91	0.92	0.93	0.95	0.96	8.17
Inc. differential	7.31	8.03	7.60	7.78	7.97	12.17	11.96	11.84	11.65	86.31
Projection 2005 deficit	13.91	14.76	15.63	16.54	17.47	18.42	19.38	20.37	21.38	157.86
Reduced subsidy	5.74	5.86	7.15	7.87	8.59	5.33	6.49	7.58	8.77	63.38

The above Table shows that even under favorable conditions, the potential income from Master Plan 2 would not be sufficient to cover the cost, or in other words, it would not be financially sustainable without supplementary income from subsidies. The required subsidy, to cover payments by households without the ATP and the income deficit with respect to cost, would fluctuate between 7.31 and 12.17 Million US$ per year, for a total of 86.31 Million US$ over the Master Plan period. The reduced subsidy requirement would fluctuate between 5.74 and 8.77 Million US$ per year, for a total of 63.38 Million US$, amount that ADN could devote to other uses.

If the potential income is realized, about 60% of the Master Plan cost would be paid for with the income to be derived from the SWM service, while about 40% of the Master Plan cost will have to come from subsidy. This is quite a financial improvement over the existing SWM service, where income covers only between one-fourth and one-third of the SWM service cost.

b.2 Case 2: Population Projection, AAA Population Distribution, 90% Bill Collection

The number of households was calculated using data of population projection and the average family size, the distribution of households into different socioeconomic strata was made using the AAA billing data, while bill collection was assumed to be 90% of billing over the entire Master Plan period.

b.2.1 Master Plan 1

Table 7-69: MP1 Case 2 Potential Income and Cost (Million US$)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	24.23	24.94	24.99	25.41	25.83	25.94	25.78	25.74	25.60	228.46
Income	24.23	24.96	24.99	25.40	25.84	25.93	25.77	25.75	25.60	228.47
Residential	15.24	15.34	15.66	15.88	16.09	16.19	16.23	16.31	16.36	143.30
Domestic	7.83	7.71	8.05	8.17	8.29	8.40	8.52	8.64	8.77	74.38
Business	7.41	7.63	7.61	7.71	7.80	7.79	7.71	7.67	7.59	68.92
Large generators	0.80	0.83	0.82	0.83	0.84	0.84	0.83	0.83	0.82	7.44
Markets	1.11	1.14	1.14	1.15	1.17	1.16	1.15	1.15	1.13	10.30
Special service	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	1.07
Subsidy	6.97	7.53	7.25	7.42	7.62	7.62	7.44	7.34	7.17	66.36
Households no ATP	0.86	0.87	0.88	0.89	0.91	0.92	0.93	0.95	0.96	8.17
Inc. differential	6.11	6.66	6.37	6.53	6.71	6.70	6.51	6.39	6.21	58.19
Projection 2005 deficit	13.91	14.76	15.63	16.54	17.47	18.42	19.38	20.37	21.38	157.86
Reduced subsidy	6.94	7.23	8.38	9.12	9.85	10.80	11.94	13.03	14.21	91.50

The above Table shows that even under favorable conditions, the potential income from Master Plan 1 would not be sufficient to cover the cost, or in other words, it would not be financially sustainable without supplementary income from subsidies. The required subsidy, to cover payments by households without the ATP and the income deficit with respect to cost, would fluctuate between 6.97 and 7.62 Million US$ per year, for a total of 66.36 Million US$ over the Master Plan period. The reduced subsidy requirement would fluctuate between 6.94 and 14.21 Million US$ per year, for a total of 91.50 Million US$, amount that ADN could devote to other uses.

If the potential income is realized, about 70% of the Master Plan cost would be paid for with the income to be derived from the SWM service, while about 30% of the Master Plan cost will have to come from subsidies. This is quite a financial improvement over the existing SWM service, where income covers only between one-fourth and one-third of the SWM service cost.

b.2.2 Master Plan 2

Table 7-70: MP2 Case 2 Potential Income and Cost (Million US$)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	24.23	24.94	24.99	25.41	25.83	30.12	29.92	29.86	29.69	244.99
Income	24.23	24.96	24.99	25.40	25.83	30.11	29.91	29.87	29.69	244.99
Residential	15.31	15.42	15.74	15.96	16.17	16.27	16.31	16.39	16.44	144.01
Domestic	7.83	7.71	8.05	8.17	8.29	8.40	8.52	8.64	8.77	74.38
Business	7.48	7.71	7.69	7.79	7.88	7.87	7.79	7.75	7.67	69.63
Large generators	0.80	0.83	0.82	0.83	0.84	0.84	0.83	0.83	0.82	7.44
Markets	1.11	1.14	1.14	1.15	1.17	1.16	1.15	1.15	1.13	10.30
Special service	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	1.07
Subsidy	6.90	7.45	7.17	7.34	7.53	11.72	11.50	11.38	11.18	82.17
Households no ATP	0.86	0.87	0.88	0.89	0.91	0.92	0.93	0.95	0.96	8.17
Inc. differential	6.04	6.58	6.29	6.45	6.62	10.80	10.57	10.43	10.22	74.00
Projection 2005 deficit	13.91	14.76	15.63	16.54	17.47	18.42	19.38	20.37	21.38	157.86
Reduced subsidy	7.01	7.31	8.46	9.20	9.94	6.70	7.88	8.99	10.20	75.69

The above Table shows that even under favorable conditions, the potential income from Master Plan 2 would not be sufficient to cover the cost, or in other words, it would not be financially sustainable without supplementary income from subsidies. The required subsidy, to cover payments by households without the ATP and the income deficit with respect to cost, would fluctuate between 6.90 and 11.72 Million US$ per year, for a total of 82.17 Million US$ over the Master Plan period. The reduced subsidy requirement would fluctuate between 7.01 and 10.20 Million US$ per year, for a total of 75.69 Million US$, amount that ADN could devote to other uses.

If the potential income is realized, about two-thirds of the Master Plan cost would be paid for with the income to be derived from the SWM service, while about one-third of the Master Plan cost will have to come from subsidies. This is quite a financial improvement over the existing SWM service, where income covers only between one-fourth and one-third of the SWM service cost.

b.3 Case 3: AAA Billing Number, AAA Population Distribution, 90% Bill Collection

The number of households was calculated using the AAA billing data, the distribution of households into different socioeconomic strata was made also using the AAA billing data, while bill collection was assumed to be 90% of billing over the entire Master Plan period.

b.3.1 Master Plan 1

Table 7-71: MP1 Case 3 Potential Income and Cost (Million US$)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	24.23	24.94	24.99	25.41	25.83	25.94	25.78	25.74	25.60	228.46
Income	24.24	24.95	24.99	25.41	25.83	25.94	25.78	25.75	25.59	228.48
Residential	11.40	11.55	11.71	11.87	12.02	12.07	12.05	12.07	12.05	106.79
Domestic	3.99	3.92	4.10	4.16	4.22	4.28	4.34	4.40	4.46	37.87
Business	7.41	7.63	7.61	7.71	7.80	7.79	7.71	7.67	7.59	68.92
Large generators	0.80	0.83	0.82	0.83	0.84	0.84	0.83	0.83	0.82	7.44
Markets	1.11	1.14	1.14	1.15	1.17	1.16	1.15	1.15	1.13	10.30
Special service	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	1.07
Subsidy	10.82	11.31	11.20	11.44	11.68	11.75	11.63	11.58	11.47	102.88
Households no ATP	0.44	0.44	0.45	0.46	0.46	0.47	0.48	0.48	0.49	4.17
Inc. differential	10.38	10.87	10.75	10.98	11.22	11.28	11.15	11.10	10.98	98.71
Projection 2005 deficit	13.91	14.76	15.63	16.54	17.47	18.42	19.38	20.37	21.38	157.86
Reduced subsidy	3.09	3.45	4.43	5.10	5.79	6.67	7.75	8.79	9.91	54.98

The above Table shows that even under favorable conditions, the potential income from Master Plan 1 would not be sufficient to cover the cost, or in other words, it would not be financially sustainable without supplementary income from subsidies. The required subsidy, to cover payments by households without the ATP and the income deficit with respect to cost, would fluctuate between 10.82 and 11.75 Million US$ per year, for a total of 102.88 Million US$ over the Master Plan period. The reduced subsidy requirement would fluctuate between 3.09 and 9.91 Million US$ per year, for a total of 54.98 Million US$, amount that ADN could devote to other uses.

If the potential income is realized, about 55% of the Master Plan cost would be paid for with the income to be derived from the SWM service, while about 45% of the Master Plan cost will have to come from subsidies. This is still quite a financial improvement over the existing SWM service, where income covers only between one-fourth and one-third of the SWM service cost.

b.3.2 Master Plan 2

Table 7-72: MP2 Case 3 Potential Income and Cost (Million US$)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	24.23	24.94	24.99	25.41	25.83	30.12	29.92	29.86	29.69	244.99
Income	24.23	24.95	24.99	25.41	25.83	30.12	29.92	29.87	29.69	245.01
Residential	11.47	11.63	11.79	11.95	12.10	12.15	12.13	12.15	12.13	107.50
Domestic	3.99	3.92	4.10	4.16	4.22	4.28	4.34	4.40	4.46	37.87
Business	7.48	7.71	7.69	7.79	7.88	7.87	7.79	7.75	7.67	69.63
Large generators	0.80	0.83	0.82	0.83	0.84	0.84	0.83	0.83	0.82	7.44
Markets	1.11	1.14	1.14	1.15	1.17	1.16	1.15	1.15	1.13	10.30
Special service	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	1.07
Subsidy	10.74	11.23	11.12	11.36	11.60	15.85	15.69	15.62	15.49	118.70
Households no ATP	0.44	0.44	0.45	0.46	0.46	0.47	0.48	0.48	0.49	4.17
Inc. differential	10.30	10.79	10.67	10.90	11.14	15.38	15.21	15.14	15.00	114.53
Projection 2005 deficit	13.91	14.76	15.63	16.54	17.47	18.42	19.38	20.37	21.38	157.86
Reduced subsidy	3.17	3.53	4.51	5.18	5.87	2.57	3.69	4.75	5.89	39.16

The above Table shows that even under favorable conditions, the potential income from Master Plan 2 would not be sufficient to cover the cost, or in other words, it would not be financially sustainable without supplementary income from subsidies. The required subsidy, to cover payments by households without the ATP and the income deficit with respect to cost, would fluctuate between 10.74 and 15.85 Million US$ per year, for a total of 118.70 Million US$ over the Master Plan period. The reduced subsidy requirement would fluctuate between 3.17 and 5.87 Million US$ per year, for a total of 39.16 Million US$, amount that ADN could devote to other uses.

If the potential income is realized, about 52% of the Master Plan cost would be paid for with the income to be derived from the SWM service, while about 48% of the Master Plan cost will have to come from subsidies. This is still quite a financial improvement over the existing SWM service, where income covers only between one-fourth and one-third of the SWM service cost.

c. Analysis of the Affordability of the Master Plan for the Households

The analysis of the affordability of the Master Plan for the beneficiary households usually consists of a comparison between the household income and the cost burden that the Master Plan would impose on the households. More specifically, the cost corresponding to the tonnage of domestic solid waste was divided by the number of households in order to estimate the cost burden of SWM on each household. This burden of the SWM cost on each household was compared with the “ability to pay” of households for the SWM service, which was defined as 1.7% of the household income, according to recommendations of international aid agencies like the World Bank.

Preparations were made during the early stages of the Study to base this affordability analysis on the ability to pay, which would be calculated according to the household income levels and the tariff categories. Unfortunately, data limitations permitted this affordability analysis mainly on the basis of the overall average of household income, as explained below.

c.1 Estimation of Household Income

A very serious problem was the absence of an updated household income and expenditures survey, which is the usual source of the data needed for such an analysis. As was already mentioned elsewhere, the latest household income and expenditures survey in the Dominican Republic was conducted in 1997-1998.

Another source of information for the estimation of household income was the statistics from the Central Bank, published as "Mercado de Trabajo", or "Labor Market". The latest year of data availability for the National District was 2002.

A third potential source of household income data was the Public Opinion Survey (POS) conducted by the Study.

c.1.1 Household income as per the household survey ENGIH

Despite being a little outdated, the extensive survey contained a wealth of information. The survey defined household income as the sum of monetary and non-monetary income received by members of the household as wages, rents, and current transfers from other economic agents, except social transfers from the government. A very important current transfer would be the remittances from family members working abroad, the United States, Spain, and so on. These remittances are known to have definite incidence on the income distribution and consumption capacity of households in the Dominican Republic. The survey estimated the household income in the National District in 1998 at 14,226 RD$, of which 40.2% as income from wages.

The household income indicated by the survey for 1998 was projected according to the economic growth rates, using historical data up to 2004, while the projected growth rates estimated as the planning framework of the Master Plan were used for the remaining years. This projection resulted in an estimated monthly household income of 17,982 RD$ in 2002, the latest year for which the Central Bank data on labor market was available for the National District.

c.1.2 Household income as per Labor Market data from the Central Bank

The Labor Market publication from the Central Bank referred to income from wages, as the data was based on the hours worked per week and the hourly wage by decile in 2002. The result was a monthly average income of 7,483 RD$, as shown in the following Table.

Table 7-73: Estimated Wage Income in 2002

Decile	Employed Population	Hourly Wages (RD$)	Weekly Working Hours Hours	Weekly Income (RD$)	Monthly Income (RD$)
1	109,395	8.18	46.85	383.23	1,642.43
2	109,395	12.73	46.71	594.62	2,548.36
3	109,395	16.29	45.65	743.64	3,187.02
4	109,395	19.56	44.09	862.40	3,696.00
5	109,395	23.69	42.81	1,014.17	4,346.44
6	109,395	28.91	43.41	1,254.98	5,378.50
7	109,395	35.71	41.76	1,491.25	6,391.07
8	109,395	45.67	41.27	1,884.80	8,077.72
9	109,395	64.39	40.08	2,580.75	11,060.36
10	109,395	149.99	38.33	5,749.12	24,639.07
Total	1,093,950	40.51	43.10	1,745.98	7,482.78

Source: Mercado de Trabajo, Banco Central

The average wage income was considered as the wage income of the individual at the head of the household. Then, the household income was estimated using the ENGIH household survey data, which indicated that 40.2% of household income consisted of wage income. The result was a monthly household income of 18,614 RD$ in 2002, quite similar to the 17,982 RD$ obtained by the 2002 projection of the 1998 household income, using the historical economic growth rates.

c.1.3 Household income as per POS

The average monthly income of 8,000 RD$ in 2005, indicated as a POS result, coincided with the 2002 Central Bank's Labor Market data projected for 2005 using the historical economic growth rates. Therefore, it was interpreted to be the income of an individual worker, not household income.

c.2 Estimation of Household Ability to Pay

The table below summarizes the above considerations, showing the average monthly amount that households may find affordable to pay for the SWM service. Ideally, this analysis should be done for each income level or socioeconomic stratum corresponding to the categories of tariffs applied, but unfortunately insufficient data prevented this type of detailed analysis.

