



No.

REPUBLIC OF CUBA
MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT IN HAVANA CITY
PROVINCIAL DIRECTION OF COMMUNAL SERVICES

**THE STUDY
ON
INTEGRATED MANAGEMENT PLAN
OF
MUNICIPAL SOLID WASTE
IN HAVANA CITY
- REPUBLIC OF CUBA -**

**Final Report
《 Volume IV : Data Book 》**



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DATABOOK

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PART 2 THE MASTER PLAN

A. MSW Generation, Recycle and Composting:

A1 Waste Quality and Composition Survey

A1 WASTE QUALITY AND COMPOSITION SURVEY

1 Waste Quantity and Composition Survey

1.1 Objective

The first objective of the waste quantity and composition survey on MSW was to understand the quantity and physical composition of MSW generated in each type of waste source, and to confirm waste amount transported to landfill sites by collection equipment. The other objective was technical transfer of the survey implementation. This survey was carried out both the dry as well as rainy seasons. The C/P initially observed how to manage the survey in the dry season, and then undertook the main survey role in the rainy season.

1.2 Methodology

The target of the waste quantity and quality survey is outlined bellow:

- Type of waste: MSW
- Target item: weight, volume, and composition (physical composition, bulk density, water content) of MSW
- Type of waste source: household, office, restaurant, hotel, and final disposal

Regarding selection of municipalities to be targeted in the household survey, various characteristics were considered as is impossible to classify actual income level of households in Cuban society. Table 1 shows the number of targets in the survey.

Table 1 Target of Waste Quantity and Composition Survey on MSW

Type of Waste Source	Number of Target
Household	45 households, (5municipalities, 9 household/municipality) Old city area: 2 municipalities (<i>Centro Havana, Plaza</i>) Suburbs: 3municipalities (<i>Boyeros, Guanabacoa, Marianao</i>)
Office	3 offices
Restaurant	3 restaurants (<i>Maraca, El Conejito, Monseigneur</i>)
Hotel	3 hotels (<i>Hotel Riviera, Hotel Colina, Hotel Vedado</i>)
Landfill site	Provincial Landfills: <i>Calle 100 , Guanabacoa</i> Special Period Landfills: <i>Fratánidad, Los Perros</i>

(1) Methodology

a) Waste Quantity Survey at Waste Generation Source

Each household, office, restaurant, and hotels was requested to store waste during the survey period. Surveyors visited these targets to collect their waste.

Especially in households, residents were requested to separate organic and inorganic waste.

Inorganic waste actually includes some organic materials such as wood and textile. The conductor of the survey and staff of C/P explained in advance to residents that organic waste meant kitchen waste and some other organic materials unsuitable for recycling such as used toilet paper. This separation enabled material other than waste separated as organic waste to be kept in a dry condition.

b) Waste Quantity Survey at Landfill Site

The numbers of waste collection equipment transporting waste to a landfill site were counted at the selected site. The waste type and type of collection equipment outlined below were identified.

- Type of waste: domestic, bulk, construction, soil, market, yard, medical
- Type of equipment: compactor truck, dump truck, tractor cart, horse cart, other

c) Waste Composition Survey

Collected waste at generation source was manually segregated in the composition survey after gathering. Eleven types of material shown below were applied as the segregation of the composition survey:

Composition: 1) Paper and card board, 2) Aluminum, 3) Scrap metals, 4) Plastics, 5) Grass and Ceramics, 6) Textile, 7) Wood, 8) Food waste, 9) Rubber, 10) Leather, 11) Others

Bulk density and water content were measured and analyzed for each waste source.

(2) Schedule

The survey was conducted in two seasons, namely the dry and rainy seasons. The schedule of waste quantity and quality survey is shown in the following tables.

The wastes collected on the first day from four types of generation source were not used in data processing. The collection on the first day was meant to empty all waste at every generation source.

Table 2 Schedule of Generation Quantity and Composition Survey (Household and Office)

Survey Season	Waste Collection	Composition Survey
Dry season	17-21 April	19, 21 April
Rainy season	30 September, 1-4 October	1, 4 October

Table 3 Schedule of Generation Quantity and Composition Survey (Restaurant and Hotel)

Survey Season	Waste Collection	Composition Survey
Dry season	16-20 April	17, 20 April
Rainy season	1-5 October	2, 4 October

Table 4 Schedule of Generation Quantity and Composition Survey (Landfill Site)

Survey Season	Transport Counting	Composition Survey
Dry season	16-20 April	17, 20 April
Rainy season	1-4 October	1, 2 October

(3) Results

1) Waste Generation Amount

a) Household

The results of the survey on waste generated in the household are shown in Table 5.

Waste generation unit of domestic waste obtained in the survey was 0.0 ~ 4.8 kg/day/person. The average value of 2 municipalities (*Centro Habana, Plaza*) of the old city area was 0.7 kg/day/person. The average value in 3 municipalities (*Guanabacoa, Marianao, Boyeros*) of the suburban area was 0.7 kg/day/person.

Table 5 Waste Generation Unit (household)

Municipality	Number of Target	Survey Days	Effective Number of Sample	Waste generation(kg/day/person)			
				Minimum	Average	Maximum	
Dry Season	<i>Centro Havana</i>	9	4	36	0.0	0.7	3.9
	<i>Guanabacoa</i>	9	4	36	0.1	0.6	2.1
	<i>Plaza</i>	9	4	36	0.1	0.7	3.4
	<i>Marianao</i>	9	4	36	0.2	0.9	2.5
	<i>Boyeros</i>	9	4	34	0.1	0.9	4.8
	Average	9	4	36	-	0.7	-
	Total	54	24	214	-	-	-
Rainy season	<i>Centro Havana</i>	9	4	35	0.1	0.6	3.2
	<i>Guanabacoa</i>	9	4	34	0.0	0.4	1.3
	<i>Plaza</i>	9	4	35	0.0	0.7	1.5
	<i>Marianao</i>	9	4	35	0.0	0.7	3.1
	<i>Boyeros</i>	9	4	36	0.1	0.6	1.9
	Average	9	4	35	-	0.6	-
	Total	54	24	211	-	-	-

Note: The value of waste generation unit is rounded to one decimal place.

b) Commercial

The results of the survey on waste generated in commercial facilities are shown in the following tables.

Waste generation unit of commercial waste obtained by the survey are as follows:

Dry season: office: 0.1~0.6 (average 0.3) kg/day/employee, hotel: 0.3~2.4 (average 1.2) kg/day/room, restaurant: 10.0~40.0 (average 30.5) kg/day/restaurant.

Rainy season: office: 0.0~0.4 (average 0.1) kg/day/employee, hotel: 0.5~1.3 (average 0.8) kg/day/room, restaurant: 14.4~40.3 (average 23.8) kg/day/restaurant.

In comparing of average value the waste generation was generally much in dray season than rainy season.

Table 6 Waste Generation Unit (Commercial)

Unit: Office: kg/day/employee, , Restaurant: kg/day/shop, Hotel: kg/day/room

Season	Type of commerce	Number of Target	Survey Days	Effective Number of Sample	Minimum	Average	Maximum
Dry Season	Office	3	2	6	0.1	0.3	0.6
	Hotel	3	4	11	0.3	1.2	2.4
	Restaurant	3	4	11	10.0	30.5	40.0
Rainy season	Office	3	2	6	0.0	0.1	0.4
	Hotel	2	4	7	0.5	0.8	1.3
	Restaurant	2	4	8	14.4	23.8	40.3

Note: The value of waste generation unit is rounded to one decimal place.

c) Landfill site

The results of the survey on waste transported to the landfill sites are shown in the following table 7~12.

The number of transport to *Calle100* landfill site was about 150~370 in dry season, and about 190~450 in rainy season.

The number of transport to *Guanabacoa* landfill site was about 40~130 in dry season, and about 20~78 in rainy season.

The number of transport to *Los Perros* landfill site was about 30~40 in dry season and about 10~50 in rainy season.

The number of transport to *Fratanidad* landfill site was 30~60 in dry season, and 20~40 in rainy season.

In general, the number decreased in holidays (18 April and 3 October were Sunday in the survey).