The basis for the analysis was the household income determined by the ENGIH household survey of 1998, which was projected to 2002 using the economic growth rates, and resulted in 17,982 RD$. As explained above, the household income estimated with this method was slightly lower than the 2002 household income estimated from the Labor Market data published by the Central Bank, and resulted in 18,614 RD$. The smaller value of the two estimates was chosen in order to be on the conservative side of the estimated ATP.

Table 7-74: Monthly Household Income and Ability to Pay

Year	Average Monthly Income (RD$)			Ability to Pay (RD$)	
	Economic Growth	Individual (Central Bank)	Household (ENGIH Projection)	Individual (Central Bank)	Household (ENGIH Projection)
2002	1.043	7,483	17,982		
2003	0.996	7,453	17,910		
2004	1.020	7,602	18,268		
2005	1.055	8,020	19,273		
2006	1.055	8,461	20,333		
2007	1.048	8,868	21,309	151	362
2008	1.047	9,284	22,311	158	379
2009	1.045	9,702	23,315	165	396
2010	1.044	10,129	24,340	172	414
2011	1.042	10,554	25,363	179	431
2012	1.040	10,977	26,377	187	448
2013	1.039	11,405	27,406	194	466
2014	1.037	11,827	28,420	201	483
2015	1.035	12,241	29,415	208	500

Source: Mercado de Trabajo, Banco Central, ENGIH

The Table above shows that the ability to pay of households would be around 362 RD$ per month in 2007, going up to around 500 RD$ in 2015. As was already mentioned elsewhere, the rather high unemployment and underemployment rates that were observed would have the effect of reducing the ability to pay of the citizens.

c.3 Estimation of the Cost Burden of the Master Plan on Households

The cost burden of the Master Plan on households equals the cost corresponding to the tonnage of domestic solid waste divided by the number of households. This cost burden of the Master Plan showed a large variation depending on the source of the number of households: population projection or the AAA billing data. However, as the SW generation per capita was calculated using the population projection data, this is the data that should take precedence. In addition, it is the number toward which the commercial activity of bill collection should move, in the search to achieve financial improvements in the SWM.

Table 7-75: MP Cost Burden and Ability to Pay of Households

Year	Monthly Cost Burden on Households (RD$)				Ability to Pay (RD$)	
	MP1		MP2		Individual (Central Bank)	Household (ENGIH)
	Population Projection	AAA	Population Projection	AAA		
2007	167	327	167	327	151	362
2008	169	332	169	332	158	379
2009	166	327	166	327	165	396
2010	166	326	166	326	172	414
2011	166	325	166	325	179	431
2012	163	320	172	337	187	448
2013	159	312	167	329	194	466
2014	156	306	164	323	201	483
2015	152	299	160	315	208	500

c.4 Conclusion on the Affordability of the Master Plan

According to the above Table, the Master Plan appears to be affordable, as households appear to have the ability to pay the cost burden of the Master Plan. However, this is valid only as long as the overall average of household income is taken into account. AAA billing data indicates that the population distribution of the National District into income levels or socioeconomic strata is bimodal, with heavy concentration on the top and bottom income groups. Then, the overall average can mask the weaknesses of the low income households to shoulder the cost of the Master Plan, and there might be a need for some kind of continued assistance in the form of subsidy to this group.

Another point of extreme importance is the fact that the amounts indicated in the ability to pay of the users of the SWM service will have a chance to become reality only when the solid waste service is provided at the entire satisfaction of the service users, and becomes accepted as a stable and dependable service of high quality. This acceptance will require some time to set in among the SW service users. As clearly stated elsewhere, the National District citizens do not know what a high quality SW service is, whereby their willingness to pay for the service is quite low, as a reflection of the situation.

Finally, unemployment and underemployment, which were observed as being rather high, would have significant effects in depressing the ability to pay of the citizens, thereby, affecting the affordability of the Master Plan. Statistical data for the country indicate historical unemployment rates hovering around 16%.

7.7.5 Economic Evaluation

The economic evaluation of the Master Plan followed the same procedure as the Justification of the Master Plan in the Financial Evaluation. For this purpose, the cost of the relevant SWM Master Plan was analyzed vis-à-vis the cost of continuing with the existing SWM system. In other words, an analytical comparison was made between the situation "with Master Plan" and "without Master Plan". The significant difference was the use of "economic prices" rather than the "market or financial prices" used in the financial evaluation.

a. Economic Prices

For the "with Master Plan" situation, the costs of both Master Plans were estimated in economic prices. For this purpose, the so called transfer payments like interests and taxes were subtracted from the financial or market prices.

Likewise, for the "without Master Plan" situation, financial expenditures incurred by ADN in 2005 were prorated and subtracted from the estimated cost of SWM, which became the initial cost that was projected using the assumed economic and population growth rates during the Master Plan period.

The resulting costs in economic prices are indicated in the Table below.

Table 7-76: Economic Cost With & Without Master Plan

Year	Cost without MP1	Cost without MP2	Cost with MP1	Cost with MP2	Cost Differential MP1	Cost Differential MP2
	(Million US$)	(Million US$)	(Million US$)	(Million US$)	(Million US$)	(Million US$)
tial						
2007	19.02	19.02	18.36	18.36	0.66	0.66
2008	20.73	20.73	18.90	18.90	1.83	1.83
2009	22.51	22.51	18.99	18.99	3.51	3.51
2010	24.37	24.37	19.37	19.37	5.01	5.01
2011	26.31	26.31	19.75	19.75	6.55	6.55
2012	28.29	31.46	19.92	23.64	8.38	7.82
2013	30.32	36.79	19.86	23.54	10.47	13.24
2014	32.43	42.34	19.89	23.56	12.54	18.78
2015	34.57	48.07	19.85	23.50	14.72	24.57
Total	238.55	271.59	174.88	189.61	63.67	81.98
NPV (10%)					34.44	42.63

Table 15 above shows that the total costs, measured in economic prices, over the Master Plan period would be lower for both MP1 and MP2, when compared with the cumulative cost of the existing SWM system, also expressed in economic prices. In addition, Table 15 shows that the yearly cost of continuing with the existing SWM system would be higher than the cost of both MP1 and MP2 during the whole Master Plan period, when the costs are measured in economic prices.

b. Economic Evaluation Results

In addition to the lower total costs with MP1 and MP2, the indicator computed to justify the implementation of the Master Plan was the net present value (NPV) discounted at 10% of the yearly stream of amounts resulting from the difference between the cost "with Master Plan" and the cost "without Master Plan". A summary is presented in Table 16 below.

Table 7-77: Economic Justification for the Implementation of the Master Plan

Cases	Master Plan 1 (Million US$)	Master Plan 2 (Million US$)
With Master Plan	174.88	189.61
Without Master Plan	238.55	271.59
NPV (10%)	34.44	42.63

Table 16 above shows that the Master Plans, when measured in economic prices, are even more favorable to be implemented than when financial prices are used. The corresponding values of NPV in favor of the Master Plans were US$34.44 Million for MP1 and US$42.63 Million for MP2, both discounted at 10%. The higher NPV when economic prices are used indicates a higher value of the Master Plan to the society as a whole, rather than to the implementing agency. This increased value of the Master Plans to the society can be considered to reflect the huge environmental benefits resulting from enormous improvements in the SWM service quality, and hence, improvements in the environmental quality. The quality of the SWM service would be vastly superior "with Master Plan" than "without Master Plan", and this would have huge impacts on public health.

c. Additional Measures of Economic Benefits

Generally speaking, the willingness to pay (WTP) reflects the environmental benefits stemming from appropriate SWM that spread over the whole society. Hence, it is the type of benefits to be taken into account in the economic evaluation. It should be pointed out, however, that the relevant WTP should be the answer of the respondents who can clearly understand and visualize the improvements that are to take place after the Master Plan implementation. Unfortunately, given the low quality SWM service provided at present, the respondents to the POS had no way of visualizing the improved SWM resulting from the Master Plan implementation.

The WTP indicated in the POS was an expression of a household or a family. This monthly WTP can be converted into WTP per ton using the data on average family size and daily per capita generation of SW. Once the WTP per ton is determined, the economic benefit can be quantified on the basis of the estimated tonnage of SW over the Master Plan period.

In the absence of relevant WTP data, an exercise can be made, based on the ability to pay (ATP) of households, which was estimated at 362 RD$ per month. There will always be a gap between the WTP and the ATP, but let the assumption be that, as a result of the improvements in the SWM quality, the WTP approaches half of the ATP, that is, 181 RD$ per month. Then, in combination with other data such as the average family size of 4.28, and the SW generation per capita per day of 750 grams, the benefits in terms of the WTP can be quantified to be equal to US$56.18 per ton according to the following calculation. To the extent that this WTP per ton exceeds the cost per ton of SWM, the economic benefits of the Master Plan are positive.

Table 7-78: WTP per ton

WTP/month (assumed)	RD$	181.00
WTP/month (assumed	US$	5.48
Household size	Persons	4.28
WTP per person per month	US$	1.28
WTP per person per year	US$	15.38
SW generation/capita/day	kg	0.75
SW generation/capita/year	ton	0.27
WTP/ton	US$	56.18

7.7.6 Overall Evaluation

a. Relevance

It seems reasonable that the M/P gives the most priority to improvement of the collection service taking into account the disfigurement of the city due to scattered waste. ADN's vision on the MSWM is "Clean City (Ciudad Limpia)." The M/P gives a direction to realize the vision. The M/P meets with the ADN's policy.

The M/P recommends collaborating with the private sector to improve the collection service and offers measures of contract management to do so. This approach is considered appropriate taking into account that most of the collection service is conducted by the private sector at present.

The "With M/P" has an advantage over the "Without M/P" in both cases, financial and economic evaluation. In the financial evaluation, calculation of Net Present Value at 10% discount rate resulted in that the "w/ M/P" exceeded the "w/o M/P" by 9.73 million US$ in case of MP1 and by 17.89 million US$ in case of MP2. Likewise, in the economic evaluation, the "w/ M/P" exceeded the "w/o MP" by 34.44 million US$ in case of MP1 and by 42.63 million US$ in case of MP2.

The overall income average of household income appears to be able to pay for the M/P cost. However, the income disparity in the study area is huge. The population is divided into two groups in principle, i.e., the high income and the low income. The low income people do not enough capacity to bear the cost of the M/P. Therefore, it requires use of the subsidy for the shortfall as in the past.

Although the M/P requires subsidies, its implementation will cut dependence on subsidies and will make it possible to divert a part of it to other public services. Also, the MSW service is one of basic public services. It should be socially allowed to use the subsidies for the poor.

b. Effectiveness

It can be said that the M/P is effective for improving the esthetic and sanitary environment, as it will directly approach the problems by introducing a good quality collection service.

As for minimization, the M/P recommends giving priority to environmental education. It may not bring immediate results. However, it is indispensable to foster an awareness of minimization so the society can accept the following effective measures such as recycling and composting.

c. Efficiency

The cost of the "w/o M/P" exceeds that of the "w/ M/P", although the "w/o M/P" will not improve the quality of the MSW service. Therefore, it can be said that "w/ M/P" is efficient compared with the "w/o M/P" as the former will bring the results with less cost.

d. Impact

There are a lot of municipalities that have as same problems regarding the MSWM as ADN. The M/P must be a good reference for them. Actually, the municipalities of the Santo Domingo Metropolitan have approached ADN to ask for support for their MSWM. Such communication would result in improvement of the collection service in those municipalities and lead to consensus building for improvement of the current operation in Duquesa and for construction of a regional landfill.

Improvement of sanitary condition brought by implementation of the M/P will contribute to

the physical and mental well-being of the citizens. In the study area, dengue fever is often spread and this may be alleviated.

e. Sustainability

The Municipal Regulation as a legal infrastructure and subsidies as a stable financial resource assure the sustainability of the M/P. In order to further guarantee sustainability, ADN has to strengthen its day to day capacity to take the initiative in the Public-private Partnership and communication with the citizens. A specific technical cooperation at the initial stage of the M/P may be effective to support to such capacity strengthening, although the M/P proposes various measures to do so.

Chapter 8

Recommendations for Disaster Waste

8 Recommendations for Disaster Waste

8.1 Immediate Action Plan

a. Outline

The damage, caused by the last hurricanes in the area of the Caribbean and the Gulf of Mexico, alert the necessity of proceeding to mitigate the fall of trees, especially, exotic species not adapted to the climate. Under appropriate conditions, native and endemic species usually resist the impacts of the natural phenomena. Also, they require less maintenance necessities.

With the purpose of mitigating the damage that could occur in the National District, the following Immediate Action Plan is proposed, which has been prepared with active participation of the Prevention and Vulnerability Reduction Department, Strategic Plan Office - Santo Domingo 2015 and the Santo Domingo Green Program Office of the Environmental Management and Urban Cleansing Directorate.