Table 7 Number of Waste Transport to Landfill Site by Waste and Equipment Type (1)

Calle 100 Landfill Site (Dry Season)

17-Apr

	Waste Type							
	Domestic	Bulky	Construction	Soil	Market	Yard	Other	Total
Compactor Truck	71 100%	0%	0%	0%	0%	0%	0%	71 100%
Dump Truck	0%	133 66%	36 21%	5 3%	7 2%	19 9%	0%	200 100%
Tractor Cart	0%	39 97%	2 3%	0%	0%	0%	0%	41 100%
Others	0%	2	0%	0%	0%	1 53%	0%	3 100%
Total	71 71%	174 21%	38 5%	5 1%	7 0%	20 2%	0%	315 100%

18-Apr

	Waste Type							
	Domestic	Bulky	Construction	Soil	Market	Yard	Other	Total
Compactor Truck	52 100%	0%	0%	0%	0%	0%	0%	52 100%
Dump Truck	25 35%	21 30%	6 7%	22 28%	0%	0%	0%	74 100%
Tractor Cart	15 65%	8 35%	0%	0%	0%	0%	0%	23 100%
Total	92 90%	29 6%	6 1%	22 3%	0%	0%	0%	149 100%

19-Apr

	Waste Type							
	Domestic	Bulky	Construction	Soil	Market	Yard	Other	Total
Compactor Truck	77 100%	0%	0%	0%	0%	0%	0%	77 100%
Dump Truck	0%	164 72%	44 21%	5 3%	0%	13 5%	0%	226 100%
Tractor Cart	0%	49 94%	2 3%	0%	0%	2 4%	0%	53 100%
Other	0%	1 100%	0%	0%	0%	0%	0%	1 100%
Total	77 69%	214 24%	46 5%	5 1%	0%	15 1%	0%	357 100%

20-Apr

	Waste Type							
	Domestic	Bulky	Construction	Market	Soil	Yard	Other	Total
Compactor Truck	79 99%	4 0%	1 0%	0%	0%	0%	0%	84 100%
Dump Truck	37 17%	125 58%	37 17%	1 0%	9 4%	8 3%	1 0%	218 100%
Tractor Cart	37 59%	25 34%	0%	0%	1 1%	4 6%	0%	67 100%
Total	153 79%	154 15%	38 4%	1 0%	10 1%	12 1%	1 0%	369 100%

Table 8 Number of Waste Transport to Landfill Site by Waste and Equipment Type (2)

Guanabacoa Landfill Site (Dry Season)

17-Apr

	Waste Type							Total
	Domestic	Bulky	Construction	Market	Soil	Yard	Other	
Dump Truck	24 30%	38 51%	6 8%	0 0%	1 1%	7 8%	1 1%	77 100%
Tractor Cart	20 86%	4 14%	0 0%	0 0%	0 0%	0 0%	0 0%	24 100%
Total	44 46%	42 40%	6 6%	0 0%	1 1%	7 6%	1 1%	101 100%

18-Apr

	Waste Type							Total
	Domestic	Bulky	Construction	Market	Soil	Yard	Other	
Compactor Truck	0 0%	1 31%	0 0%	0 0%	1 69%	0 0%	0 0%	2 100%
Dump Truck	20 77%	0 0%	0 0%	0 0%	6 23%	0 0%	0 0%	26 100%
Tractor Cart	12 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	12 100%
Total	32 82%	1 1%	0 0%	0 0%	7 17%	0 0%	0 0%	40 100%

19-Apr

	Waste Type							Total
	Domestic	Bulky	Construction	Market	Soil	Yard	Other	
Compactor Truck	3 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	3 100%
Dump Truck	26 28%	48 57%	1 1%	0 0%	6 7%	3 3%	3 3%	87 100%
Tractor Cart	28 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	28 100%
Total	57 62%	48 30%	1 1%	0 0%	6 4%	3 2%	3 2%	118 100%

20-Apr

	Waste Type							Total
	Domestic	Bulky	Construction	Market	Soil	Yard	Other	
Compactor Truck	6 33%	4 29%	0 0%	0 0%	4 30%	1 9%	0 0%	15 100%
Dump Truck	62 77%	3 4%	1 1%	0 0%	7 10%	3 5%	3 3%	79 100%
Tractor Cart	28 87%	0 0%	0 0%	1 4%	1 4%	1 4%	0 0%	31 100%
Total	98 75%	7 5%	1 1%	1 1%	12 10%	5 5%	3 2%	127 100%

Table 9 Number of Waste Transport to Landfill Site by Waste and Equipment Type (3)

Los Perros Landfill Site (Dry Season)

17-Apr

	Waste Type	
	Domestic	Total
Horse Cart	29	29
Dump Truck	3	3
Tractor Cart	3	3
Total	35	35

18-Apr

	Waste Type	
	Domestic	Total
Horse Cart	27	27
Tractor Cart	2	2
Total	29	29

19-Apr

	Waste Type	
	Domestic	Total
Horse Cart	29	29
Dump Truck	6	6
Tractor Cart	7	7
Total	42	42

20-Apr

	Waste Type	
	Domestic	Total
Horse Cart	32	32
Compactor Truck	2	2
Dump Truck	2	2
Tractor Cart	5	5
Other	1	1
Total	42	42

Fratanidad Landfill Site (Dry Season)

17-Apr

	Waste Type	
	Domestic	Total
Horse Cart	39	39
Total	39	39

18-Apr

	Waste Type	
	Domestic	Total
Horse Cart	35	35
Total	35	35

19-Apr

	Waste Type	
	Domestic	Total
Horse Cart	59	59
Total	59	59

20-Apr

	Waste Type	
	Domestic	Total
Horse Cart	32	32
Total	32	32

Table 10 Number of Waste Transport to Landfill Site by Waste Type and Equipment Type (4)

Calle 100 Landfill Site (Rainy season)

1-Oct

	Waste Type				
	Domestic	Bulky	Construction	Soil	Total
Dump Truck	337 83%	38 9%	1 0%	30 7%	406 100%
Tractor Cart	31 82%	7 18%	0 0%	0 0%	38 100%
Others	8 73%	2 18%	0 0%	1 9%	11 100%
Total	376 83%	47 10%	1 0%	31 7%	455 100%

2-Oct

	Waste Type				
	Domestic	Bulky	Construction	Yard	Total
Compactor Truck	54 100%	0 0%	0 0%	0 0%	54 100%
Dump Truck	0 0%	17 24%	13 18%	41 58%	71 100%
Tractor Cart	3 10%	10 33%	0 0%	17 57%	30 100%
Others	0 0%	16 47%	10 29%	8 24%	34 100%
Total	57 30%	43 23%	23 12%	66 35%	189 100%

4-Oct

	Waste Type				
	Domestic	Bulky	Construction	Yard	Total
Compactor Truck	68 100%	0 0%	0 0%	0 0%	68 100%
Dump Truck	0 0%	50 31%	20 12%	92 57%	162 100%
Tractor Cart	0 0%	20 33%	3 5%	37 62%	60 100%
Others	0 0%	31 53%	17 29%	10 17%	58 100%
Total	68 20%	101 29%	40 11%	139 40%	348 100%

Table 11 Number of Waste Transport to Landfill Site by Waste Type and Equipment Type (5)

Guanabacoa Landfill Site (Rainy season)

1-Oct

	WasteType						
	Domestic	Bulky	Construction	Soil	Market	Yard	Total
Compactor Truck	15 94%	1 6%	0%	0%	0%	0%	16 100%
Dump Truck	18 18%	49 50%	7 7%	4 4%	3 3%	17 17%	98 100%
Tractor Cart	19 70%	7 26%	0%	0%	0%	1 4%	27 100%
HorseCart	5 100%	0%	0%	0%	0%	0%	5 100%
Total	57 39%	57 39%	7 5%	4 3%	3 2%	18 12%	146 100%

2-Oct

	WasteType					
	Domestic	Bulky	Construction	Soil	Yard	Total
Compactor Truck	0%	1 50%	0%	0%	1 50%	2 100%
Dump Truck	21 36%	27 47%	7 12%	3 5%	0%	58 100%
Tractor Cart	15 88%	2 12%	0%	0%	0%	17 100%
Others	1 100%	0%	0%	0%	0%	1 100%
Total	37 47%	30 38%	7 9%	3 4%	1 1%	78 100%

3-Oct

	WasteType				
	Domestic	Bulky	Construction	Yard	Total
Compactor Truck	11 100%	0%	0%	0%	11 100%
Dump Truck	11 61%	2 11%	2 11%	3 17%	18 100%
Tractor Cart	13 100%	0%	0%	0%	13 100%
Total	35 83%	2 5%	2 5%	3 7%	42 100%

Table 12 Number of Waste Transport to Landfill Site by Waste Type and Equipment Type (6)

Los Perros Landfill Site (Rainy Season)

1-Oct

	Waste Type			
	Domestic	Bulk	Yard	Total
Compactor Truck	1			1
Tractor Cart	1	4	3	8
Horse Cart	34			34
Total	36	4	3	43

2-Oct

	Waste Type	
	Domestic	Total
Horse Cart	20	20
Total	20	20

3-Oct

	Waste Type	
	Domestic	Total
Tractor Cart	1	1
Horse Cart	8	8
Total	9	9

4-Oct

	Waste Type			
	Domestic	Bulk	Yard	Total
Compactor Truck	2			2
Dump Truck			3	3
Tractor Cart		5	4	9
Horse Cart	38			38
Total	40	5	7	52

Fratanidad Landfill Site (Rainy Season)

1-Oct

	Waste Type	
	Domestic	Total
Horse Cart	38	38
Total	38	38

2-Oct

	Waste Type	
	Domestic	Total
Horse Cart	38	38
Others	2	2
Total	40	40

3-Oct

	Waste Type	
	Domestic	Total
Horse Cart	20	20
Total	20	20

4-Oct

	Waste Type	
	Domestic	Total
Horse Cart	38	38
Total	38	38

2) Waste Composition

a) Household

The results of the composition survey on waste generated in a household are shown in Tables 13~14.

Paper/cardboard, Glass, and kitchen waste occupied high percentage of the waste generated in households.

b) Commercial

The results of the composition survey on waste generated in commercial facilities are shown in Tables 15~16.

Paper and cardboard showed high percentages in the composition of solid waste generated in offices.

c) Landfill site

The results of the composition survey on waste transported to the landfill sites are shown in Tables 17~18. The percentage of kitchen waste is most among all materials.

Table 13 Result of Composition Survey (Household, Dry Season)

Municipality		<i>Centro Havana</i>		<i>Guanabacoa</i>		<i>Plaza de la Rev.</i>		<i>Marianao</i>		<i>Boyeros</i>	
Survey Date		19 Apr.	21 Apr.	19 Apr.	21 Apr.	19 Apr.	21 Apr.	19 Apr.	21 Apr.	19 Apr.	21 Apr.
No.	Component	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)
1	Paper & Cardboard	9.9	9.4	9.3	7.0	0.8	2.4	5.2	19.1	6.1	23.6
2	Aluminum	0.7	0.0	0.6	0.5	0.8	0.6	0.6	1.9	0.6	0.6
3	Scrap metals	0.7	0.0	3.5	0.5	0.0	0.0	0.0	0.0	0.0	0.6
4	Plastics	7.9	4.7	6.4	8.1	5.0	7.1	11.7	10.5	8.9	12.9
5	Glass	15.1	0.9	18.6	21.6	7.6	12.9	3.9	3.8	12.3	8.4
6	Textile	0.7	0.0	2.3	0.5	0.0	0.0	0.6	0.0	0.0	6.2
7	Wood & Yard waste	2.0	17.0	0.6	13.0	0.0	44.1	1.3	0.0	2.2	10.1
8	Kitchen waste	63.2	67.9	55.8	48.6	85.7	32.9	76.6	64.8	69.3	37.6
9	Rubber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
10	Leather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	Others	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Bulk Density (kg/little)	0.25	0.20	0.24	0.13	0.31	0.13	0.22	0.07	0.24	0.16
	Water Content (wt-%)	49.3	-	42.7	-	62.9	-	49.0	-	49.3	-

Table 14 Result of Composition Survey (Household, Rainy season)

Municipality		<i>Centro Havana</i>		<i>Guanabacoa</i>		<i>Plaza de la Rev.</i>		<i>Marianao</i>		<i>Boyeros</i>	
Survey Date		1 Oct.	3 Oct.	1 Oct.	3 Oct.	1 Oct.	3 Oct.	1 Oct.	3 Oct.	1 Oct.	3 Oct.
No.	Component	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)
1	Paper & Cardboard	7.6	12.9	13.7	13.1	6.1	7.5	8.4	10.8	24.1	3.4
2	Aluminum	0.0	5.2	1.5	4.4	0.0	0.7	10.5	0.9	1.6	1.1
3	Scrap metals	1.9	3.2	0.0	3.6	0.0	2.0	0.0	0.0	0.0	0.0
4	Plastics	10.1	7.1	7.6	11.7	4.5	4.1	14.7	13.8	13.6	3.4
5	Glass	6.3	11.6	13.7	5.8	15.2	2.0	2.1	19.8	10.5	4.5
6	Textile	1.9	2.6	1.5	2.9	0.0	0.7	16.8	1.3	1.0	1.1
7	Wood & Yard waste	0.0	3.2	3.8	4.4	0.0	0.0	0.0	6.0	1.0	0.0
8	Kitchen waste	72.2	54.2	58.0	48.2	74.2	83.0	45.3	44.8	48.2	86.5
9	Rubber	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.6	0.0	0.0
10	Leather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	Others	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Bulk Density (kg/little)	0.25	0.20	0.12	0.09	0.26	0.26	0.10	0.15	0.18	0.24
	Water Content (wt-%)	55.6	-	45.7	-	53.2	-	35.8	-	35.9	-

Table 15 Result of Composition Survey (Commercial, Dry Season)

Type of commerce		Office	Hotel		Restaurant	
Survey Date		21 April	17 April	20 April	17 April	20 April
No.	Component	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)
1	Paper & Cardboard	37.9	19.8	23.3	16.2	28.6
2	Aluminum	0.5	1.8	3.2	4.8	2.9
3	Scrap metals	0.0	0.5	1.8	2.4	0.6
4	Plastics	7.1	7.8	10.8	4.8	12.0
5	Glass	3.3	17.1	8.6	18.0	20.6
6	Textile	0.5	0.5	0.4	0.0	0.0
7	Wood & Yard waste	0.0	0.0	0.0	0.0	0.0
8	Kitchen waste	50.5	52.5	52.0	53.9	35.4
9	Rubber	0.0	0.0	0.0	0.0	0.0
10	Leather	0.0	0.0	0.0	0.0	0.0
11	Others	0.0	0.0	0.0	0.0	0.0
TOTAL		100.0	100.0	100.0	100.0	100.0
Bulk Density (kg/little)		0.10	0.21	0.11	0.17	0.09

Table 16 Result of Composition Survey (Commercial, Rainy season)

Type of commerce		Office		Hotel		Restaurant	
Survey Date		1 Oct	4 Oct	1 Oct	4 Oct	1 Oct	4 Oct
No.	Component	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)	(wt-%)
1	Paper & Cardboard	70.9	25.0	23.5	19.0	23.9	27.7
2	Aluminum	0.0	0.0	1.5	38.0	14.2	0.8
3	Scrap metals	0.0	1.4	3.0	1.2	1.6	0.0
4	Plastics	3.6	4.2	7.6	10.4	12.9	13.1
5	Glass	0.0	0.0	9.8	6.3	5.2	5.4
6	Textile	0.0	1.4	2.3	1.7	1.9	1.2
7	Wood & Yard waste	1.8	1.4	0.0	0.0	0.6	1.2
8	Kitchen waste	23.6	66.7	52.3	23.3	39.5	50.8
9	Rubber	0.0	0.0	0.0	0.0	0.0	0.0
10	Leather	0.0	0.0	0.0	0.0	0.0	0.0
11	Others	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0
Bulk Density (kg/little)		-	0.12	0.27	0.16	-	0.21

Table 17 Result of Composition Survey (Landfill Site, Dry Season)

Category of Landfill Site		Provincial Landfill Site		Special Period Landfill Site	
Survey Date		17 April	20 April	17 April	20 April
No.	Component	(wt-%)	(wt-%)	(wt-%)	(wt-%)
1	Paper & Cardboard	13.4	10.3	12.6	10.7
2	Aluminum	0.9	0.6	0.5	0.3
3	Scrap metals	1.2	0.2	1.3	0.0
4	Plastics	10.1	8.2	10.3	7.7
5	Glass	2.0	3.9	0.9	3.0
6	Textile	3.9	3.0	2.0	4.3
7	Wood & Yard waste	4.9	4.4	9.5	7.7
8	Kitchen waste	58.3	65.3	47.4	65.2
9	Rubber	0.0	0.0	0.0	0.0
10	Leather	1.0	1.1	0.0	0.0
11	Others	4.6	3.2	15.8	1.0
	TOTAL	100.0	100.0	100.0	100.0
	Bulk Density (kg/little)	0.37	0.27	0.33	-
	Water Content (wt-%)	-	43.7	-	45.7

Table 18 Result of Composition Survey (Landfill site, Rainy season)

Category of Landfill Site		Provincial Landfill Site		Special Period Landfill Site	
Survey Date		1 Oct	2 Oct	1 Oct	2 Oct
No.	Component	(wt-%)	(wt-%)	(wt-%)	(wt-%)
1	Paper & Cardboard	8.8	20.8	17.7	11.8
2	Aluminum	1.4	2.8	0.0	1.7
3	Scrap metals	0.3	0.0	1.0	0.0
4	Plastics	10.9	14.7	9.6	8.4
5	Glass	1.0	3.2	1.3	3.4
6	Textile	2.4	2.3	8.1	1.7
7	Wood & Yard waste	2.2	2.5	2.7	2.5
8	Kitchen waste	73.0	52.9	55.4	70.6
9	Rubber	0.0	1.0	0.3	0.0
10	Leather	0.0	0.0	0.0	0.0
11	Others	0.2	0.0	4.0	0.0
	TOTAL	100.0	100.0	100.0	100.0
	Bulk Density (kg/little)	0.48	0.29	0.32	0.23
	Water Content (wt-%)	52.1	-	42.1	-

A. MSW Generation, Recycle and Composting:

A2 Questionnaire for Recycling Market Survey

A2 QUESTIONNAIRE FOR RECYCLING MARKET SURVEY

(1) Questionnaire for ERMP Havana City

Please provide us the following data.

1. Trend of material recovery in Havana city

Materials	Amount of Recovery (ton/year)				
	1990	1995	2000	Latest year(200_)	
				Havana City	Cuba
1. Paper and Card board					
2. Plastic bottles (PET)					
3. Other plastics					
4. Ferrous scrap					
5. Alminium					
6. Glass					
7. Grass bottles					
8. Textiles					
9.					
10.					
11.					

2. Amount of material recovery by materials in Havana city in 200_

① Paper and Card Board

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

② Plastic Bottles (PET)

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

③ Other Plastics

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

④ Ferrous scrap

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

⑤ Aluminium

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

⑥ Glass bottles

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

⑦ Textiles

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

⑧

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Industry		
2. Delegations		
3. Junk buyer		
4. Population		
5. CDR		
6.		