Table 8-1: Immediate Action Plan for Disaster Waste

<table>
<tr><td colspan="2">Plan to minimize the possible damage before the emergency (mitigation)</td></tr>
<tr><td colspan="2">Species Selection
Select native and endemic species that resist the hurricane winds verifying in the Botanical Garden.</td></tr>
<tr><td>The behavior of the trees and palms can be divided in the following categories:
• trees that fall with ease (trees introduced with superficial roots and/or with compact top that offers high resistance to the wind (e.g. laurel, ficus retusa, casuarina, casuarina equisetifolia, yellow acacia, cassia siamea, and other similar ones)
• trees of any species, not well pruned and/or with structural flaws and/or transplanted and with insufficient roots that facilitate their fall
• trees that shed their leaves easily and after hurricane sprouts of the trunk. (e.g. Creole oak, catalpa longissima, yagrumo, cecropia peltata, and other similar ones)
• native trees that resist wind maintaining their foliage and branches (e.g. beach grape, mahogany, samán and other similar ones)
• palms that don't fall over and only lose their foliage; their fruits resist the winds assuring the sustenance of the birds after the hurricane.
Most of the tree-planting in the city corresponds to the first two categories. Although now preference is giving to the native species, resistant to the strong winds, is difficult to find in the nurseries trees of good quality.</td><td>Immediate actions
Select the species according to the following approaches:
• species resistant to hurricane winds
• trees of the appropriate size for the space available
• trees of good quality
• produce the appropriate trees that are not in the market (nurseries)</td></tr>
<tr><td colspan="2">Planting Methodology
Large trees should be placed in a location that allows the roots to sufficiently anchor and be sustained; they are preferably isles without pavement and the continuous green fringes with a minimum width of 1.20 meters.</td></tr>
<tr><td>The following practices are inadequate for planting and can cause/facilitate the fall of the trees:
• large trees with roots confined to a narrow space (green narrow fringes, individual spaces "tree pits" of insufficient dimensions)
• planting of trees transplanted (during the transplant the root that later on is developed superficially and with smaller strength that don't hold well the tree is cut)</td><td>Immediate actions
• Plant young trees grown from seeds
• Plant trees with healthy roots
• The planting of high trees and/or alone very developed roots only should be allowed in places with enough space for its growth.
• In places of reduced spaces palms or small trees will be planted.</td></tr>
</table>

<table>
<tr><td colspan="2">Tree-planting Maintenance
With appropriate maintenance, strong and well balanced structures can be achieved. Trees of good quality and formation pruning in the first years are essential for the development of a structure resistant to damage due to hurricane winds.</td></tr>
<tr><td>The following are the most common structural flaws:
• multiple shafts
• bark included between branches and trunks
• top too high and very high shaft
• vigorous sprout weakly linked to the trunk
• dominant branches not well spaced vertically
• unbalanced top caused by a not well executed pruning (common to eliminate conflicts with wired air)
• branches linked to the trunk with weak angles
• branches that intersect
• branches that grow toward inside
• top very dense</td><td>Immediate actions
• Qualify personnel for pruning of species with botanical approaches.
• Inventory trees in the N.D. that for their location, age or symbolism, cover them of patrimonial character.
• Buy only small trees of high quality that need very little structural pruning
• Begin structural pruning in the first years
• Identify structural problems in the biggest trees and intervene with corrective pruning
• Execute the cleaning of the treetop regularly to reduce the resistance of the foliage to the wind
• Have an up-to-date database with the information on the condition, age and distribution of the species with the purpose of planning the planting, watering, prunes and cutting.
• Program the substitution of trees not adequate in a planned, gradual and regular process of substitution and planting; should begin on the roads that lead to the hospital centers and other strategic facilities for the operation of the city in emergency cases..</td></tr>
<tr><td colspan="2">Plan the management of the situation after the hurricane
The following are the outstanding aspects in the ADN that should be considered to face an emergency situation
• Organizational and functional structures
• Name of the person in charge, telephone and address
• Place of the control position and communications system
• Map pointing out the routes that should be clear according to their priority
• List of the personnel selected and previously trained to assist the emergency
• List of the team to assist the emergency, location, situation and availability
• List of the private resources previously committed to assist the emergency</td></tr>
<tr><td colspan="2">Recovery of the demolished trees
• Recover only trees of high value since the roots are not well developed and they can constitute a danger in the event of a new hurricane.
• Have the heavy equipment to mobilize trees of great size
• Appropriate manage post rising to facilitate the rooting: prunes, watering and fertilization
• Special attention requires trees considered patrimonial.</td></tr>
<tr><td colspan="2">Elimination of the waste
• Determine the storing place of the trees that are collected
• Collect the trees quickly to facilitate the traffic and prevent fires and plagues.
• Take advantage of the usable wood with the help of a mobile sawmill
• Preserve the pieces to be able to saw them later on through the flotation in water, keep them humid using a watering system or use chemical preservatives.
• Eliminate the unusable wood.</td></tr>
</table>

b. Spaces to Give Attention

There are spaces that are important in the case of emergencies such as access to healthcare centers.

Table 8-2: Access to Healthcare Centers

LIST OF THE PUBLIC HOSPITAL CENTERS IN THE N.D.		
Health Center	Road of main access	Prevail Species
HOSPITAL CENTRAL DE LAS FFAA	AVE. ORTEGA Y GASSET	YELLOW ACACIA
HOSPITAL GENERAL PLAZA DE LA SALUD	AVE. ORTEGA Y GASSET	YELLOW ACACIA
HOSPITAL SALVADOR B. GAUTIER	C/ PEDRO LIVIO CEDEÑO	YELLOW ACACIA JAVILLA EXTRANJERA
HOSPITAL INFANTIL SANTO SOCORRO	C/ 28 (ENS. LA FE)	YELLOW ACACIA JAVILLA EXTRANJERA
HOSPITAL DEL BILLETERO	C/ 14 (VILLA CONSUELO)	JAVILLA AMERICANA
HOSPITAL LUIS E. AYBAR	C/ FEDERICO VELASQUEZ ESQ. C/ FEDERICO BERMUDEZ	YELLOW ACACIA JAVILLA EXTRANJERA
UNIDAD DE QUEMADOS		
CENTRO DE GASTROENTEROLOGIA	C/FEDERICO BERMUDEZ ESQ. C/OSVALDO BAZIL	
INSTITUTO DOMINICANO DE DERMATOLOGIA	C/ ALBERT THOMAS	YELLOW ACACIA JAVILLA EXTRANJERA
HOSPITAL DR. FRANCISCO MOSCOSO PUELLO (MORGAN)	AVE. NICOLAS DE OVANDO	
MATERNIDAD NUESTRA SRA. DE LA ALTAGRACIA	AVE. PEDRO HENRIQUEZ UREÑA – AVE. MEXICO	YELLOW ACACIA JAVILLA EXTRANJERA PALMS ¿
HOSPITAL PADRE. BILLINI	C/ SANTOME	NO TREE-PLANTING
HOSPITAL DE LA MUJER	AVE. BOLIVAR	
HOSPITAL INFANTIL DR. ROBERT REID CABRAL	AVE. ABRAHAM LINCOLN	JAVILLA EXTRANJERA
INSTITUTO DE LA DIABETES (INDEN)	C/ PASEO DEL YAQUE (LOS RIOS)	SEVERAL BUSHES
INSTITUTO DOMINICANO DE CARDIOLOGIA	C/ MAGUEY (LOS RIOS)	SEVERAL BUSHES
INSTITUTO ONCOLOGICO DR. HERIBERTO PIETER	C/ CORREA Y CIDRON (ZONA UNIVERSITARIA)	SEVERAL BUSHES

The prevalent species in all the cases are yellow acacia (Cassia siamea) and javilla extranjera (Aleurites fordii). Their substitution will depend in each case of the available space in the public space for the planting, the presence or nonexistence on wired air and the verification of pipes or wired buried of public infrastructures.

Table 8-3: Recommendable Species

	FOR SPACES OF SMALLER PLANTING OF 1.00M X 1.00M + WIRED	FOR SPACES OF PLANTING OF 1.00M TO 2.OOM	FOR SPACES OF PLANTING OVER THE 2.OOM
SPECIES RECOMMENDED	MANGLE BOTON	MANGLE BOTON	MAHOGANY
	AVELLANO CRIOLLO	AVELLANO CRIOLLO	ALMACIGO
	CAYMONI	FRIJOLITO	MARA
	CABRITA	PENDA	

Source: Lic. Mariana Zsabo EMUCD

Other centers of strategic attendance for the city include: the Municipal Palace of the Center of the Heroes, the General Barracks of Firemen and the Firemen Stations, the Transfer Station of Villas Agrícolas, the facilities of the Emergencies National Commission and the Cruz Roja Dominicana.

Special attention should be paid to roads with access to the main provisional housings in the north area of the N.D. (Ave. Nicolás of Ovando, Ave. The Ríos-Carlos Pérez Ricart-Ave. Sol Poniente, Ave. Francisco Of the Rosario Sánchez).

The Central Government should ensure free access to the National Palace, the SESPAS, the CDEEE, the SEOPC, the central buildings of the National Police and the Secretary of the Armed forces and all Secretary of State with operative functions.

It is necessary to highlight that some avenues are distinguished by concentrated private health centers (Independence Ave.).

c. Necessary equipment

To develop the mitigation program and assist the emergency it is necessary to have the following facilities:

- Nine manual power saw
- Three branches and trunks cutters
- Three platform vehicles for the transporting.
- A place to process and accumulate the compost
- Enough and appropriate space for a metropolitan nursery

Chapter 9

Action Programs

9 Action Programs

This Chapter presents the Action Programs for ADN to carry out the implementation of the Master Plan, especially during the preparatory stage (2006) and Phase 1 (2007-2008). In addition, for the case of a new final disposal site being needed, recommendations are given as technical guidance for the selection of the new final disposal site, and the administrative procedures required for its construction. Furthermore, in the event that the new final disposal site is to be located farther away, as assumed in MP2, recommendations are given for the construction of the proposed transfer station.

The following are Action Programs proposed. In addition, the table below shows relations between the Strategies, the Description of the Master Plan, the Action Programs and Major Expected Results to be achieved.

Establishment of Legal Infrastructure

Program 101: Establishment of a Basic Rule

Strengthening of the Management Organization

Program 201: Strengthening of Coordination among ADN Directorates
Program 202: Reform of the Urban Cleansing Department of EMUCD
Program 203: Establishment of Municipal Company

Towards Achievement of the Collection Goal

Program 301: Categorization and Definition of Collection Services
Program 302: Design of Collection Routes
Program 303: Establishment of Collection Service Structure
Program 304: Establishment of Contract Auditing System
Program 305: Expansion of Collection Data Management
Program 306: Reform of ADN Direct Operation
Program 307: Communication with Citizens

Towards Achievement of the Final Disposal Goal

Program 401: Improvement of the Current Disposal Operation
Program 402: Landfill Site Selection
Program 403: Construction and Operation of a New Transfer Station

Towards Achievement of the Waste Minimization Goal

Program 501: Generation Control
Program 502: Discharge Control
Program 503: Resource Recovery (Composting)

Towards Achievement of the Financial Goal

Program 601: Increase of Income
Program 602: Reduction of Expenditures
Program 603: Subsidy to the Poor

Table 9-1: Action Programs

Strategies	M/P description	A/P	Expected Results	2006-08	2009-11	2012-15
1. To establish legal infrastructure	7.3.1 a. Municipal Regulation for Cleansing	101: Establishment of Basic Rule	Municipal regulation for cleansing is enacted.	◆		
2. To strengthen the management organization	7.3.2 a.1 Directorate Level	201: Strengthening of Coordination among Directorates of ADN	Functions of Directorates of ADN are clarified	◆		
	7.3.2 a.2 EMUCD	202: Reform of the Urban Cleansing Department of EMUCD	Necessary number of qualified personnel are assigned to the Urban Cleansing Department	◆		
	7.3.2 b. Establishment of Municipal Company	203: Establishment of Municipal Company	A Municipal Company is established		◆	
3. To establish order in the collection service market	7.3.3 Public-private Partnership 7.3.5 Communication regarding Collection Service 7.4.2 a. Collection	301: Categorization and Definition of Collection Services	Deferent services are well categorized and defined	◆		
		302: Design of Collection Routes	Collection routes are designed	◆		
		303: Establishment of Collection Service Structure	Contracts with the private sector are revised or newly made	◆		
		304: Establishment of Contract Auditing System	New collection services are implemented	◆		
		305: Expansion of Collection Data Management				
		306: Reform of ADN Direct Operation				
		307 Communication with Citizens				
4. To build a consensus among the municipalities in the Metropolitan Area	7.4.2 b. Transfer Station 7.4.7 Final Disposal	401 Improvement of the Current Disposal Operation	Operation of Duquesa disposal site is improved	◆		
		402 Landfill Site Selection	A new landfill is constructed and operated if necessary		◆	
		403 Construction and Operation of a New Transfer Station	A transfer station is constructed and operated if necessary		◆	

Strategies	M/P description	A/P	Expected Results	2006-08	2009-11	2012-15
5. To begin 3Rs and to apply the principle of Extended Producer Responsibility	7.3.5 b. Communication regarding Waste Minimization 7.4.4 Waste Minimization	501: Generation Control	Environmental education is conducted by the Information Center	◆		
		502: Discharge Control	Recycling activities are conducted at supermarkets, colmados and/or schools		◆	
		503: Resource Recovery	Composting is carried out targeting the market waste		◆	
6. To apply the Polluter Pay Principle, but to consider the poor	7.3.4 Financial Management	601: Increase of Income	Income from collection service charge is increased	◆		
		602: Reduction of Expenditures	Commercial service fee for billing and bill collection is reduced	◆		
		603: Subsidy to the Poor	Subsidy is applied to the poor Total amount of subsidy is reduced	◆		

9.1 Establishment of Legal Infrastructure

This section presents the programs for strengthening the organization's structure and legislation that are to be the basis for bringing the Master Plan to the implementation stage.

9.1.1 Program 101: Establishment of a Basic Rule

This Program is related to "the Master Plan, 7.3.1 Legal System, a. Municipal Regulation for Cleansing," and "Annex Z, Municipal Regulation on Non-hazardous Solid Waste Management."

a. Objective and Target

Various actors, such as ADN, the central government, citizens and contracted private firms for service provisions, work in the field of Municipal Solid Waste Management. Problems often happen due to differences of their understandings. A rule that takes into account the characteristics of the society is necessary for solving or preventing such problems and for coordinating their activities towards adequate MSWM. In order to establish such a basic rule, the current existing related laws were investigated and analyzed, the necessity of a new municipal regulation on MSWM was examined, and then a new municipal regulation was established after discussions in the municipal council in ADN. The regulation is called "Regulation on Non-hazardous Waste Management" (See Annex).

The objective of the regulation is to establish order in activities and relations among ADN, the citizens and the contracted private firms for solid waste service provisions. Its target is non-hazardous waste.

b. Organization

EMUCD, Municipal council (Sala Capitular), Executive (Mayor, Vice Mayor, Secretary General, etc.), Legal Department (Consultoria Juridica).

EMUCD took the initiative in enforcement of the regulation with support from the Legal Department.

c. Activities and Schedule

The regulation was approved by the Municipal Council and the Executive in August 2006. Promulgation of the regulation was officially announced on 15th September 2006. The regulation is already effective.

- Approved by the Municipal Council
- Approved by the Executive
- Promulgation
- Execution

The following is the schedule of the regulation.

Activities	2006	2007	2008
M. Council			
Executive			
Promulgation			
Execution			

d. Expected Result

The following result will be obtained as a result of this action program:

- Enactment of the "Regulation on Non-hazardous Waste Management"

9.2 Strengthening of the Management Organization

9.2.1 Program 201: Strengthening of Coordination among ADN Directorates

This Program is related to "the Master Plan, 7.3.2 Organization, a. Organizational Strengthening of ADN, a.1 Directorate Level," and "Annex AA Coordination among Directorates of ADN."

a. Objective and Target

Solid waste management is a service closely linked with other public services. The planned 2005 budget of EMUCD comprised of 35% of the ADN budget, but the executed expanded budget indicated a proportion closer to 44%. On the other hand the actual income from SWM in 2005 comprised of 34% of EMUCD`s executed budget, which dropped to 26% when the expanded budget execution was considered. In any event, this implied that 66%-74% of the SWM cost in 2005 depended on the general financial resources of ADN. It also implied that the heavy burden of SWM cost on ADN finances probably affected the ADN capacity to provide other public services. A budget structure reflecting a more balanced provision of public services may be required. Moreover, increased efficiency in SWM implies not only the continued improvement of SWM, but also the availability of financial resources, freed from SWM, in favor of other public services under ADN jurisdiction. Further, urban development (business district, road, parks) has strong effects on SWM, while there are many matters that EMUCD cannot fully cover, such as coordination with citizens, labor management of street sweepers and a multitude of laborers.