3. Number of delegation of UERMP in municipalities

Municipality	Nos. of delegation office	Nos. of staff
Head quarter of ERMP Havana	---	
Playa		
Plaza		
Centro Havana		
Havana Vieja		
Regla		
Havana del Este		
Guanabacoa		
San Miguel		
Diez de Octubre		
Cerro		
Marianao		
La Lisa		
Boyeros		
Arroyo Naranjo		
Cotorro		
Total	62	

4. Means for utilization of the recovered materials

① Paper and Card Board

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

② Plastic Bottles (PET)

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

③ Other Plastics

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

④ Ferrous scrap

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

⑤ Aluminium

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

⑥ Glass bottles

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

⑦ Textiles

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

⑧

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

⑨

Route for Utilization	Amount (kg/month)	Unit price for selling (US\$/kg)
1. Domestic Industry		
2. International market		
3. Re-use		
4.		
5.		

5. Future plan of material recovery and processing by UERMP

Please describe this matter below.

(2) Questionnaire for Manufacturer

Please provide us the following data.

1. Type of business

1. Collection of materials

2. Produce of raw material by means of collected material

3. Produce of product/commodity by means of collected material

Kind of product/commodity: _____

4. Others _____

2. Number of Employee

_____ employees

3. Trend of amount of recovered material treated in your company/organization

Materials	Amount (ton/year)			
	1990	1995	2000	Latest year (200__)
1.				
2.				
3.				
4.				

4. Income by business

_____ US\$/year in latest year (200_)

_____ US\$/year in 2000

_____ US\$/year in 1995

5. Amount of material recovery by materials in Havana city

① _____

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Other Industry		
2. Junk buyer		
3. General people		
4. CDR		
5.		

How is the trend of buying price in 1 year?

1. Coming up _____% up compared to the price of 1 year ago
 2. Coming down _____% down compared to the price of 1 year ago
 3. Stable 4. Others _____

How is the trend of buying price in 5 years?

1. Coming up _____% up compared to the price of 5 years ago
 2. Coming down _____% down compared to the price of 5 years ago
 3. Stable 4. Others _____

② _____

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Other Industry		
2. Junk buyer		
3. General people		
4. CDR		
5.		

How is the trend of buying price in 1 years?

1. Coming up _____% up compared to the price of 1 year ago
 2. Coming down _____% down compared to the price of 1 year ago
 3. Stable 4. Others _____

How is the trend of buying price in 5 years?

1. Coming up _____% up compared to the price of 5 years ago
 2. Coming down _____% down compared to the price of 5 years ago
 3. Stable 4. Others _____

③ _____

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Other Industry		
2. Junk buyer		
3. General people		
4. CDR		
5.		

How is the trend of buying price in 1 years?

1. Coming up _____% up compared to the price of 1 year ago
 2. Coming down _____% down compared to the price of 1 year ago
 3. Stable 4. Others _____

How is the trend of buying price in 5 years?

1. Coming up _____% up compared to the price of 5 years ago
 2. Coming down _____% down compared to the price of 5 years ago
 3. Stable 4. Others _____

④ _____

Recovery Source	Amount of Recovery (kg/month)	Unit price for buying (US\$/kg)
1. Other Industry		
2. Junk buyer		
3. General people		
4. CDR		
5.		

How is the trend of buying price in 1 years?

1. Coming up _____% up compared to the price of 1 year ago
 2. Coming down _____% down compared to the price of 1 year ago
 3. Stable 4. Others _____

How is the trend of buying price in 5 years?

1. Coming up _____% up compared to the price of 5 years ago
 2. Coming down _____% down compared to the price of 5 years ago
 3. Stable 4. Others _____

(3) Answer from ERMP Havana City to Questionnaire

Product recovery trend in Havana City

Product	Amount recovered (ton/year)	
	2000	2003
Paper and cardboard	10718.70	7469.3
Plastic	356.70	452.2
Steel and cast iron	70939.30	29975.6
Aluminum	668.50	3599.5
Glass	428.90	224.3
Glass bottles	9064.40	9012.0
Fabric scraps	190.70	151.4
Fabric packs	3350.80	2501.2
Bronze	296.40	865.7
Copper	657.60	1673.3
Lead	802.40	303.2

Amount of materials recovered in Havana City

Paper and cardboard

Source	Amount recovered (ton/year)		Unit purchase price (USD/ton)	
	2000	2003	2000	2003
Industry	9733.46	5029.0		
Purchase shops		146.066		
CDR	848.07	1886.956		
MRF	137.223	407.459		

Plastic

Source	Amount recovered (ton/year)		Unit purchase price (USD/ton)	
	2000	2003	2000	2003
Industry	225.402	160.0		
Purchase shops				
CDR	86.833	217.48		
MRF	44.465	48.145		

Ferrous scrap

Source	Amount recovered (ton/year)		Unit purchase price (USD/ton)	
	2000	2003	2000	2003
Industry	70660.1	26294.0		
Purchase shops		2861.044		
CDR	247.782	772.552		
MRF	31.394	48.886		

Aluminum

Source	Amount recovered (ton/year)		Unit purchase price (USD/ton)	
	2000	2003	2000	2003
Industry	435.500	71.0		
Purchase shops	160.000	3485.88		
CDR	60.583	36.476		
MRF	12.395	6.259		

Number of ERMP-Havana City purchase shops by municipality

Municipality	Number of purchase shops	Staff
Playa	7	7
Plaza	6	6
Centro Habana	4	4
Habana Vieja	5	5
Regla	3	3
Habana del Este	6	6
Guanabacoa	4	4
San Miguel	6	6
10 de Octubre	5	5
Cerro	5	5
Marianao	5	5
La Lisa	4	4
Boyeros	8	8
Arroyo Naranjo	4	4
Cotorro	4	4
Total	76	76

Usage of recovered materials

Paper and cardboard

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	9974.2	7835.7		

Plastics

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	235.4	425.2		

Ferrous scrap

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	63430.0	27869.5		

Aluminum

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	668.6	1831.1		

Glass bottles

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	2453.3	5617.4		

Fabric packs

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	3350.8	2342.7		

Fabric scrap

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	190.7	148.3		

Copper

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	657.6	1702.5		

Bronze

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	296.4	703.9		

Lead

Source	Amount recovered (ton/year)		Purchase unit price (USD/ton)	
	2000	2003	2000	2003
Industry	802.3	283.5		

MRF (Recoverers of the Future Movement)

CDR (Committees for the Defense of the Revolution)

A. MSW Generation, Recycle and Composting:

A3 Projection of Waste Generation

A3 PROJECTION OF WASTE GENERATION

(1) Demarcation of Municipalities covered by Facilities for Solid Waste Management

Landfill to where waste to be collected without segregation will be transported

No.	Municipality	2006	2007-2009	2010	2011-2012	2013-2015
1	Playa	Calle 100	Calle 100 Ex			
2	Plaza de la Revolucion	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	
3	Centro Habana	Calle 100	Calle 100 Ex	Calle 100 Ex	NG	
4	Habana Vieja	Calle 100	Calle 100 Ex	Calle 100 Ex	NG	
5	Regla	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	New site 1
6	Habana del Este	Ocho vias, SPL	NG			
7	Guanabacoa	Ocho vias, SPL	NG	NG	NG	NG
8	San Miguel del Padron	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	New site 1
9	Diez de Octubre	Calle 100	Calle 100 Ex	Calle 100 Ex	NG	
10	Cerro	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	
11	Marianao	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	New site 1
12	La Lisa	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	New site 1
13	Boyeros	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	New site 1
14	Arroyo Naranjo	Calle 100	Calle 100 Ex	Calle 100 Ex	New site 1	New site 1
15	Cotorro	Calle 100	NG	NG	NG	NG

Note: NG: New Guanabacoa landfill Calle 100 Ex: Calle 100 landfill extension
SPL: special period landfills

Composting yard to where kitchen waste will be transported

No.	Municipality	2006	2007-2009	2010	2011-2012	2013-2015
1	Playa			NG	NG	Calle 100
2	Plaza de la Revolucion					Calle 100
3	Centro Habana					NG
4	Habana Vieja					NG
5	Regla					
6	Habana del Este			NG	NG	NG
7	Guanabacoa					
8	San Miguel del Padron					
9	Diez de Octubre					NG
10	Cerro					Calle 100
11	Marianao					
12	La Lisa					
13	Boyeros					
14	Arroyo Naranjo					
15	Cotorro					

Note: NG: New Guanabacoa composting yard

Recycling plant to where resource waste will be transported

No.	Municipality	2006	2007-2009	2010	2011-2012	2013-2015
1	Playa			Calle 100	Calle 100	Calle 100
2	Plaza de la Revolucion					Calle 100
3	Centro Habana					NG
4	Habana Vieja					NG
5	Regla					
6	Habana del Este			Calle 100	Calle 100	NG
7	Guanabacoa					
8	San Miguel del Padron					
9	Diez de Octubre					NG
10	Cerro					Calle 100
11	Marianao					
12	La Lisa					
13	Boyeros					
14	Arroyo Naranjo					
15	Cotorro					