This program has the purpose of providing SWM that is well balanced with other public services, taking into consideration all the public services under ADN jurisdiction, and recommends the coordination among the concerned municipal Directorates.

b. Organization

Executing municipal offices and Directorates

EMUCD will take the initiative in this regard.

c. Activities and Schedule

According to what is established in the Annex as Coordination among Directorates of ADN concerning SWM, each Directorate is to fulfill its role, either individually or through the Directors Committee. The main topics are listed below.

- Budget preparation
- Verification of efficiency
- Citizens coordination
- Labor management
- Urban planning
- Coordination with other cities (especially coordination with neighboring cities)

The following is the schedule.

Activities	2006	2007	2008
Discussion of each Directorate's roles	▬		
Regularization of roles	◆		
Implementation		▬	▬

d. Expected Results

The following results will be obtained as a result of this action program:

- Functions of the Directorates regarding MSWM are clarified
- The Directorates well coordinate each other regarding MSWM such as budget preparation, verification of efficiency, citizen coordination, labor management, urban planning, and coordination with neighborhood municipalities.

9.2.2 Program 202: Reform of the Urban Cleansing Department of EMUCD

This Program is related to "the Master Plan 7.3.2 Organization, a. Organizational Strengthening, a.2 EMUCD," and "Annex BB Divisions of Duties of the Urban Cleansing Department."

a. Objective and Target

The Urban Cleansing Department of EMUCD should strengthen its capacity in order to achieve the goals of the Master Plan. Particularly, the capacity for collection and transport, and street sweeping should be urgently strengthened. The Master Plan clearly stipulated and categorized the various types of collection service, and recommended the provision of the service in an integrated manner. These services are to be provided mainly through private companies. This program targets the Urban Cleansing Department, with the purpose of reorganizing it, so that it can deal with diverse types of services, and acquire the capacity to supervise and control the private companies in an appropriate manner.

b. Organization

Urban Cleansing Department of EMUCD

c. Activities and Schedule

According to the recommendations of the Master Plan, the Urban Cleansing Department is to be organized by creating the necessary capacities (see details in the Annex Division of Duties of the Urban Cleansing Department). Qualified personnel should be hired in accordance with the requirements of each job or position, seeking to strengthen the capacity of the organization, in order to make it capable of handling the bidding process, contract management and other routine tasks.

- Organization restructuring
- Securing human resources
- Strengthening of organization capacity

The following is the schedule.

Activities	2006	2007	2008
Organization restructuring	▬		
Securing human resources		▬	
Strengthening of organization capacity		▬	▬

d. Expected Results

The following results will be obtained as a result of this action program:

- Organization structure of the Urban Cleansing Department is reformed according to the Master Plan
- Necessary numbers of qualified personnel are assigned
- The Urban Cleansing Department is capable to handle the bidding process, contract management and other routine tasks

9.2.3 Program 203: Establishment of Municipal Company

This Program is related to "the Master Plan 7.3.2 Organization, b. Establishment of Municipal Company."

a. Objective and Target

Solid waste collection and street sweeping are public services that are indispensable in the daily life of citizens. Stable provision of this service requires a great diversity of knowledge and capacities, not only technical but also matters relating to legal, financial, private sector participation, citizens coordination, social and environmental considerations. In order for an organization to acquire these knowledge and capacities, it is necessary to accumulate experience through continued daily activities.

Mayoral elections take place every four years, and a change in administration implies the change of numerous municipal employees. Accordingly, it is not unusual in such cases to lose the knowledge and capacities acquired and accumulated by the organization. This is one reason why Santo Domingo, National District, and many other municipalities face serious problems in SWM.

The purpose of this program is to set up a Municipal Company that can provide the SWM service in a stable and continuous manner. The targets of the program are ADN and citizen representatives.

b. Organization

Municipal Council, municipal executing offices, related Directorates, Advisory Committee

EMUCD will take the initiative in this regard.

c. Activities and Schedule

The Urban Cleansing Department of EMUCD will be the base, and in due time will become the Municipal Company. The establishment of the Municipal Company is hoped to be completed by the end of 2009, the year before the next Mayoral election.

The first step is the establishment of the Advisory Committee, as stipulated in the Urban Cleansing Regulation (See Annex Z Municipal Regulation on Non-hazardous Solid Waste Management, Chapter IV Shared Responsibility). Within the continued advisory activity to the Urban Cleansing Department, it is desirable to hold ample discussions between the members of the Advisory Committee and ADN concerning features and limits of authority of the Municipal Company. Such a meeting should be held periodically, e.g., once a month or once every other month.

- Preparation for Establishment of Advisory Committee
- Establishment of Advisory Committee
- Preparation for Establishment of Municipal Company
- Establishment of Municipal Company

The schedule is as follows.

Activities	2006	2007	2008	2009 - 11
Preparation of AC				
Establishment of AC				
Preparation of MC				
Establishment of MC				

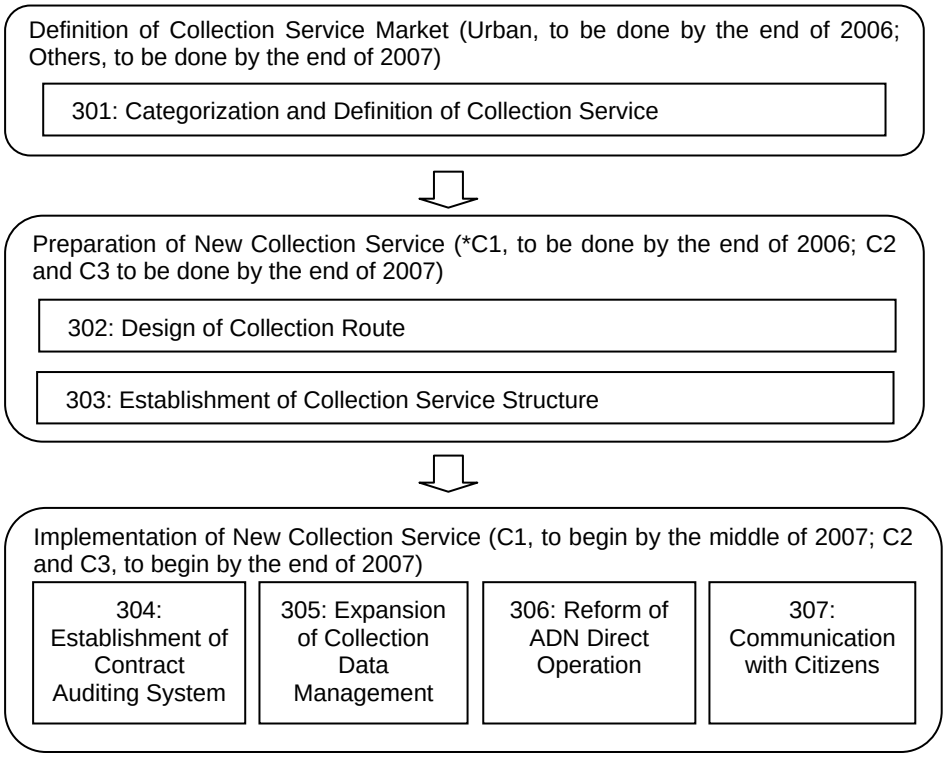
d. Expected Results

The following result will be obtained as a result of this action program:

- A Municipal Company is established.

9.3 Towards Achievement of the Collection Goal

The key concept towards the achievement of the collection goal is "to Establish Order in the Collection Service Market." This section describes the programs, which are related as follows,



*C means Circumscription

Figure 9-1: Establishment of Order in the Collection Service Market

9.3.1 Program 301: Categorization and Definition of Collection Services

This Program is related to "the Master Plan 7.3.3 Public-private Partnership a. Categorization and Definition of Collection Service."

a. Objective and Target

The collection service consists of various services such as collection of waste generated by households and small business entities, collection of large amounts of waste generated by supermarkets and hotels, collection of construction debris, collection of bulky waste such as electronic waste and furniture waste, collection of pruning waste, and road sweeping. The characteristics of the services are very different. This program aims to establish order in the collection service market by categorizing and defining those services.

b. Organization

EMUCD, Municipal Council (Sala Capitular), Executive (Mayor, Vice mayor, Secretary General, etc.), Legal Department (Consultoria Juridica)

EMUCD takes initiative in the preparation of detailed regulations necessary under the "Regulation on Non-hazardous Waste Management", having support from the Legal Department and getting approval from the Municipal Council and the Executive.

c. Activities and Schedule

This program consists of the following main activities.

- Categorization and definition of collection services
- Preparation of detailed regulations

c.1 Categorization and definition of collection services

According to the Master Plan, the SW collection service is divided into the following six categories: urban area, marginal area, large generators, municipal markets, sweeping, and special service. These services are defined appropriately.

c.2 Preparation of detailed regulations

The EMUCD should administer the implementation of the ADN services and of the private firms according to the definitions mentioned previously. For a better interpretation of the services, the EMUCD will elaborate a detailed regulation that includes the following.

- Definition of waste to be targeted by each collection service: The definition of waste should be established based on the one described in the Master Plan. It may be modified if necessary through practical application.
- Limits of the urban and marginal areas: The limits should be clearly established on the map.
- Definition of big generator: The regulation should contain characteristics of big generators. Waste generators with such characteristics will be classified as big generators and the authorization will be given to select the collection service for them.
- Contents of collection services: The minimum requirements of each service should be established. For example, installation of containers, their cleaning and washing, fumigations, sweeping the interior and adjacent streets of the market, should be defined for collection and transport service of market waste. Also, a policy to use containers for both urban and marginal area should be defined.

- Waste management plan of construction debris: Construction firms may be obliged to submit waste management plan of construction debris.

c.3 Schedule

The following is the general schedule recommended.

Activities	2006	2007	2008
Categorization and definition	▬		
Preparation of detailed regulations		▬ ▬ ▬	▬

d. Expected Results

The following results will be obtained as a result of this action program:

- A drawing with urban and marginal area boundary lines. Demarcations of difficult access sectors will be included inside the urban area. This drawing will constitute as the basic instrument for the assignment of territory for the private companies as micro-companies or foundations. Simultaneously for urban area contracts, it will be possible to clearly define which are the difficult access sectors that require special equipment to allow operation.
- A manual with descriptions of the services. This manual will include the technical aspects of the different types of collection service that will be carried out in the National District. It will include the definition of the characteristics of the waste to be collected by the type of service, collection methodology, frequencies, characteristics of the collection vehicles, place of waste disposal, operator type, coverage area, definition of complementary activities, and the users' characteristics by service type.
- Instructions of the Waste Management Plan. These instructions will focus on the waste generators that are not the competition of ADN, such as construction rubble and healthcare waste. In the instructions, the procedure to continue by the generator to handle and appropriately arrange its waste in sites authorized by ADN will be described.

9.3.2 Program 302: Design of Collection Routes

This Program is related to “Annex P Integrated Improvement of the Collection Service,” and “Annex Q Manual for the Improvement of the Collection Service.”

a. Objective and Target

The private service providers contracted to implement the service should design SW collection routes, which should be authorized by ADN before the actual implementation of the service. This is a desirable mechanism. However, so far, the private service providers have not had such capabilities, and ADN have not had the capabilities to guide such activities. This has been the main cause of the low quality collection service.

Consequently, in this program, SW collection routes in urban area and marginal area are to be designed by ADN. Contract revision or bidding will take place on the basis of these collection routes.

b. Organization

Urban Cleansing Department of EMUCD

c. Activities and Schedule

During this Study, a Collection Improvement Pilot Project was implemented, and the SW collection routes of the target area were designed. This program will expand the design of SW collection routes to the whole city. The collection areas will use, as a basis, the "sectors" utilized by Triple A. By collecting and analyzing such data regarding the collection area as population, existence or inexistence of commercial area, and road conditions, the design of collection routes, collection time and collection frequency will be carried out. The required number of vehicles and personnel will be determined. Detailed work will have as reference the Annex on the contents of the Pilot Project, and the Manual for the Design of SW Collection Routes. The tasks will be carried out for each of the Circumscription 1, 2 and 3, in the said order (Circumscription 1, 2 and 3).

The following is the general schedule recommended.

Activities	2006	2007	2008
Circumscription 1	▬		
Circumscription 2		▬	
Circumscription 3		▬	

d. Expected Results

The following results will be obtained as a result of this action program:

- The drawing includes: Limit of the area of every collection route with its respective identification number; Collection frequency for every route defined on the basis of the limit color of the same one; Type of vehicle, defined on the basis of the shading area of every route
- Diagram of the trips for each of the collection routes, including the identification number, starting and end point of the trip, frequency, days and working schedule.
- Drawing with sector identification and collection routes according to "Triple A" (company that manages the collection service) and limits of the collection routes.
- Database with records of every route, which will later include the records of every operator and the details of the service BDRoutes in the Master Plan.

9.3.3 Program 303: Establishment of Collection Service Structure

This Program is related to "the Master Plan 7.3.3 Public-private Partnership," and "7.4.2 Collection & Transport a. Collection."

a. Objective and Target

This program aims to establish a collection service structure, in which a service provider is clarified for each type of collection service. The targets are services for urban areas, marginal areas, public areas, big generators, municipal markets and special services. Services for hazardous waste are excluded.

b. Organization

EMUCD, citizens, private collection service providers

EMUCD is to be fully in charge of this program.

c. Activities and Schedule

c.1 Services for Urban Area and Marginal Area

For each collection area, sample contract documents will be prepared, in which the Scope of Work of the collection service and the Terms of Reference will be clarified, by taking into consideration the unique characteristics of each collection area. A collection area will basically correspond with a "sector" used by Triple A in its operations. The contract types will be those indicated in the Master Plan. Likewise, the contents of the contracts should cover at least those indicated in the Master Plan. The contract should include the results from the previous program "Design of Collection Routes" concerning collection time, collection frequency and collection routes.

On the basis of the newly prepared contract documents, decisions will be made whether revision of the existing contracts or a new public bidding is called for. The bidding should be implemented according to the procedures indicated in the Master Plan. And, it is recommended to begin negotiations using the basic contract prices indicated in the Master Plan.

The contractor will be selected after the contract revision of the contracts or a new public bidding. The contractor will be exclusively assigned to a certain area. Then, the whole area of the DN will be covered with the contract of services for urban areas and marginal areas.

A contractor will be selected after the above described process of revision of the existing contract or a new bidding. A contractor will be exclusively assigned to a clearly delimited area. Then, the whole DN will be covered with contracted services for urban areas and marginal areas.

- Preparation of Bid Document
- Bidding or Revision of the existing contracts
- Bid Evaluation and Contract Negotiation
- Conclusion of Contract

c.2 Services for Big Generators

A license system is to be introduced for the service for big generators. The conditions, which service providers have to meet, are to be established along with a period of license, procedures of renewal, conditions of deprivation, and so on. Meanwhile, big generators have to be identified in order to be excluded from the ordinary service, i.e., the services for urban areas and marginal areas.

- Licensing to Service Providers
- Identification of Big Generators

c.3 Service for Markets

Targeting the existing five municipal markets, EMUCD is to begin a bid process for the award of the contracts or to renegotiate with the current contractor for the collection and transport of market waste. Just like for the service in the urban area and marginal area, the Master Plan recommendations should be followed concerning bidding procedures and the contents of the contract.

- Preparation of Bid Document
- Bidding or Revision of the existing contracts
- Bid Evaluation and Contract Negotiation
- Conclusion of Contract

c.4 Sweeping

EMUCD is to begin a bid process for the award of the contracts for the collection and transport of sweeping waste. Just like for the service in the urban area and marginal area, the Master Plan recommendations should be followed concerning bidding procedures and the contents of the Contract. In principle, "sectors" utilized by Triple A should be the basic unit for this service, in the same way as for the service in urban area and marginal area, and the Contract should be "sector" specific.

- Preparation of Bid Document
- Bidding or Revision of the existing contracts
- Bid Evaluation and Contract Negotiation
- Conclusion of Contract

c.5 Special Service

EMUCD is to begin a bid process for the award of the contracts for the collection and transport of special waste. Meanwhile the procedures of the reception of request for the service, registration of the request, provision and monitoring of the service have to be established.

- Preparation of Bid Document
- Bidding or Revision of the existing contracts
- Bid Evaluation and Contract Negotiation
- Conclusion of Contract

c.6 Schedule

The following is the general schedule recommended.

Activities	2006	2007	2008
Urban Area			
Marginal Area			
Big Generators			
Market			
Sweeping			
Special			

d. Expected Results

The following results will be obtained as a result of this action program:

- Terms of reference for bidding of the collection service concerning the urban area, markets, sweeping, and special waste.
- Contract type for the collection services of: urban area, marginal area, sweeping, markets and special waste, with its respective reference values for the services.
- Procedure manual to grant operation licenses to companies dedicated to the waste collection of big generators.
- Request format for users who want to choose the service of big generators
- Database with records of big generators, service providers, and records of the waste amount managed by this service.
- Manual for the determination of reference values of the different collection services.

9.3.4 Program 304: Establishment of Contract Auditing System

This Program is related to "the Master Plan 7.3.3 Public-private Partnership, d.3 Contract Auditing," and "Annex R Manual for the Inspection of the Collection Service."

a. Objective and Target

Once a contract is signed with a private service provider, ADN is obligated to audit the implementation and compliance of the contract specifications. This program has the purpose of establishing the audit procedures and preparation of a manual, so that the contract audit can be undertaken on a routine basis, according to the recommendations of the Master Plan for auditing the contracts. The Urban Cleansing Department of EMUCD will be the target of this program.

b. Organization

Urban Cleansing Department of EMUCD

c. Activities and Schedule

The Master Plan contains an outline of the audit items, which municipal office will implement the audit, and how the audit process will be conducted. Accordingly, clarification will have to be done on which municipal offices and which employees will participate in the audit, as well as clarification of the duties of each employee. Then, detailed audit procedures will have to be established, clarifying the order of procedural activities, and specifying the required documents. These procedures should be included in a manual, in order to train the pertinent employees. After all these tasks are completed, routine audit of contracts can be implemented.

- Clarification of duties of each employee participating in Contract audit
- Establishment of Contract audit procedures
- Training of employees participating in Contract audit
- Implementation of Contract audit

The following is the schedule.

Activities	2006	2007	2008
Clarification of duties			
Establishment of procedures			
Training of personnel			
Implementation			

d. Expected Results

The following results will be obtained as a result of this action program:

- Manual of organization with inspection of unit structure, definition of the working places and corresponding responsibilities, establishing the mechanisms of communication and management of the information.
- Manual of procedures for control, follow-up and inspection of the contracts of the urban area collection.
- Manual of procedures for control, follow-up and inspection of the contracts of marginal area collection.
- Manual of procedures for control, follow-up and inspection of the contracts of market waste collection.

- Manual of procedures for control, follow-up and inspection of the contracts of special waste collection.
- Formats of routes or service follow-up to use in the inspection process.
- Data base with service follow up records and
- Database with the service follow up precedents and the sanction processes in front of nonfulfillment of the contract terms.

9.3.5 Program 305: Expansion of Collection Data Management

This Program is related to "Annex S Data Management," "Annex T Collection Route Database System Users Manual" and "Annex U Weighbridge Database System Users Manual."

a. Objective and Target

Management of such data as collection quantity and collection time, by sector, will permit a quantified understanding and evaluation of the collection service in any given sector. Furthermore, by feeding the evaluation results back into the operation of the collection service, continued improvements will become possible. This program aims at expanding the "Formulation of Data Management System", implemented as a Pilot Project, to the whole area of Santo Domingo, National District, in order to formulate a collection data management system that covers the collection routes in the urban and marginal areas.

b. Organization

Urban Cleansing Department of EMUCD

c. Activities and Schedule

This program will be implemented simultaneously with the previously described Program 202 "Design of Collection Routes", Program 203 "Establishment of Collection Structure", and Program 204 "Establishment of Contract Auditing System". Information to be obtained from collection data management will be useful in the continued improvement of collection routes. When signing a contract with a private service provider, the number of vehicles and assigned employees will be indicated, and this data can be input in the data management system. Also, the analysis and evaluation of collection data is a part of contract auditing.

This program will be implemented using the recommendations presented in "Data Management," "Collection Route Database System Users Manual" and "Weighbridge Database System Users Manual," contained in the Annex as reference.

The following is the general schedule recommended.

Activities	2006	2007	2008
Circumscription 1	▬		
Circumscription 2		▬	
Circumscription 3			▬

d. Expected Results

The following results will be obtained as a result of this action program:

- Data of collection routes is recorded in a digital form
- Data at the existing transfer station is recorded in a digital form
- Data at the Duquesa disposal site is recorded in a digital form

9.3.6 Program 306: Reform of ADN Direct Operation

This Program is related to "Annex P Integrated Improvement of the Collection Service."

a. Objective and Target

The Master Plan states that basically the private sector will be in charge of SW collection activities. However, as of 2006, the private sector does not have the number of vehicles needed to provide the collection service in the whole area of Santo Domingo, National District. The hope is that the necessary vehicles can be acquired by the private sector as the result of contract revision or public bidding. This, however, will take time. The question arises on how to deal with this time lag, considering that solid waste is generated every day.

The quality of the collection service is expected to improve continuously as the result of signing appropriate contracts and the ensuing routine contract auditing. However, the residents of Santo Domingo, National District, do not know what a high quality collection service is. It is desirable to have a model that clearly shows a high quality collection service.

This program aims at implementing the reform and strengthening of the direct service provided by ADN, as a model for a high quality collection service, and to supplement the deficient equipment with which private service providers operate at present.

b. Organization

Executive Offices, Urban Cleansing Department of EMUCD, Equipment & Transport Directorate

EMUCD will take the initiative in this regard.

c. Activities and Schedule

At present, collection and transport activities are carried out as part of the duties of the Equipment and Transport Directorate. In order to concentrate all relevant activities, it is suggested that the collection and transport functions be relocated from the Equipment and Transport Directorate to the jurisdiction of EMUCD. This requires decision making by the executing offices. The operation hours are short in the case of the existing vehicles, due to the superannuated fleet and inappropriate operation and maintenance, thereby requiring improved operation and maintenance. Further, collection operations will be carried out in order to supplement the insufficient number of equipment used by private companies, and in order to continue the Pre-Pilot Project implemented to improve the direct collection service of ADN. Also, the six small compactor trucks to be donated by Japan can be used for this purpose.

- Concentration of collection and transport service
- Improvement of operation and maintenance of existing vehicles
- Improvement of collection service management

The general schedule recommended is as follows.

Activities	2006	2007	2008
Concentration	▬		
O&M Improvement		▬▬	
Management improvement		▬▬	

d. Expected Results

The following results will be obtained as a result of this action program:

- Equipment and Transport Directorate is relocated to the jurisdiction of EMUCD.

- Rule of operation and maintenance is clarified and fulfilled.
- The Pre-Pilot Project is continuously operated by the ADN.

9.3.7 Program 307: Communication with Citizens

This Program is related to "the Master Plan 7.3.5 Citizens' Participation, a. Communication regarding Collection Service," "Annex V Promotion of the Citizen Participation," and "Annex W Guidance for Citizen Participation Activities."

a. Objective and Target

A high quality collection service presupposes that citizens comply with the basic rules of SW discharge, such as day and time of collection, the use of appropriate containers, and so on. For this purpose, information relevant to SW discharge should be widely and precisely transmitted to the citizens. This program aims at the formulation of an information dissemination system, consisting of methods and mechanisms of communication among organizations in charge of information dissemination.

b. Organization

Executing offices, Urban Cleansing Department of EMUCD, Triple A

EMUCD will take the initiative in this regard.

c. Activities and Schedule

The Urban Cleansing Department, jointly with Triple A, will prepare a plan annually for the dissemination of information, and they will estimate the necessary budget amount. ADN and Triple A will jointly share the necessary expenses. The budget will be earmarked every year.

Two methods of information dissemination activities can be considered, one to be implemented simultaneously with collection service improvement, and the other to be continued routinely. In the case of simultaneous implementation with collection service improvement, the advance knowledge of the residents is of great importance, whereby concentrated and direct activities are thought to be most effective. Resident meetings and door to door visits for the distribution of leaflets may be effective methods for doing this. On the other hand, effective methods for continuous information dissemination may be the placement of posters encouraging compliance with discharge manners, or leaflets with the same information enclosed with the SW service bills. Planning and implementation of information activities are suggested to have the Pilot Project on Promotion of Citizens Participation, which was carried out during this Study, as a reference.

- Formulation of information dissemination plan
- Securing the budget
- Implementation of information dissemination

The following is the general schedule recommended.

Activities	2006	2007	2008
Plan formulation	▬	▬	▬
Securing the budget	▬	▬	▬
Implementation		▬▬	▬▬

d. Expected Results

The following results will be obtained as a result of this action program:

- An information dissemination plan is formulated.
- Budget for information dissemination is secured.
- Information is disseminated.

9.4 Towards Achievement of the Final Disposal Goal

This Section presents the actions needed to achieve the necessary improvements in the existing final disposal site, the selection of a new final disposal site, and the construction of a transfer station that will become necessary in the event the new final disposal site is to be located farther away.

9.4.1 Program 401: Improvement of the Current Disposal Operation

a. Objectives and Target

The current operation at the final disposal site “Duquesa” requires improvements from the view points of correct operation and environmental impacts. Most of activities described in this section have to be taken by the operator of the disposal site. This program targets the whole waste disposed in Duquesa, i.e., not only the waste from the National District but also the ones from Santo Domingo Este, Santo Domingo Oeste and Santo Domingo Norte.

b. Organization

Municipalities of Santo Domingo Norte, Santo Domingo Este, Santo Domingo Oeste, National District, Consortium Duquesa and Secretariat for the Environment and Natural Resources

EMUCD will take the initiative in this regard.

c. Activities and Programs

During the month of June of the present year, the "Consortium Duquesa", current operator of Duquesas' sanitary landfill, presented an Environmental Impact Declaration to the Secretariat of State for the Environment and Natural Resources, the Sub-Secretariat of Environmental Management, with the purpose of regularizing the situation of the final disposal site and at the same time extending its useful life. The Environmental Impact Declaration mentions that some of the design items, which might cause negative environmental impacts, have not been adequately considered. Those are the following.

c.1 Analysis of Structural Stability of the Sanitary Landfill

According to the EID, the type of landfill to build is called as “Area,” where the waste is to be disposed of on land that is sealed with clay layer and leveled off. The design aims at disposing of domestic wastes adequately. That is to say, the landfill should act like a structure that completely confines the waste and adequately manages sub products such as gases and liquids during the whole life time.

One of the important design items of sanitary landfill is the foundation that supports the load of waste. Another is the stability of waste mass. Important variables for analyzing these items are the supporting capacity of foundation, height of landfill, angle of slopes, water content of waste, waste compaction degree, entrance of rain water, pressure of sediments, coverage of cells, stress caused by seismic load, risks of slope failure, besides the interaction among the impermeable bottom, the subsoil and the mass of waste, and the minimization of the excavation depths.

Therefore, to validate the proposed design, it is indispensable to conduct a study that includes

analysis of all variables mentioned previously and to consider the safety factors to make the design secure. This study is to define the geometric characteristics of the landfill as well as the protection works such as dikes and berms, leachate evacuation system, bottom slopes, etc.

Technical specifications and operation manner can be designed based on the results of the study, and the useful lifetime of the landfill can be determined.

c.2 Analysis of Effectiveness of the Proposed Impermeable Bottom Liner

A study should be conducted to analyze the effectiveness of the proposed impermeable bottom. The results of the study will clarify the materials to use and technique of their installation.

c.3 Estimation of Leachate Generation Volume and Required Storage Capacity

Another item that was proposed in the EID and should be studied in detail is the leachate management system, which collects leachate at the bottom of the landfill by means of pipes, conducting it to storage lagoons that will be built and closed along with the progress of landfilling.

It is true that leachate may cause a serious risk to the environment, if it leaks from the landfill. Leachate also has another risk. Accumulation of leachate inside the landfill may cause considerable pore pressure, being so strong as to cause the collapse of the dike of the landfill. Therefore, it is important to take into account in the design of the sanitary landfill, that leachate increases as the volume of waste increases, due to water content of waste and decomposition of waste. Also, a bigger surface of uncovered waste allows rain water to infiltrate into the landfill. Evapotranspiration is the only factor to reduce water volume, but it is not enough to assure the stability of the landfill.

If the liquid stays confined in the landfill, its level increases with time, and the pressure inside the landfill will rise. Such a condition prevents biogas from being channeled adequately through the gas extraction pipes. It may cause the biogas to escape from the banks of the landfill, which may even collapse.

Taking into account the above, the project should consider a leachate reception system in order to allow its evacuation toward storage units for later treatment if necessary.

According to the EID, the project considers the collection, storage and recirculation of leachate. However, the quantity of leachate to be dealt with has not been clarified. It is necessary to estimate the quantity of leachate to be generated during the useful life of the landfill, and to verify whether the proposed leachate management system has enough capacity to deal with it in order to correctly operate the landfill.