Note: N.G.: New Guanabacoa recycling plant

Landfill to where other waste will be transported

No.	Municipality	2006	2007-2009	2010	2011-2012	2013-2015
1	Playa			Calle 100 Ex	New site 1	New site 1
2	Plaza de la Revolucion					New site 1
3	Centro Habana					NG
4	Habana Vieja					NG
5	Regla					
6	Habana del Este			NG	NG	NG
7	Guanabacoa					
8	San Miguel del Padron					
9	Diez de Octubre					NG
10	Cerro					New site 1
11	Marianao					
12	La Lisa					
13	Boyeros					
14	Arroyo Naranjo					
15	Cotorro					

Note: NG: New Guanabacoa landfill Calle 100 Ex: Calle 100 landfill extension

(2) Prediction of Domestic Solid Waste Amount

Population by Municipality

	Municipality	Year										
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	180,964	182,638	184,313	185,988	187,663	189,337	191,194	193,051	194,908	196,765	198,624
2	Plaza de la Revolucion	171,970	170,710	169,450	168,190	166,930	165,670	164,410	162,885	161,360	159,835	158,045
3	Centro Habana	152,595	151,337	150,079	148,821	147,563	146,306	145,048	143,552	142,056	140,560	138,824
4	Habana Vieja	94,703	94,696	94,689	94,682	94,675	94,669	94,662	94,523	94,384	94,245	93,973
5	Regla	42,513	42,616	42,720	42,824	42,928	43,031	43,135	43,072	43,009	42,946	42,715
6	Habana del Este	183,095	184,774	186,453	188,132	189,811	191,489	193,168	195,022	196,876	198,730	200,760
7	Guanabacoa	105,729	106,529	107,329	108,129	108,929	109,730	110,530	111,650	112,770	113,890	115,330
8	San Miguel del Padron	153,386	151,109	148,832	146,555	144,278	142,003	139,726	137,382	135,038	132,694	130,281
9	Diez de Octubre	228,940	228,766	228,591	228,416	228,241	228,066	227,891	227,556	227,221	226,886	226,389
10	Cerro	134,598	134,357	134,117	133,877	133,637	133,397	133,157	132,961	132,765	132,569	132,416
11	Marianao	137,349	134,838	132,326	129,814	127,302	124,791	122,279	119,960	117,641	115,322	113,195
12	La Lisa	126,038	124,928	123,818	122,708	121,598	120,487	119,377	117,919	116,461	115,003	113,195
13	Boyeros	185,178	186,871	188,564	190,257	191,950	193,641	195,334	197,185	199,036	200,887	202,896
14	Arroyo Naranjo	197,655	196,422	195,189	193,956	192,723	191,489	190,256	188,693	187,130	185,567	183,674
15	Cotorro	73,690	74,443	75,196	75,949	76,702	77,456	78,209	79,377	80,545	81,713	83,294
	Total	2,168,404	2,165,034	2,161,666	2,158,298	2,154,930	2,151,562	2,148,376	2,144,788	2,141,200	2,137,612	2,135,747

Source of total population of Havana City predicted for 2005, 2015: Proyeccion de la Poblacion Nivel Nacinal y Provincial Period 2000-2025, Oficina Nacional de Estadisticas Centro de Estudios de Poblacion y Desarrollo, 1999

Note: Population by municipalities were predicted by the JICA Study Team

Unit Generation Rate of Domestic Waste

0.7 kg/person/day

Source: Waste Quantity and Quality Survey conducted by the Study Team, CITMA and DPSC, 2004

This rate is set by the result of waste quantity survey conducted in the Study. This value is constant throughout the target period of the master plan based on the assumption of future economic condition of Havana City.

Calculation of Amount of Domestic Solid Waste Generation

[Amount of domestic waste generation in municipality]
= [Unit generation rate of domestic solid waste] x [population in municipality]

(3) Prediction of Commercial Solid Waste Generation

Unit Generation Rate of Commercial Waste

Hotel	1.2 kg/room/day
Restaurant	31 kg/ restaurant/day
Others	0.3 kg/ employee/day

Source: Waste Quantity and Quality Survey conducted by the Study Team, CITMA and DPSC, 2004

Market	60 t/day in Havana City
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The amount of market waste generated is estimated utilizing weight data of market waste as measured at the recycling plant and the total weight of agricultural products sold in each type of market. This measured data provides weight of waste generated from December 2003 to February 2004 in some of the markets.

Prediction of Number of Hotel Rooms

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	4,416	4,481	4,546	4,611	4,675	4,740	4,805	4,870	4,935	5,000	5,065
2	Plaza de la Revolucion	Urban	3,997	4,087	4,177	4,267	4,357	4,447	4,538	4,628	4,718	4,808	4,898
3	Centro Habana	Urban	1,132	1,170	1,209	1,248	1,286	1,325	1,364	1,402	1,441	1,479	1,518
4	Habana Vieja	Urban	1,132	1,170	1,209	1,248	1,286	1,325	1,364	1,402	1,441	1,479	1,518
5	Regla	Urban											
6	Habana del Este	Semi-urban	3,786	4,196	4,607	5,017	5,428	5,838	6,249	6,659	7,070	7,480	7,891
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		4,416	4,481	4,546	4,611	4,675	4,740	4,805	4,870	4,935	5,000	5,065

Note: Number of hotel rooms in 2003, 2025 is predicted by Physical Planning Institute (PPI). The JICA Study Team predicted the number in each year based on the prediction by PPI.

Prediction of Number of Restaurant

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	21	21	22	22	22	23	23	23	24	24	25
2	Plaza de la Revolucion	Urban	19	19	20	20	21	21	22	22	23	23	24
3	Centro Habana	Urban	5	6	6	6	6	6	6	7	7	7	7
4	Habana Vieja	Urban	5	6	6	6	6	6	6	7	7	7	7
5	Regla	Urban											
6	Habana del Este	Semi-urban	18	20	22	23	25	27	29	31	33	35	39
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		68	71	74	77	80	84	87	90	93	96	102

Note: The number of restaurants will increase in response to demand due to the development in tourism.

Number of Office Workers in Municipalities

	Municipality	Workers	Percentage
1	Playa	245,582	27%
2	Plaza de la Revolucion	108,959	12%
3	Centro Habana	53,873	6%
4	Habana Vieja	73,275	8%
5	Regla	21,568	2%
6	Habana del Este	46,928	5%
7	Guanabacoa	29,278	3%
8	San Miguel del Padron	25,485	3%
9	Diez de Octubre	43,399	5%
10	Cerro	50,625	6%
11	Marianao	35,362	4%
12	La Lisa	31,159	3%
13	Boyeros	81,154	9%
14	Arroyo Naranjo	39,202	4%
15	Cotorro	29,144	3%
	Total	914,993	100%

Source: Anuario Statistics de Cuba 2002

Calculation of Amount of Commercial Solid Waste Generation

[Amount of waste generation in hotels]

$$= [\text{Unit generation rate of solid waste in hotels}] \times [\text{number of hotel rooms}]$$

[Amount of waste generation in restaurants]

$$= [\text{Unit generation rate of solid waste in restaurants}] \times [\text{number of restaurants}]$$

[Amount of waste generation in other commerce]

$$= [\text{Unit generation rate of solid waste in other commerce}] \times [\text{number of workers in other commerce}]$$

(4) Estimation of Material Utilization Amount

Physical Composition of Solid Waste

Type of Waste Source		Domestic (wt-%)	Hotel (wt-%)	Restaurant (wt-%)	Office (wt-%)
No.	Component				
1	Paper & Cardboard	9	22	22	38
2	Aluminum	1	3	4	1
3	Scrap metals	1	1	2	0
4	Plastics	8	9	8	7
5	Glass	11	13	19	3
6	Textile	1	0	0	1
7	Wood & Yard waste	9	0	0	0
8	Kitchen waste	60	52	45	51
9	Rubber	0	0	0	0
10	Leather	0	0	0	0
11	Others	0	0	0	0
TOTAL		100	100	100	100

Source: Waste Quantity and Quality Survey conducted by the Study Team, CITMA and DPSC, 2004

Ratio of Defined Use as Usable in Segregated Waste

Classification in Segregation	Material	Defined Form of Use	Ratio of Defined Form of Use
Resources	Glass	Drink bottles	0.9
	Aluminum	Drink cans	0.9
	Metals	Drink cans, food containers	0.9
	Plastic	Bottles	0.1
	Paper	Card board	0.2
Kitchen waste		Kitchen waste	0.9

Note: The values were set based on the observation in Waste Quantity and Quality Survey

Ratio of Proper Discharge of Resources in Segregated Collection

Material	Introduction of segregation		
	1st year	2nd year	After 3rd year
Glass	0.5	0.6	0.7
Aluminum	0.6	0.7	0.8
Metals	0.6	0.7	0.8
Plastic	0.4	0.6	0.8
Paper	0.6	0.7	0.8