Some technical considerations that should be kept in mind at the moment of evaluating the design of the drainage, collection, storage and recirculation systems of leachate are the following.

- The leachate volume will be given by the formula below.

$$\Delta V_{water} = V_{S.W.water} + V_{infilwater} - V_{Lix} - V_{Biogas} - V_{condens} \qquad (Ec.1)$$

Where:

ΔV_{water} = Volume of water amount in the landfill

$V_{S.W.water}$= Volume of water originated from water content of the solid waste

$V_{infil\ water}$ = Volume of rain water infiltrated = Rainfall – Evaporation – Runoff

V_{Lix} = Volume of leachate removed from the sanitary landfill

V_{Biogas} = Volume of water necessary for biogas formation

$V_{condens}$ = Volume of water taken out by biogas saturation

- The volume of liquid captured at the bottom of the landfill depends on the permeability of waste, soil cover thickness and height of the landfill.
- The design of the drainage ditch and leachate collection systems should be determined by different return periods (10 to 100 years) and different durations of rainfall (1 to 24 hrs). This way, the correct operation of the landfill will be assured during its useful life period without the system being saturated.
- The design of the pipe system should consider the design parameters mentioned above, considering structural aspects such as static and dynamic loads.
- The selection of the materials, pipes, pumps, and other equipment, should be made on the basis of the design technical specifications. Those should be of appropriate materials to assure the correct operation with leachate.
- The slopes at the bottom drainage and leachate pipes should assure continuous flow of the liquid.
- The leachate collection system should allow maintenance works during its operation. This refers to the elimination and/or removal of the deposits of sediments in the leachate that can obstruct the system.
- The volume of leachate generated and the velocity of leachate movement towards the bottom of landfill determine the required storage capacity.
- The necessity to make recirculation of liquids should be established based on the volume of water stored in the landfill.
- In the calculation of the accumulated volume of leachate, due consideration should be given to the volume increase in the rainy season, directly caused by rainwater.

c.4 Preparation of Environmental Monitoring Program

A continuous monitoring program of underground and surface water should be established. Sampling points should be established upstream and downstream of the landfill. Monitoring should be conducted at a frequency of no less than six months.

Piezometers should be installed inside the landfill to continuously monitor pore pressure. It permits monitoring of whether the leachate is correctly discharged from the inside of the landfill.

Monitoring devices should be installed to check the displacement of waste in the landfill, particularly in the areas close to ravines and protection structures like dikes.

The methane concentrations in the drainage pipes and the landfill area should be monitored, with the purpose of evaluating whether there are combustion or explosion risks and evaluating the necessity to capture the biogas.

In addition to the monitoring programs, emergency and contingency programs should be prepared against events of contamination or risks.

c.5 Control of the Landfill Site

A program should be prepared with the purpose of assuring that the site for landfill will not be invaded by people unrelated to the operation, so that the whole area proposed in the EID can be used. This program should consider fencing the whole perimeter of the site, and setting up a green belt formed by trees and bushes, which will minimize the negative visual impacts of the project.

c.6 Elimination of the Waste Recovery Activities

A strategy shall be prepared to reduce and eliminate in a short period of time the recycling activities carried out at the work front. This should include the creation of social programs to establish alternative activities for the scavengers. It is necessary to take into account that the population concerned with this activity is not only the people working on the site but also their families and people who purchase the recyclable materials.

c.7 Control of Biogas Emissions

Methane emission has to be controlled by burning the biogas on the site. Burning should be carried out under conditions of extreme security to avoid fires or explosions.

c.8 Sludge and Special Waste Management

Procedures for the management of special waste such as sludge, drainage waste, hospital waste, and so on should be established. Waste with high content of humidity should be dehydrated and later disposed of in the domestic waste cells. The dehydration can be carried out through mixture with fine soils or sawdust. Drying by sunlight is not recommended due to high rainfall. Hospital waste should be disposed of in specially designed cells, clearly identified and located far from the work front in order to avoid the recovery of materials, and should be immediately covered with soil.

c.9 Program

The general program recommended is:

Activities	2006	2007	2008
Analysis of the structural stability			
Analysis of the bottom liner			
Estimation of leachate volume			
Preparation of monitoring program			
Control of the landfill site			
Elimination of the waste recovery activities			
Control of biogas emission			
Management of sludge & special waste			

d. Expected Results

The following results will be obtained as a result of this action program:

- Final design of new disposal sites, determined on the basis of technical criteria and safety indicated for this type of project.
- Technical specifications for materials and construction of the rehabilitation of the new disposal sites.
- Operation manual for the new disposal sites.
- Design of storing areas for return periods no less than 50 years.
- Program for monitoring and environmental follow-up of the surface, groundwater, stability of the mass of waste, and migration of biogas.

- Programs of contingencies for accidents and environmental pollution.
- Gas managing program.
- Manual of the procedures for sludge and special waste management.

9.4.2 Program 402: Landfill Site Selection

a. Objectives and Goals

The objective of this program is the selection of an appropriate landfill site in the event that a new landfill site becomes necessary. This section indicates the procedures and methods of site selection from a technical viewpoint. It is assumed that all four Municipalities currently using the Duquesa landfill (National District, Santo Domingo Este, Santo Domingo Oeste, and Santo Domingo Norte) will participate in this Program.

b. Organization

Municipalities of Santo Domingo Norte, Santo Domingo Este, Santo Domingo Oeste, National District, Consortium Duquesa, Secretariat for the Environment and Natural Resources

EMUCD will take the initiative in this regard.

c. Methodology

The selection of a final disposal site requires several activities, trying to reach a balance among the social aspects, the environmental impacts, and the final cost of the work. It should always take into account that an appropriate site represents lower risks to the environment and the public health, but fundamentally it means lower costs of installation, operation and closure.

The selection of the site is a sequential process of complementary stages. It is important to conduct the process this way, starting from general studies, identifying several sites, of which those with greater potentials will be selected for detailed studies.

The selection process consists of three phases, starting with an analysis at macro level (selection of appropriate areas) to reach an analysis in detail (selection of the site).

c.1 Phase 1: Identification of the Potential Areas

This phase includes the compilation of information, at the regional level, on the geology, hydrogeology, geotechnical data, land use and occupation, environmental legislation and identification of the maps and aerial photos to be used in the study. Estimation is carried out for the current generation of waste, as well as future behavior, in order to guide the decisions regarding the dimension of the necessary area (minimum useful life 20 years).

Then, by applying technical, economic and environmental criteria, inappropriate areas will be excluded first (such as excessively distant areas, areas of natural risks, with high slopes, etc.) Later, homogeneous potential areas are identified and prioritized. The information of the physical environment and socioeconomic data should be analyzed at the regional level. For the works, maximum available information should be obtained and the areas should be visited to verify and control the information. The information includes the following aspects:

- Socioeconomic background: including such aspects as the distance of the area in relation to the generation centers, value of the land, available infrastructure (road network, electricity, communication, drinkable water, etc.), land use and occupation, population density, main urban centers, rural areas, and so on.

- Vulnerable areas: related with the existence of natural risks that can affect the project. It is recommended to consider the following criteria in the evaluation of the area: the site is dry, exclude areas with water saturated land, swamps, humid riversides, coast. Also, the area should not be exposed to wash up or waste swept away by water, be it by surface runoff or by the occurrence of floods with return periods of less than 100 years, should not be located on active geologic faults, should not be exposed to landslides or land collapses, should not be exposed to subsidence or settlements due to the existence of underground mines, extraction of water, petroleum or gas, or of land exposed to breakup, should not be located in unstable land or of low resistance.

- Geology: spatial distribution and characteristics of the substratum, petrology, main structural aspects (faults and fractures), etc.;

- Soil: characteristics of the soil in the region studied, mainly the type of clay, thickness, erosion susceptibility, mass removal, potential as construction material, etc.;

- Morphology: related to the main characteristics of the geomorphologic macro-units and the processes of the external dynamics that act in the region;

- Underground and surface waters: information on main permanent and temporary courses of surface waters, depth of the phreatic layer, flow direction, use of the waters, natural quality, recharge area and flood areas;

- Climate: mainly rainy régime (historical series), predominant direction and intensity of the winds; identification of microclimates;

- Archaeology: refers to the existence of an area with archaeological interests, archaeological remains, cultural heritage or monumental patrimony.

- Aspects of specific legislation: refers to the information of the laws and norms at the national, regional and municipal levels, development plans, or some other instrument of territorial classification, as well as the other conditions of the environmental legislation, such as areas with vegetation and protected species, Environmental Protection Area, parks, reservations, urban zoning of the municipality, etc.; compatibility with the integral waste management at regional and national level.

Preparation of a schematic representation of the information collected is recommended, in order to exclude areas that are clearly inadequate. The weighing of the factors considered and the integrated spatial analysis will permit the identification of the most suitable homogeneous areas, where the most favorable sites will be identified for the installation of the sanitary landfill.

Later on, the projection of waste generation will be determined for the useful life of the sanitary landfill, as the basis to estimate the dimensions of the place and of the final disposal site. This is a new restriction to the selection of a final disposal site.

Once the most suitable areas are identified, the process continues with Phase 2.

c.2 Phase 2: Identification of the Potential Places

Starting from the evaluation of the homogeneous areas prioritized in the previous phase, the places that present bigger potential for the installation of the landfill will be identified. This phase contains deeper studies, even though the regional criteria are still used.

There is no maximum number of places to be pre-selected, but a minimum of three is recommended.

The criteria applied in this phase include:

- Minimum dimensions of the area;
- Appropriate slopes;
- Appropriate thickness of the soil;
- Permeability of the soil;
- Minimum distance from houses, water courses, underground or surface sources of water supply, airports, protected areas and of native vegetation, towers of high voltage, gas or ducts, and other civil works of risk;
- Distance to the roads and access roads and their accessibility during the whole year.
- Land use
- Availability of cover material.
- Direction of winds regarding populated centers.
- External location to areas of environmental restriction; and
- Appropriate geographical location regarding the basin/aquifer of interest for the public local/regional supply.

Starting from the integration, analysis and interpretation of the data obtained and of the information on land use, the places are classified according to their potential for the installation of a sanitary landfill.

The Table 9-2 presents some criteria that can be used in this phase.

Table 9-2: Criteria for Site Classification Phase 2

Criteria	Good	Regular	Bad
Useful life	More than or same as 20 years	More than 10 years and less than 20 years	Less than 10 years
Distance to generators	Between 10 and 20 Km.	Between 20 and 40 Km.	More than 40 Km.
Distance to population nucleus	More than 1000 m	More than 600 m	Less than 600 m
Population density	Low	Medium	High
Zoning	Area without restriction	Area with restriction	Protected Areas
Populations' growth	Low	Medium	High
Land use and occupation	Unused area	Little use	Intense occupation
Distance to surface water courses	More than 1000 m	Less than 1000 m and more than 300	Less than 300
Land value	Low	Medium	High

Once the sites are classified, two or three that present the best conditions to make the detailed studies are selected.

c.3 Phase 3: Detailed Study

The works, in this stage, are local, getting into the details of those in the previous phase, in order to understand the characteristics of the places pre-selected. The field works are fundamental, with surface and underground investigations, using the traditional techniques of

the geologic engineering. Socioeconomic and other relevant information are also collected. The aspects that should be investigated correspond to:

- Geology-geotechnical: investigation of parameters such as permeability of the soil, load capacity and deformity of the foundation land, stability conditions of the solid and adjacent, susceptibility to erosion, etc., composing the geologic and geotechnical profile of the place;

- Hydrogeology: investigation of the parameters that control the dynamics of the underground water, such as direction of underground flow, hydraulic gradients, depth and fluctuation of the phreatic layer, recharge of the aquifer, physical, chemical and bacteriological quality of the waters, etc.;

- Hydrology: investigation of the parameters that control the dynamics of the surface water, such as flow direction, regime type, flood area, physical, chemical and bacteriological quality of the waters, and so on;

- Infrastructure: location and access conditions, availability of electric power and basic services, quarry location and soil extraction facilities, productive activities that can generate synergies, etc.

- Social: opinion of the people and their organized entities, interference level in the local dynamics, and

- Specific and economic aspects: cost of land, in addition to the assessment of the needs for specific and additional works to consider in the project and their impact on the costs.

From the integration, analysis and interpretation of the data collected, it is possible to determine one or more places that are appropriate for the installation of the work, and elaborate the recommendations for the project.

c.4 Additional Considerations

Once the place has been selected, it is important to carry out a retrospective analysis, that is to say, to carry out a complete checkup of the place, testing it according to the criteria used and not used, verifying the viability (technical and economic), in order to overcome deficiencies of the physical means, through project measures and the involved social factors. It may be necessary to re-execute the phases.

Lastly, it is important to keep in mind that the activities described previously should be executed according to the local procedures for obtaining the environmental permits of sanitary landfills.

d. Products

As a result of this action plan a list of 2 or 3 sites that present suitable conditions for the construction and operation of a sanitary landfill will be obtained.

9.4.3 Program 403: Construction and Operation of a New Transfer Station

This Program is related to “the Master Plan, 7.4.2 Collection & Transport, b. Transfer Station.”

a. Objectives and Goals

This program`s objective is the construction and operation of the new transfer station

considered in the scenario of change of place of the final disposal site. The goals are the residential urban area waste collection service.

b. Organization

The EMUCD, Municipal Council, Executives (Major, Vice-Major, General Secretary, etc.) Legal Department (Juridical Consultancy), the private suppliers of the collection and transfer service, the citizens. The EMUCD should be in full charge of the coordination of this program.

c. Activities of the Program

c.1 Definition of the Participation of the Private Sector and Elaboration of a Feasibility Study

In the Master Plan, the breakeven point was determined comparing the productivities of the conventional system of transport (using compactor trucks of 16 yd^3, 20 yd^3 and 25 yd^3) and a transfer system with a trailer of 85 yd^3. The discharge is direct (without compacting). The capacity required for the transfer station considering the projection of waste generation is 1,200 ton/day. The conceptual design of the transfer station was elaborated.

From this background information, the different modalities of participation of the private sector should be analyzed. A feasibility study should be conducted in order to estimate with greater confidence the amount of necessary investments and the operating costs. Then, it will be possible to establish the basic contract prices.

The participation of the private sector can involve all or part of the necessary activities for the construction of a transfer station, including:

- Place selection.
- Design of the transfer station and transport.
- Elaboration and approval of the corresponding Environmental Impact Study.
- Obtaining of permits according to the valid norms.
- Elaboration of the detailed engineering plan.
- Construction of the transfer station.
- Acquisition of equipment, machinery, vehicles and others.