Note: The values were set considering easiness of separation of material

(5) Amount of MSW Generation by Generation Sources

Domestic Waste Generation (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	127	128	129	130	131	133	134	135	136	138	139
2	Plaza de la Revolucion	Urban	120	119	119	118	117	116	115	114	113	112	111
3	Centro Habana	Urban	107	106	105	104	103	102	102	100	99	98	97
4	Habana Vieja	Urban	66	66	66	66	66	66	66	66	66	66	66
5	Regla	Urban	30	30	30	30	30	30	30	30	30	30	30
6	Habana del Este	Semi-urban	128	129	131	132	133	134	135	137	138	139	141
7	Guanabacoa	Semi-urban	74	75	75	76	76	77	77	78	79	80	81
8	San Miguel del Padron	Semi-urban	107	106	104	103	101	99	98	96	95	93	91
9	Diez de Octubre	Urban	160	160	160	160	160	160	160	159	159	159	158
10	Cerro	Urban	94	94	94	94	94	93	93	93	93	93	93
11	Marianao	Semi-urban	96	94	93	91	89	87	86	84	82	81	79
12	La Lisa	Semi-urban	88	87	87	86	85	84	84	83	82	81	79
13	Boyeros	Semi-urban	130	131	132	133	134	136	137	138	139	141	142
14	Arroyo Naranjo	Semi-urban	138	137	137	136	135	134	133	132	131	130	129
15	Cotorro	Semi-urban	52	52	53	53	54	54	55	56	56	57	58
	Total		1,517	1,514	1,515	1,512	1,508	1,505	1,501	1,498	1,498	1,494	

Commercial Waste Generation [hotel] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	5	5	5	5	6	6	6	6	6	6	6
2	Plaza de la Revolucion	Urban	4	5	5	5	5	5	5	6	6	6	6
3	Centro Habana	Urban	2	2	2	2	2	2	2	2	2	2	2
4	Habana Vieja	Urban	2	2	2	2	2	2	2	2	2	2	2
5	Regla	Urban											
6	Habana del Este	Semi-urban	4	5	5	6	6	7	7	8	8	9	9
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		17	19	19	20	21	22	22	24	24	25	25

Commercial Waste Generation [restaurant] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
2	Plaza de la Revolucion	Urban	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7
3	Centro Habana	Urban	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	Habana Vieja	Urban	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
5	Regla	Urban											
6	Habana del Este	Semi-urban	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.8	2.9	3.0

Commercial Waste Generation [other commercial] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	27	27	27	27	27	27	27	27	27	27	27
2	Plaza de la Revolucion	Urban	12	12	12	12	12	12	12	12	12	12	12
3	Centro Habana	Urban	6	6	6	6	6	6	6	6	6	6	6
4	Habana Vieja	Urban	8	8	8	8	8	8	8	8	8	8	8
5	Regla	Urban	2	2	2	2	2	2	2	2	2	2	2
6	Habana del Este	Semi-urban	5	5	5	5	5	5	5	5	5	5	5
7	Guanabacoa	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
8	San Miguel del Padron	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
9	Diez de Octubre	Urban	5	5	5	5	5	5	5	5	5	5	5
10	Cerro	Urban	6	6	6	6	6	6	6	6	6	6	6
11	Marianao	Semi-urban	4	4	4	4	4	4	4	4	4	4	4
12	La Lisa	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
13	Boyeros	Semi-urban	9	9	9	9	9	9	9	9	9	9	9
14	Arroyo Naranjo	Semi-urban	4	4	4	4	4	4	4	4	4	4	4
15	Cotorro	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
	Total		100	100	100	100	100	100	100	100	100	100	100

Waste Generation [Bulky Waste and Others] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	76	76	76	76	76	76	76	76	76	76	76
2	Plaza de la Revolucion	Urban	56	56	56	56	56	56	56	56	56	56	56
3	Centro Habana	Urban	21	21	21	21	21	21	21	21	21	21	21
4	Habana Vieja	Urban	48	48	48	48	48	48	48	48	48	48	48
5	Regla	Urban	6	6	6	6	6	6	6	6	6	6	6
6	Habana del Este	Semi-urban	59	59	59	59	59	59	59	59	59	59	59
7	Guanabacoa	Semi-urban	51	51	51	51	51	51	51	51	51	51	51
8	San Miguel del Padron	Semi-urban	13	13	13	13	13	13	13	13	13	13	13
9	Diez de Octubre	Urban	9	9	9	9	9	9	9	9	9	9	9
10	Cerro	Urban	12	12	12	12	12	12	12	12	12	12	12
11	Marianao	Semi-urban	14	14	14	14	14	14	14	14	14	14	14
12	La Lisa	Semi-urban	18	18	18	18	18	18	18	18	18	18	18
13	Boyeros	Semi-urban	76	76	76	76	76	76	76	76	76	76	76
14	Arroyo Naranjo	Semi-urban	35	35	35	35	35	35	35	35	35	35	35
15	Cotorro	Semi-urban	27	27	27	27	27	27	27	27	27	27	27
	Total		520	520	520	520	520	520	520	520	520	520	520

(6) Amount of MSW to be Collected by DPSC, UPPH

Waste Collection for Material Recovery (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban						20	20	20	20	20	20	
2	Plaza de la Revolucion	Urban									16	16	16	
3	Centro Habana	Urban									10	10	10	
4	Habana Vieja	Urban									9	9	9	
5	Regla	Urban												
6	Habana del Este	Semi-urban						7	7	7	7	7	7	
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban									10	10	10	
10	Cerro	Urban									10	10	10	
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		0	0	0	0	0	0	27	27	27	84	84	84

Waste Collection for Composting (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban						66	66	66	66	66	66	
2	Plaza de la Revolucion	Urban									58	58	58	
3	Centro Habana	Urban									37	37	37	
4	Habana Vieja	Urban									34	34	34	
5	Regla	Urban												
6	Habana del Este	Semi-urban						24	24	24	24	24	24	
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban									40	40	40	
10	Cerro	Urban									40	40	40	
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		0	0	0	0	0	0	90	90	90	299	299	299

Waste Collection of Others (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban	63	63	63	63	63	63	63	63	63	63	63	63
2	Plaza de la Revolucion	Urban				46	46	46				46	46	
3	Centro Habana	Urban				27	27	27				27	27	
4	Habana Vieja	Urban				28	28	28				28	28	
5	Regla	Urban												
6	Habana del Este	Semi-urban	19	19	19	19	19	19	19	19	19	19	19	
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban				28	28	28				28	28	
10	Cerro	Urban				29	29	29				29	29	
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		83	83	83	241	241	241	83	83	83	241	241	

Mixed Waste Collection (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	149	149	149	149	149						
2	Plaza de la Revolucion	Urban	121	121	121	121	121	121	121	121			
3	Centro Habana	Urban	74	74	74	74	74	74	74	74			
4	Habana Vieja	Urban	71	71	71	71	71	71	71	71			
5	Regla	Urban	26	26	26	26	26	26	26	26	26	26	26
6	Habana del Este	Semi-urban	51	51	51	51	51						
7	Guanabacoa	Semi-urban	40	40	40	40	40	40	40	40	40	40	40
8	San Miguel del Padron	Semi-urban	36	36	36	36	36	36	36	36	36	36	36
9	Diez de Octubre	Urban	78	78	78	78	78	78	78	78			
10	Cerro	Urban	80	80	80	80	80	80	80	80			
11	Marianao	Semi-urban	64	64	64	64	64	64	64	64	64	64	64
12	La Lisa	Semi-urban	48	48	48	48	48	48	48	48	48	48	48
13	Boyeros	Semi-urban	42	42	42	42	42	42	42	42	42	42	42
14	Arroyo Naranjo	Semi-urban	48	48	48	48	48	48	48	48	48	48	48
15	Cotorro	Semi-urban	14	14	14	14	14	14	14	14	14	14	14
	Total		940	940	940	940	940	740	740	740	316	316	316

All Waste Collection (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	149	149	149	149	149	149	149	149	149	149	149
2	Plaza de la Revolucion	Urban	121	121	121	121	121	121	121	121	121	121	121
3	Centro Habana	Urban	74	74	74	74	74	74	74	74	74	74	74
4	Habana Vieja	Urban	71	71	71	71	71	71	71	71	71	71	71
5	Regla	Urban	26	26	26	26	26	26	26	26	26	26	26
6	Habana del Este	Semi-urban	51	51	51	51	51	51	51	51	51	51	51
7	Guanabacoa	Semi-urban	40	40	40	40	40	40	40	40	40	40	40
8	San Miguel del Padron	Semi-urban	36	36	36	36	36	36	36	36	36	36	36
9	Diez de Octubre	Urban	78	78	78	78	78	78	78	78	78	78	78
10	Cerro	Urban	80	80	80	80	80	80	80	80	80	80	80
11	Marianao	Semi-urban	64	64	64	64	64	64	64	64	64	64	64
12	La Lisa	Semi-urban	48	48	48	48	48	48	48	48	48	48	48
13	Boyeros	Semi-urban	42	42	42	42	42	42	42	42	42	42	42
14	Arroyo Naranjo	Semi-urban	48	48	48	48	48	48	48	48	48	48	48
15	Cotorro	Semi-urban	14	14	14	14	14	14	14	14	14	14	14
	Total		940	940	940	940	940	940	940	940	940	940	940

Waste Collection for Material Recovery (m³/day) by DPSC,UPPH

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban						200	200	200	200	200	200	
2	Plaza de la Revolucion	Urban										160	160	160
3	Centro Habana	Urban										100	100	100
4	Habana Vieja	Urban										90	90	90
5	Regla	Urban												
6	Habana del Este	Semi-urban						70	70	70	70	70	70	70
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban										100	100	100
10	Cerro	Urban										100	100	100
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		0	0	0	0	0	0	270	270	270	820	820	820

Waste Collection for Composting (m³/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban						150	150	150	150	150	150	150
2	Plaza de la Revolucion	Urban										130	130	130
3	Centro Habana	Urban										80	80	80
4	Habana Vieja	Urban										80	80	80
5	Regla	Urban												
6	Habana del Este	Semi-urban						50	50	50	50	50	50	50
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban										90	90	90
10	Cerro	Urban										90	90	90
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		0	0	0	0	0	200	200	200	670	670	670	670

Waste Collection of Others (m³/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban						530	530	530	530	530	530	530
2	Plaza de la Revolucion	Urban										380	380	380
3	Centro Habana	Urban										230	230	230
4	Habana Vieja	Urban										230	230	230
5	Regla	Urban												
6	Habana del Este	Semi-urban						160	160	160	160	160	160	160
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban										230	230	230
10	Cerro	Urban										240	240	240
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		0	0	0	0	0	690	690	690	2,000	2,000	2,000	2,000

Mixed Waste Collection (m³/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	830	830	830	830	830						
2	Plaza de la Revolucion	Urban	670	670	670	670	670	670	670	670			
3	Centro Habana	Urban	410	410	410	410	410	410	410	410			
4	Habana Vieja	Urban	390	390	390	390	390	390	390	390			
5	Regla	Urban	140	140	140	140	140	140	140	140	140	140	140
6	Habana del Este	Semi-urban	280	280	280	280	280						
7	Guanabacoa	Semi-urban	220	220	220	220	220	220	220	220	220	220	220
8	San Miguel del Padron	Semi-urban	200	200	200	200	200	200	200	200	200	200	200
9	Diez de Octubre	Urban	430	430	430	430	430	430	430	430			
10	Cerro	Urban	440	440	440	440	440	440	440	440			
11	Marianao	Semi-urban	350	350	350	350	350	350	350	350	350	350	350
12	La Lisa	Semi-urban	260	260	260	260	260	260	260	260	260	260	260
13	Boyeros	Semi-urban	230	230	230	230	230	230	230	230	230	230	230
14	Arroyo Naranjo	Semi-urban	260	260	260	260	260	260	260	260	260	260	260
15	Cotorro	Semi-urban	80	80	80	80	80	80	80	80	80	80	80
	Total		5,190	5,190	5,190	5,190	5,190	4,080	4,080	4,080	1,740	1,740	1,740

All Waste Collection (m³/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	830	830	830	830	830	880	880	880	880	880	880
2	Plaza de la Revolucion	Urban	670	670	670	670	670	670	670	670	670	670	670
3	Centro Habana	Urban	410	410	410	410	410	410	410	410	410	410	410
4	Habana Vieja	Urban	390	390	390	390	390	390	390	390	400	400	400
5	Regla	Urban	140	140	140	140	140	140	140	140	140	140	140
6	Habana del Este	Semi-urban	280	280	280	280	280	280	280	280	280	280	280
7	Guanabacoa	Semi-urban	220	220	220	220	220	220	220	220	220	220	220
8	San Miguel del Padron	Semi-urban	200	200	200	200	200	200	200	200	200	200	200
9	Diez de Octubre	Urban	430	430	430	430	430	430	430	430	420	420	420
10	Cerro	Urban	440	440	440	440	440	440	440	440	430	430	430
11	Marianao	Semi-urban	350	350	350	350	350	350	350	350	350	350	350
12	La Lisa	Semi-urban	260	260	260	260	260	260	260	260	260	260	260
13	Boyeros	Semi-urban	230	230	230	230	230	230	230	230	230	230	230
14	Arroyo Naranjo	Semi-urban	260	260	260	260	260	260	260	260	260	260	260
15	Cotorro	Semi-urban	80	80	80	80	80	80	80	80	80	80	80
	Total		5,190	5,190	5,190	5,190	5,190	5,240	5,240	5,240	5,230	5,230	5,230

Waste Collection [Domestic] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	116	116	116	116	115	115	115	115	115	115	115
2	Plaza de la Revolucion	Urban	104	103	103	103	103	103	103	103	102	102	102
3	Centro Habana	Urban	66	66	66	66	66	66	66	66	66	66	66
4	Habana Vieja	Urban	61	61	61	61	61	61	61	61	61	61	61
5	Regla	Urban	23	23	23	23	23	23	23	23	23	23	23
6	Habana del Este	Semi-urban	41	40	40	39	39	38	38	37	37	36	36
7	Guanabacoa	Semi-urban	36	36	36	36	36	36	36	36	36	36	36
8	San Miguel del Padron	Semi-urban	33	33	33	33	33	33	33	33	33	33	33
9	Diez de Octubre	Urban	73	73	73	73	73	73	73	73	73	73	73
10	Cerro	Urban	75	75	75	75	75	75	75	75	75	75	75
11	Marianao	Semi-urban	60	60	60	60	60	60	60	60	60	60	60
12	La Lisa	Semi-urban	44	44	44	44	44	44	44	44	44	44	44
13	Boyeros	Semi-urban	33	33	33	33	33	33	33	33	33	33	33
14	Arroyo Naranjo	Semi-urban	43	43	43	43	43	43	43	43	43	43	43
15	Cotorro	Semi-urban	11	11	11	11	11	11	11	11	11	11	11
	Total		821	819	819	818	816	815	815	813	813	812	812

Amount to be collected for Material Recovery [Domestic] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						15	15	15	15	15	15
2	Plaza de la Revolucion	Urban									14	14	14
3	Centro Habana	Urban									9	9	9
4	Habana Vieja	Urban									8	8	8
5	Regla	Urban											
6	Habana del Este	Semi-urban						5	5	5	5	5	5
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban									10	10	10
10	Cerro	Urban									10	10	10
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		0	0	0	0	0	20	20	20	70	70	70

Amount to be collected for composting in facility [Domestic] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						63	63	63	63	63	63
2	Plaza de la Revolucion	Urban									55	55	55
3	Centro Habana	Urban									36	36	36
4	Habana Vieja	Urban									33	33	33
5	Regla	Urban											
6	Habana del Este	Semi-urban						21	21	20	20	19	19
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban									40	40	40
10	Cerro	Urban									40	40	40
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		0	0	0	0	0	84	84	84	287	286	286

Amount to be Collected as Others [Domestic] (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban						38	38	38	38	38	38	
2	Plaza de la Revolucion	Urban										33	33	33
3	Centro Habana	Urban										22	22	22
4	Habana Vieja	Urban										20	20	20
5	Regla	Urban												
6	Habana del Este	Semi-urban						12	12	12	12	12	12	12
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban										24	24	24
10	Cerro	Urban										24	24	24
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
	Total		0	0	0	0	0	50	50	50	50	172	172	172

Amount of Mixed Collection [Domestic] (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban	116	116	116	116	115							
2	Plaza de la Revolucion	Urban	104	103	103	103	103	103	103	102				
3	Centro Habana	Urban	66	66	66	66	66	66	66	66				
4	Habana Vieja	Urban	61	61	61	61	61	61	61	61				
5	Regla	Urban	23	23	23	23	23	23	23	23	23	23	23	23
6	Habana del Este	Semi-urban	41	40	40	39	39							
7	Guanabacoa	Semi-urban	36	36	36	36	36	36	36	36	36	36	36	36
8	San Miguel del Padron	Semi-urban	33	33	33	33	33	33	33	33	33	33	33	33
9	Diez de Octubre	Urban	73	73	73	73	73	73	73	73				
10	Cerro	Urban	75	75	75	75	75	75	75	75				
11	Marianao	Semi-urban	60	60	60	60	60	60	60	60	60	60	60	60
12	La Lisa	Semi-urban	44	44	44	44	44	44	44	44	44	44	44	44
13	Boyeros	Semi-urban	33	33	33	33	33	33	33	33	33	33	33	33
14	Arroyo Naranjo	Semi-urban	43	43	43	43	43	43	43	43	43	43	43	43
15	Cotorro	Semi-urban	11	11	11	11	11	11	11	11	11	11	11	11
	Total		821	819	819	818	816	662	662	661	284	284	284	284

Waste Collection [hotel] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	5	5	5	5	6	6	6	6	6	6	6
2	Plaza de la Revolucion	Urban	4	5	5	5	5	5	5	6	6	6	6
3	Centro Habana	Urban	2	2	2	2	2	2	2	2	2	2	2
4	Habana Vieja	Urban	2	2	2	2	2	2	2	2	2	2	2
5	Regla	Urban											
6	Habana del Este	Semi-urban	4	5	5	6	6	7	7	8	8	9	9
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		17	19	19	20	21	22	22	24	24	25	25

Amount to be collected for Material Recovery [hotel] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						1	1	1	1	1	1
2	Plaza de la Revolucion	Urban									1	1	1
3	Centro Habana	Urban									0	0	0
4	Habana Vieja	Urban									0	0	0
5	Regla	Urban											
6	Habana del Este	Semi-urban						1	1	2	2	2	2
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		0	0	0	0	0	3	3	3	5	5	5