The inspection and quality control of the construction can also be contracted with the private sector, whereby the basic contract prices should also be estimated.

c.2 Establishment of the Scope of Work and the Terms of Reference

According to the participation modality of the private sector, the scope of work, and the administrative and technical terms of reference should be established. These are necessary for the bidding. The Administrative and Technical Terms of Reference will have the structure indicated in the Master Plan.

c.3 Bid Process and Recruiting

A public competition should be the basis for awarding the contracts associated with the construction of the transfer station. Awarding the contract will take place using the basic contract prices. The contracts will be elaborated according to the structure established in the Master Plan for service contracts.

c.4 Supervision of the Construction

For the inspection and quality control of the construction, the Municipality can consider recruiting an external company. This will require preparation of the Terms of Reference on

the basis of detailed engineering and the requirements outlined by the competent authorities. The corresponding contract should be elaborated using the basic contract prices determined in the feasibility study.

After the signing of the contract and receiving the order to proceed, the private operator will start all the works and carry out all the final administrations of approvals and permits from the competent authorities.

The EMUCD, independent of hiring the inspection service and quality control of the construction of the transfer station, will create a supervision unit to monitor and supervise the strict execution according to the Terms of Reference and the respective technical specifications.

c.5 Adjustment of the Collection Service

The collection routes should be re-designed based on the new distance to the discharge point, since they will decrease the times of transport and discharge. The new design should try to maintain the current routes, only modifying the schedules of attention in the case that is necessary, in order to minimize the changes of the service.

c.6 Construction and Operation of the Transfer Station

Once the transfer station is built, and the works are approved, it should proceed to its construction with a test period of less than two months, in order to gradually incorporate the new system by verifying their correct operation as well as the new design of the collection service. During this period all necessary modifications will be carried out, and at the end of this phase normal operation will begin.

c.7 Program

The general program recommended is:

Activities	2006	2007	2008	2009-2011	2012-2015
Definition of the participation, Feasibility Study				—	
Establishment of the S/W and the ToR				—	
Bidding process and recruiting				—	
Supervision of the construction				—	
Adjustment of the collection service				—	
Construction and operation of the transfer station					—

d. Expected Results

The following products will be obtained as a result of this action plan:

- Definition of the transfer operator
- Selection of the site for the construction and operation of the transfer station

- Preliminary design of the transfer station
- Studies of Environmental Impact
- Environmental permits
- Design of the station
- Technical specifications of construction
- Terms of reference for construction bid of a transfer station
- Terms of reference for bidding of construction quality control
- Contract for the construction of the transfer station
- Contract for construction quality control
- Construction of the station
- Quality control of the station
- Reception of the works
- Station commencement
- New design of collection routes, with corresponding diagrams of the trips

9.5 Towards Achievement of the Waste Minimization Goal

In Santo Domingo, National District, the most urgent issue is the improvement of the collection service, followed by stable final disposal, and financial strengthening. It can be seen that waste minimization has a low priority. Accordingly, the Master Plan foresees waste minimization activities no sooner than the year 2009.

Consequently, this action program will only indicate broad guidelines for the activities, expecting that ADN would take up the issue with detailed planning when the need for such actions becomes pressing.

9.5.1 Program 501: Generation Control

This Program is related to "the Master Plan 7.3.5 b. Communication regarding Waste Minimization," "7.4.4 Waste Minimization," "Annex X Environmental Education, Training Workshop for the C/P Team," and "Annex Y Environmental Education, Workshop for Teachers."

a. Objectives and Targets

The objective of this program is the promotion of generation control, which is usually granted the highest priority in waste minimization. In other words, appropriate information concerning avoidance of waste generation is to be disseminated among community residents. Residents are encouraged to purchase durable goods that are not easily discarded as waste, to purchase recycled goods, to avoid using disposable containers, and so on. The targets of this program are the city population and residents of the neighboring municipalities, who commute daily to work in Santo Domingo, National District.

b. Organization

Environmental Information Center of EMUCD

EMUCD will take the initiative in this regard.

c. Activities and Schedule

Implementation of the following two actions is proposed, taking as reference the section of the Master Plan on waste minimization.

- Environmental education

- Charging SW tariff as a function of generated waste: Polluter Pays Principle

The following is the general schedule recommended.

Activities	2006	2007	2008
Environmental education	▬	▬	▬
SW tariff according to generated waste		▬	▬

d. Expected Results

The following products will be obtained as a result of this action plan:

- Environmental education on generation control is carried out by the Environmental Information Center
- A tariff corresponding to amount of waste is applied to ICIs.

9.5.2 Program 502: Discharge Control

This Program is related to "the Master Plan 7.3.5 b. Communication regarding Waste Minimization," "7.4.4 Waste Minimization," "Annex X Environmental Education, Training Workshop for the C/P Team," and "Annex Y Environmental Education, Workshop for Teachers."

a. Objectives and Targets

The objective of this program is the promotion of discharge control. In other words, reuse and recycling are to be promoted at the SW generation points, so that SW collection and final disposal will have to operate with reduced quantities of waste. The targets of this program are the city population and residents of the neighboring municipalities, who commute daily to work in Santo Domingo, National District.

b. Organization

Environmental Information Center, EMUCD, SEMARN

EMUCD will take the initiative in this regard.

c. Activities and Schedule

Implementation of the following four actions is proposed, taking as reference the section of the Master Plan on waste minimization.

- Environmental education
- Waste exchange
- Recycling at supermarkets and colmados
- Recycling at schools and communities

The following is the general schedule recommended.

Activities	2006	2007	2008
Environmental education			
Waste Exchange			
Recycling at supermarkets and colmados			
Recycling at schools and communities			

d. Expected Results

The following results will be obtained as a result of this action program:

- Environmental education on recycling is conducted by the Environmental Information Center
- Recycling activities are conducted at supermarkets, colmados and/or schools.

9.5.3 Program 503: Resource Recovery (Composting)

This Program is related to "the Master Plan 7.4.4 Waste Minimization, d. Resource Recovery."

a. Objectives and Targets

The objective of this program is the implementation of composting as one aspect of the promotion of resource recovery, taking as reference the section of the Master Plan on waste minimization.

b. Organization

EMUCD

c. Activities and Schedule

Formulation of a plan for composting is required, including site selection and a feasibility study. On the other hand, organic waste should be secured for raw materials, by introducing separate waste storage in public markets.

- to conduct a feasibility study along with site selection
- to introduce separate waste storage at the municipal markets
- to begin a composting program targeting biodegradable waste generated from the municipal markets and pruning of roadside trees

The following is the general schedule recommended.

Activities	2006	2007	2008	2009 - 11	2012 -15
Feasibility study					
Separate storage					
Composting					

d. Expected Results

The following result will be obtained as a result of this action program:

- Composting is carried out targeting the market waste.

9.6 Towards Achievement of the Financial Goal

The SWM cost of ADN is high, having comprised of around 40% of the executed budget of the city in 2005. On the other hand, the income from the SW collection service comprises of only around 25% of the cost of SW service. The remainder is covered by the general financial resources that the Central Government submits to each Municipality as a function of the population in the Municipality (Law 166-03). Then, it cannot be denied that the use of large amounts of the general financial resources in the SW service is a cause of placing restrictions on financial resources that could be used for other public services.

When the goal is to achieve appropriate solid waste management, placing restrictions on its expenditures is not desirable. As indicated in the Master Plan, expenditures will increase over the short run. For the financial strengthening of SWM, it is desirable to increase the income from SWM, which is presently low.

In line with the Polluter Pays Principle, it is desirable to impose the cost of the SWM service on the dischargers of solid waste. However, due consideration should be taken of the fact that some residents of Santo Domingo, National District, belong to the poverty group without the capacity to pay for the tariff of SWM service.

Taking into account all the above factors, the programs are recommended to achieve income improvement, cost control, and considerations for the poverty groups. A balanced implementation of these programs will make the attainment of the financial goals of the Master Plan possible, such as a more suitable allotment of the general financial resources to other public services, improved efficiency of SWM operations, and due considerations for the poverty groups.

9.6.1 Program 601: Increase of Income

This Program is related to “the Master Plan 7.3.4 Financial Management.”

a. Objectives and Targets

The objective of this program is to increase the income from the SWM service tariff paid by the dischargers of the solid waste. The need felt for the SWM service varies with each discharger of solid waste, and so varies the willingness to pay of each user of the service. Accordingly, appropriate measures should be devised, targeting such service users as households, small and medium size business firms, large commercial facilities, and offices, by taking into account the characteristics of each type of SW discharger.

b. Organization

Executing offices, Finance Directorate, EMUCD, Triple A

EMUCD will take the initiative in this regard.

c. Activities and Schedule

Official documents like the Population Census indicate the population of Santo Domingo, National District, to be around 1 million, the average family size is slightly over 4, resulting in around 200,000 households. On the other hand, the billing list of Triple A places the number of households at around 100,000. Even admitting that there are multi-family housing units (condominiums and apartments) which are counted as one bill, it appears that the difference with the official data is quite wide. It is known that Triple A constantly updates its list of customers, an action which is recommended to be continued, paying special attention to the discrepancy with the official data concerning the number of household clients.

Paying customers on the basis of the number of bills reached around 20% of households and around 40% of the other types of customers (commerce, industry, official). The goal should be to increase these percentages to around 90%.

The SW discharge quantity varies depending on the nature of the activities of the business firms and official institutions. The Municipal Urban Cleansing Regulation stipulates that non-household clients of the SWM service should pay according to the quantity of SW discharged. Enforcement of this legal provision is expected to increase the income from SWM, and also to achieve waste minimization.

At present, several private service providers, authorized by ADN, carry out the SW collection service exclusively targeting large generators. The collection companies and the SW dischargers enter into direct contractual agreements, and the service fees are paid directly by the SW dischargers to the collection service providers. The authorized private service provider has the obligation to pay 20% of their income to ADN. However, these payments of private service providers to ADN have been sporadic and small, not reaching even 1% of the SWM income. This situation requires clear improvements.

Implementation of the following four actions is recommended, taking as reference the section on financial management of the Master Plan.

- Expansion of the customer base
- Improvement of the bill collection rate
- Charging business establishments (ICI) according to the volume of waste that they generate
- Control of the service providers to big generators

The following is the general schedule recommended.

Activities	2006	2007	2008
Expansion of customer base			
Improvement of bill collection rate			
Charging ICI according to generated volume			
Control the service providers to big generators			

d. Expected Results

The following result will be obtained as a result of this action program:

- Income from collection service charge is increased.

9.6.2 Program 602: Reduction of Expenditures

This Program is related to “the Master Plan 7.3.4 Financial Management.”

a. Objectives and Targets

The objective of this program is not the reduction of the total expenditure of SWM, but the close oversight of individual expense items, in order to attain waste-less financial management. The targets are SWM expenditure items that are included in the budgets of EMUCD and other relevant municipal offices.

b. Organization

Executing offices, Finance Directorate, EMUCD, Triple A

Finance Directorate will take the initiative in this regard.

c. Activities and Schedule

Billing and collection of the SWM service are done by Triple A, a private company under contract with ADN. At present, the fees for this billing and collection service reaches around 30% of the bill collection amount. Although it appears to be high, a reduction of expenditure needed for the appropriate management of relevant activities cannot be recommended. However, as bill collection amount increases, it should be possible to hold discussions on ways to decrease the percentage of fees relative to the bill collection amount.

Effective use of financial resources requires clarification of the cost structure of the SWM service. In 2006 ADN began introducing improvements in the budget control system for the whole municipal budget, and this situation may be opportune to introduce a cost control system specific to SWM. The goal is to continuously monitor the SWM expenditure, in order to feedback the cost data to the operation units, seeking further improvements such as making the SW collection service even more efficient.

Implementation of the following two actions is recommended, taking as reference the section on financial management of the Master Plan.

- Reduction of the commercial service fee for billing and bill collection
- Clarification of the cost structure and monitoring

The following is the general schedule recommended.

Activities	2006	2007	2008
Reduction of commercial service fee		▬▬	▬▬
Clarification of cost structure and monitoring		▬▬	▬▬

d. Expected Results

The following result will be obtained as a result of this action program:

- Commercial service fee for billing and bill collection is reduced.

9.6.3 Program 603: Subsidy to the Poor

This Program is related to “the Master Plan 7.3.4 Financial Management.”

a. Objectives and Targets

The Polluter Pays Principle is well known in solid waste management. On the other hand, SWM is fundamentally a public service, and through provision of this service, all residents of a city should be guaranteed to live in a sanitary environment. Some residents of Santo Domingo, National District, belong to the poverty group without the capacity to pay for the SWM service tariff. The objective of this program is to use the subsidy to offset the lack of their capacity to pay for the SWM tariff, seeking continued improvements in the financial management of SWM as a whole.

b. Organization

Executing office, Finance Directorate, EMUCD, Triple A

Finance Directorate will take the initiative in this regard.

c. Activities and Schedule

At present, around three-fourths of the cost of SWM is covered by a subsidy from the Central Government (Law 166-03 allocates a percentage of the Central Government income to each Municipality according to the population of the Municipality, and this was the source of nearly 80% of the ADN budget). Hence, it might not be exaggerated to say that almost all residents of Santo Domingo, National District, are beneficiaries of the subsidy. In the future, the subsidy should be used only for the benefit of the poverty group without the capacity to pay for the tariff of SWM service.

The poverty group should be identified, and the amount of subsidy needed for this group should be calculated. Then, efforts should be made to reduce, up to the calculated amount, the Central Government subsidy devoted to the SWM service. On the other hand, those SWM service users with the capacity to pay should be properly charged and billed, seeking payment of the amount they consider appropriate to the service they receive, by taking the measures indicated above in the program to increase the SWM income.

- Clarification of the poverty group
- Estimation of the required subsidy
- Application of the subsidy to the poor
- Reduction of the total amount of subsidy in SWM

The following is the general schedule recommended.

Activities	2006	2007	2008
Clarification of the poverty group		━━	━━
Estimation of required subsidy		━━	━━
Application of subsidy to the poor			━━
Reduction of total amount of subsidy in SWM			━━

d. Expected Results

The following result will be obtained as a result of this action program:

- Subsidy is applied to the poor.
- Total amount of subsidy is reduced.

Chapter 10

Conclusion and Recommendations

10 Conclusion and Recommendations

10.1 Conclusion

10.1.1 The Current Situation of the MSWM and Challenges

a. Collection, Transport and Sweeping

a.1 Establishment of collection route and frequency was required

Regrettably, the city is not necessarily kept clean. Accumulated and scattered waste can often be found on roads and vacant spaces. The direct cause of this problem is the irregular collection service that causes waste to remain for a long period outside households. Adequate planning of collection routes and frequency and conduction of these routes are required to solve the problem.

a.2 Strengthening ADN's capability to manage contracts was required

Most of the collection service in the city is operated by the private sector. According to the contract, the contractors have to make a service operation plan including routes and frequency and submit it to ADN. However, such plans have never been prepared by them. Also, ADN does have the capability to instruct them to do so. ADN should strengthen its capability of contract management in order to encourage adequate participation of the private sector in the collection service.

a.3 Communication with the citizens was necessary

Collaboration with the citizens is indispensable for improving the collection service. The citizens have not been informed about the collection day and time, as those were not established. ADN has to establish a collection service plan and establish a system to distribute the information to the citizens.

a.4 Improvement of sweeping was necessary

In September 2005, about 1,500 people were working on sweeping. This figure later became 3,000 people. The reason why such a large number of sweepers were required is that the inadequate collection service increased the amount of waste scattered on the roads and required sweeping, and there was no efficient sweeping plan in place. The cost of sweeping was estimated as 30% of the total MSWM cost in 2005. This was a considerable financial burden for ADN. It is necessary to attack the improvement of sweeping along with the improvement of the collection service.

b. Final Disposal

b.1 Consensus building regarding Duquesa was necessary

At the initial stage of this Study, there was a concern of whether Duquesa would be closed due to the opening of the airport constructed nearby. At this time, the Secretariat of State for Public Works and Communications took the initiative in building consensus among the municipalities, which disposed their waste in Duquesa, and other institutions concerned for improving the operation. Thus, the airport and Duquesa coexist at present.

At the final stage of this Study, late September 2006, the Municipality of Santo Domingo Norte declared that it would tear up the contract with Duquesa Consortium who operates the landfill. Although the reason for this has not been clarified, there is a concern that the cancellation of this contract may adversely affect the MSWM of the concerned municipalities, e.g., temporal suspension of collection service.

Stable operation of Duquesa is indispensable for the municipalities that dispose of waste there. It is necessary to build consensus and work together for stable operation.

b.2 Consensus building for construction of a new landfill was necessary

It was roughly estimated that Duquesa could continue the operation for about 10 years more. However, the duration may change as no detailed operation plan has been prepared. Furthermore, closure of the operation may result if a fire occurs and it adversely impacts on the operation of the airport.

It is recommendable to build consensus among organizations concerned for construction of a new landfill, as it requires a long period of time and there are uncertainties on the operation of Duquesa as mentioned above.

c. Minimization

c.1 Start environmental education

The waste generation amount per capita was estimated as 1.5 kg/day. This value is comparable to that of industrialized countries and is large enough to require minimization. However, the MSWM in the National District should give priority to the improvement of the collection service taking into account the current situation. While doing so, it is recommendable to focus on environmental education that disseminates importance of minimization.

d. Finance

d.1 Improvement of the accounting system was required

Proper financial management is indispensable for stably and continuously providing the SW service to the citizens. In order to properly carry out financial management, it is necessary to accurately know how much is spent on what kind of activities. However, the current accounting system cannot give such information. Therefore, it is recommendable for ADN to clarify the cost structure of the MSWM and to establish an accounting system that makes it possible to give accurate and detailed financial information. Such information should be fed back to the MSWM for continuously improving its efficiency.

d.2 Increase of fare receipts was required

The fee collection rate at amount base was 7% in June 2004. It had been considerably improved to 43% in June 2005. However, it reached only to about 50% in June 2006. The improvement has slowed down. Four third of the MSWM cost is covered by the general budget, i.e., subsidies from the central government. It was recommendable to increase the fare receipt for the collection service in order to make the financial base stable. To reduce the dependence on subsidies also increases financial resources for other municipal services.

e. Institution and Organization

e.1 Establishment of legal infrastructure was required

The Secretariat of the State for Environment and Natural Resources had well developed legislations for solid waste management at the national level. However, the municipalities did not have legislations to meet with the requirements established by the national legislations. Therefore, a legislation was required that responds to the national legislations and to give guidance to the National District.

e.2 Strengthening of organizational ability was required

Up till now, change of organization and personnel has been conducted in each alteration of governments. This made it difficult to accumulate experiences and knowledge in public organizations. The MSWM is not an exception. The MSWM should solve many problems that arise every day, as well as coordinate the activities of several actors such as the citizens and service providers of the private sector. The complexity of the problems that they confront daily requires MSWM to have high technical and organizational abilities.

10.1.2 Pilot Projects

a. Integrated Collection Improvement

A series of pilot projects were conducted in order to improve the collection service. First, a project conducted by the direct operation of ADN with the principal purpose of letting ADN and the citizens understanding what is a good quality collection service. The target area was sector 6 according to the categorization of Triple A that extends to the south of Mirador Sur Park and has a population of 70,000.

Following that, a project was carried out with a private firm with the purpose of strengthening the contract management ability of ADN. The target area was sector 5 which extends to the north of Mirador Sur Park and has a population of 80,000.

The projects were composed mainly of two aspects. One was to approach the service senders; design the collection route and frequency, and implement and monitor it. The other was to address the service takers; distribute information regarding the collection day and time to the residents in order to encourage proper waste discharge.

As a result of the implementation of the projects, 97% of the residents expressed their satisfaction of the new collection service in the former case, and 93% confirmed improvement of the quality of collection service in the latter case. Therefore, it can be said that the new service introduced by the projects were adequate for the project area.

As for communication with the residents, various tools were employed. In particular, the distribution of leaflets, which give information about the collection day, time and a way of discharging waste, to the residents by hand with explanation, was effective. Also, holding meetings with communities, Juta de Vecinos, and explaining directly to the residents were effective ways.

Furthermore, the projects established a data management system to quantitatively monitor the collection service. With this system, it became possible to timely obtain detailed information of the collection service in the target area.

It is recommendable for ADN to expand the pilot projects to other areas, then to cover the whole city. In order to do so, a strong organization is required that is capable of designing a collection service plan, communicating with the residents, monitoring the collection service and feeding back lessons for continuous improvement.

b. Environmental Education

A project for environmental education focusing on waste minimization was carried out. The targets were the counterparts from ADN, the Secretariat of the State for Education and the Secretariat of the State for Environment and Natural Resources. Firstly, workshops were held targeting the counterparts. Secondly, the trained counterparts carried out workshops inviting teachers from seven schools. Finally, those teachers practiced trial environmental education classes in their schools inviting the counterparts and other teachers to observe.

The counterparts and the teachers fully understood the contents of the workshops. The trial lessons acquired a favorable reputation from the parents. It can be said that the project may be acceptable for the society of the National District.

The issue is sustainability, because it is disputable that ADN gives resources for such activities. SEE may have to take in charge of these kind of activities.

However, ADN has the Environmental Information Center. In the pilot project, staffs of the center played important roles and the workshops were held in the center. The Center can play a role, such as holding workshops, within the jurisdiction of ADN.

10.1.3 The Master Plan

The Master Plan was prepared on the basis of understanding of the current challenges and the lessons learned from the pilot projects.

a. Two Scenarios, MP1 and MP2

The Master Plan has two scenarios, MP1 and MP2, as it is uncertain that Duquesa operates until the target year, 2015. MP1 considers that Duquesa operates until 2015. Meanwhile, MP2 assumes that a new landfill, which is located 40km away from the city center, operates after 2012. Setting these two scenarios, the Master Plan increases its flexibility.

b. Basic Concept, Objectives and Goals of the Master Plan

The ADN's vision in the field of MSWM is a "Clean City", where the citizens enjoy a sound environment. The M/P contributes to realize this vision.

The basic approach of the M/P is "collaboration among the municipal government, the citizens and the private sector", taking into account the importance of their appropriate participation in the MSWM. In this collaboration, ADN is expected to assure provision of proper SW service, the citizens are to contribute by respecting discharge manners, and the private sector is to operate the SW service efficiently according to contracts.

The M/P aims at the "establishment of a Sustainable Solid Waste Service." Its goals are 1) 100% collection rate, 2) sanitary landfilling at Duquesa or a new site, 3) 15% waste minimization rate, and 4) less than 50% dependence on subsidies.

c. Institutional System

- The Municipal Regulation for Urban Cleansing was prepared as the legal basis of the Master Plan. This was given by its quick approval by the City Council and its enactment by the Mayor's Office in September 2006.

- The Master Plan proposes coordinated action among Municipal Directorates related to solid waste management, strengthening of the executing office EMUCD, and the establishment of a municipal company which would be open to citizens but would prevent uncalled for political interference in its management.

- Within ADN, one aspect of the capacity of the organization that should be developed refers to the public private partnership. The Master Plan presents the definitions of the collection service and the expected image of each service, indicating the design of all the collection activities. Also, the Master Plan presents guidelines for bidding, like the order of bidding tasks, contents of the bidding, and contract auditing, as a set of activities for contract management.

- In order to provide a high quality solid waste service in a continued and stable way, it

is necessary to secure the required income and use it effectively. At present, ADN is in the process of undertaking improvements in the budget control system, which are expected to result in more precise calculation of the solid waste management cost. Furthermore, the Master Plan recommends the addition of an accounting system specific to solid waste management, if such a need is recognized.

- Proposed measures to increase the income from solid waste management include improving the accuracy of the number of billed customers, charging a license fee and stricter control of the private companies providing the service to large generators. On the other hand, measures recommended to reduce costs include the already mentioned improvement of cost estimation, the continued monitoring of cost items, and the re-negotiation of commercial fees for billing and bill collection services.

- The use of subsidies is recommended for the residents of the city in the poverty group, while for those with the capacity to pay, the application of the Polluter Pays Principle is recommended as payment for the incurred cost.

- Communication topics and methods have been proposed to residents with regard to the collection service and problems of waste minimization.

d. Technical System

- Appropriate manners of storage and discharge were recommended for each type of discharger.

In the pursuit of a collection service market with order, the Master Plan divided the collection service into six categories, taking into account the road conditions, quantity of waste discharged, and type of solid waste. It further indicates the types and quantities of equipment needed.

Assuming that in the future the final disposal site would be constructed farther away, a study was conducted for transfer and transport. Joint decision with the counterpart personnel assumed that the new disposal site would be located 40km away, in which case the conclusion was that transfer and transport would be more economical. Therefore, the Master Plan includes a plan for transfer and transport. The capacity of the new transfer station is 1,300 ton/day.

The Master Plan includes such indicators as the lineal meters to be swept by a sweeper in one day, the necessary number of brooms and plastic bags. Furthermore, the necessary number of sweepers and equipment are estimated.

In waste minimization, the differences and priorities are given for generation control, discharge control, resource recovery, followed by recommendations on environmental education, volumetric tariff, recycling based on the Extended Producer Principle, and composting with the use of market waste and pruning waste.

The final disposal site is located in Santo Domingo Norte Municipality, out of the scope of this Study, whereby no plan has been formulated. However, measures are presented as an action plan for the improvement of Duquesa, the existing final disposal site. Also, guidelines are presented for the event that a new final disposal site is needed, indicating in the corresponding action plan the measures needed for the selection of an appropriate site.

e. Evaluation

The Master Plan was evaluated from the viewpoints of institutions, techniques, the environment, social, economic and finance perspectives. Then, the validity of the implementation of the M/P was confirmed.

In both the financial and economic evaluation, the "With M/P" was favorable compared to the "Without M/P". In the financial evaluation, the calculation of Net Present Value at a 10% discount rate resulted in the "w/ M/P" exceeding the "w/o M/P" by 9.73 million US$ in the case of MP1 and by 17.89 million US$ in the case of MP2. Likewise, in the economic evaluation, the "w/ M/P" exceeded the "w/o MP" by 34.44 million US$ in the case of MP1 and by 42.63 million US$ in the case of MP2.

Financial Justification for the Implementation of the Master Plan

Cases	Master Plan 1 (Million US$)	Master Plan 2 (Million US$)
With Master Plan	228.47	245.00
Without Master Plan	255.70	290.57
NPV (10%)	9.73	17.89

Economic Justification for the Implementation of the Master Plan

Cases	Master Plan 1 (Million US$)	Master Plan 2 (Million US$)
With Master Plan	174.88	189.61
Without Master Plan	238.55	271.59
NPV (10%)	34.44	42.63

10.1.4 Action Programs

Programs to be implemented during preparation, 2006, and phase I, 2007 – 2008, of the M/P were presented. In addition, procedures for site selection and construction of a new landfill and recommendations for the construction of a new transfer station as technical guidance are presented for the case of necessary.

10.2 Recommendations

The following recommendations are made for achieving the M/P goals and for realizing the ADN's vison, "Clean City."

a. Towards achievement of the Master Plan Goals

It is recommendable to begin with the Action Programs under the Strategy towards achievement of the M/P Goals. What is described in the M/P will become reality by implementing the Action Programs.

b. Keep in mind the Objectives of the MSWM

The main objectives of the MSWM are 1) to eliminate waste from living environment so citizens can enjoy their healthy lives, 2) to dispose of waste so the collected waste does not cause an adverse impact on the environment, and 3) to encourage waste minimization to reduce the burden on the MSWM and to preserve natural resources. In addition, the MSWM should contribute to social well-being as a public service.

The Master Plan set its goals according to the objectives. Therefore, the most important is the objectives and the goals are the second important.

The M/P Goals are considerably challenging. ADN is expected to give efforts to attain the goals. However, the objectives should always be kept in mind. Those should not be underestimated. For example, if waste is illegally dumped to reduce transportation time, to collect more waste in the city. It will cause serious environmental contamination and undermine the citizens' confidence in the MSWM.

Therefore, ADN is also required to continuously review the goals taking into account results of measures and the external environment.

c. Carrying out of "Check – Plan – Do – See"

Various actors play in the MSWM and act according to their characteristics. Such behavioral traits change in correspondence to the socioeconomic system. For example; consumption increases along with an economic upward trend, then the amount of waste also increases; technical innovation shifts use of glass for containers to plastic, then, it results in waste. The MSWM is a mirror of the socioeconomic system, it changes along with time, and there is no absolute unique answer for the MSWM.

In order to cope with such changeable MSW issues, the management body has to set goals according to the objectives, to plan activities for attaining the goals, to establish indicators to measures results of the activities, to continuously monitor and analyze the indicators and to feedback to the activities. In short, the management body is required to carry out the "Check – Plan – Do – See," in their day to day operations. While doing so, if it is clear that the goals do not meet with the objectives, new goals will have to be set up again.

ADN is also expected to accumulate experiences and knowledge by carrying out the "Check – Plan – Do – See," and continuously strengthen its ability. First, in the contract management of the collection service, it is expected to employ qualified persons, to design collection routes, to review the contracts or to invite bid, and to establish a contract auditing system according to the Action Plan.

ADN has just begun to proceed towards establishment of the proper MSWM. It could make a big step, if it gets a certain technical support to follow this Study at the initial stage in the Master Plan.

In conclusion, the Study Team would like to express its appreciation to all organizations and individuals on both the Dominican side and the Japanese side, who participated and cooperated with the Study. We expect that what we have done together with the counterpart will lead to the establishment of sustainable MSWM in Santo Domingo de Guzman , National District, Dominican Republic.