Amount to be collected for composting in facility [hotel] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						3	3	3	3	3	3
2	Plaza de la Revolucion	Urban									3	3	3
3	Centro Habana	Urban									1	1	1
4	Habana Vieja	Urban									1	1	1
5	Regla	Urban											
6	Habana del Este	Semi-urban						3	3	4	4	4	4
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		0	0	0	0	0	6	6	7	11	12	12

Amount to be Collected as Others [Hotel] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						2	2	2	2	2	2
2	Plaza de la Revolucion	Urban									2	2	2
3	Centro Habana	Urban									1	1	1
4	Habana Vieja	Urban									1	1	1
5	Regla	Urban											
6	Habana del Este	Semi-urban						2	2	3	3	3	3
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
Total								4	4	5	8	8	8

Amount of Mixed Collection [Hotel] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	5	5	5	5	6						
2	Plaza de la Revolucion	Urban	4	5	5	5	5	5	5	6			
3	Centro Habana	Urban	2	2	2	2	2	2	2	2			
4	Habana Vieja	Urban	2	2	2	2	2	2	2	2			
5	Regla	Urban											
6	Habana del Este	Semi-urban	4	5	5	6	6						
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
Total			17	19	19	20	21	9	9	10			

Waste Collection [restaurant] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
2	Plaza de la Revolucion	Urban	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7
3	Centro Habana	Urban	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	Habana Vieja	Urban	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
5	Regla	Urban											
6	Habana del Este	Semi-urban	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.8	2.9	3.0

Amount to be collected for Material Recovery[restaurant] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						0.2	0.2	0.2	0.2	0.2	0.2
2	Plaza de la Revolucion	Urban									0.2	0.2	0.2
3	Centro Habana	Urban									0.1	0.1	0.1
4	Habana Vieja	Urban									0.1	0.1	0.1
5	Regla	Urban											
6	Habana del Este	Semi-urban						0.2	0.2	0.3	0.3	0.3	0.3
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		0	0	0	0	0	0.4	0.4	0.5	0.9	0.9	0.9

Amount to be collected for composting in facility [restaurant] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						0.3	0.3	0.3	0.3	0.3	0.3
2	Plaza de la Revolucion	Urban									0.3	0.3	0.3
3	Centro Habana	Urban									0.1	0.1	0.1
4	Habana Vieja	Urban									0.1	0.1	0.1
5	Regla	Urban											
6	Habana del Este	Semi-urban						0.3	0.3	0.4	0.4	0.4	0.4
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban											
10	Cerro	Urban											
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total		0	0	0	0	0	0.6	0.6	0.7	1.1	1.2	1.2

Amount to be Collected as Others [restaurant] (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban							0.2	0.2	0.2	0.2	0.2	0.2
2	Plaza de la Revolucion	Urban										0.2	0.2	0.2
3	Centro Habana	Urban										0.0	0.0	0.0
4	Habana Vieja	Urban										0.0	0.0	0.0
5	Regla	Urban												
6	Habana del Este	Semi-urban							0.3	0.3	0.3	0.3	0.3	0.3
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban												
10	Cerro	Urban												
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
Total			0	0	0	0	0	0	0.5	0.5	0.5	0.8	0.8	0.9

Amount of Mixed Collection [restaurant] (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban	0.7	0.7	0.7	0.7	0.7							
2	Plaza de la Revolucion	Urban	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7				
3	Centro Habana	Urban	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
4	Habana Vieja	Urban	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
5	Regla	Urban												
6	Habana del Este	Semi-urban	0.6	0.6	0.7	0.7	0.8							
7	Guanabacoa	Semi-urban												
8	San Miguel del Padron	Semi-urban												
9	Diez de Octubre	Urban												
10	Cerro	Urban												
11	Marianao	Semi-urban												
12	La Lisa	Semi-urban												
13	Boyeros	Semi-urban												
14	Arroyo Naranjo	Semi-urban												
15	Cotorro	Semi-urban												
Total			2.2	2.3	2.4	2.5	2.5	1.1	1.1	1.1	0	0	0	

Waste collection [other commercial] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban	27	27	27	27	27	27	27	27	27	27	27
2	Plaza de la Revolucion	Urban	12	12	12	12	12	12	12	12	12	12	12
3	Centro Habana	Urban	6	6	6	6	6	6	6	6	6	6	6
4	Habana Vieja	Urban	8	8	8	8	8	8	8	8	8	8	8
5	Regla	Urban	2	2	2	2	2	2	2	2	2	2	2
6	Habana del Este	Semi-urban	5	5	5	5	5	5	5	5	5	5	5
7	Guanabacoa	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
8	San Miguel del Padron	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
9	Diez de Octubre	Urban	5	5	5	5	5	5	5	5	5	5	5
10	Cerro	Urban	6	6	6	6	6	6	6	6	6	6	6
11	Marianao	Semi-urban	4	4	4	4	4	4	4	4	4	4	4
12	La Lisa	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
13	Boyeros	Semi-urban	9	9	9	9	9	9	9	9	9	9	9
14	Arroyo Naranjo	Semi-urban	4	4	4	4	4	4	4	4	4	4	4
15	Cotorro	Semi-urban	3	3	3	3	3	3	3	3	3	3	3
	Total		100	100	100	100	100	100	100	100	100	100	100

Amount to be collected for Material Recovery [other commercial] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						3	3	3	3	3	3
2	Plaza de la Revolucion	Urban									1	1	1
3	Centro Habana	Urban									1	1	1
4	Habana Vieja	Urban									1	1	1
5	Regla	Urban											
6	Habana del Este	Semi-urban						1	1	1	1	1	1
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban									1	1	1
10	Cerro	Urban									1	1	1
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total							4	4	4	8	8	8

Amount to be Collected as Others [other commercial] (ton/day)

	Name of Municipality	Classification	Year										
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Playa	Urban						24	24	24	24	24	24
2	Plaza de la Revolucion	Urban									11	11	11
3	Centro Habana	Urban									5	5	5
4	Habana Vieja	Urban									7	7	7
5	Regla	Urban											
6	Habana del Este	Semi-urban						5	5	5	5	5	5
7	Guanabacoa	Semi-urban											
8	San Miguel del Padron	Semi-urban											
9	Diez de Octubre	Urban									4	4	4
10	Cerro	Urban									5	5	5
11	Marianao	Semi-urban											
12	La Lisa	Semi-urban											
13	Boyeros	Semi-urban											
14	Arroyo Naranjo	Semi-urban											
15	Cotorro	Semi-urban											
	Total							28	28	28	60	60	60

Amount of Mixed Collection [other commercial] (ton/day)

	Name of Municipality	Classification	Year											
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Playa	Urban	27	27	27	27	27							
2	Plaza de la Revolucion	Urban	12	12	12	12	12	12	12	12				
3	Centro Habana	Urban	6	6	6	6	6	6	6	6				
4	Habana Vieja	Urban	8	8	8	8	8	8	8	8				
5	Regla	Urban	2	2	2	2	2	2	2	2	2	2	2	2
6	Habana del Este	Semi-urban	5	5	5	5	5							
7	Guanabacoa	Semi-urban	3	3	3	3	3	3	3	3	3	3	3	3
8	San Miguel del Padron	Semi-urban	3	3	3	3	3	3	3	3	3	3	3	3
9	Diez de Octubre	Urban	5	5	5	5	5	5	5	5				
10	Cerro	Urban	6	6	6	6	6	6	6	6	6			
11	Marianao	Semi-urban	4	4	4	4	4	4	4	4	4	4	4	4
12	La Lisa	Semi-urban	3	3	3	3	3	3	3	3	3	3	3	3
13	Boyeros	Semi-urban	9	9	9	9	9	9	9	9	9	9	9	9
14	Arroyo Naranjo	Semi-urban	4	4	4	4	4	4	4	4	4	4	4	4
15	Cotorro	Semi-urban	3	3	3	3	3	3	3	3	3	3	3	3
	Total		100	100	100	100	100	68	68	68	32	32	32	32

(7) Material balance in waste flow

		unit: ton/day										
Type of Waste		Y2005	Y2006	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
Waste Generation	Domestic Waste	1,517	1,514	1,515	1,512	1,508	1,505	1,505	1,501	1,498	1,498	1,494
	Hotel and Restaurant	19	21	21	22	24	25	25	27	27	28	28
	Market	60	60	60	60	60	60	60	60	60	60	60
	Others (Commerce)	100	100	100	100	100	100	100	100	100	100	100
	Bulky waste	520	520	520	520	520	520	520	520	520	520	520
	Total	2,216	2,215	2,216	2,214	2,212	2,210	2,210	2,210	2,208	2,205	2,206
Uncollected	Illegal dumping	16	16	16	16	16	15	12	9	6	3	0
	Recycle by ERMP	30	30	30	30	30	30	30	30	30	30	30
Collected (Total)	Total	2,170	2,169	2,170	2,168	2,166	2,165	2,168	2,169	2,169	2,173	2,172
Collected by UPPH	Kitchen waste						90	90	90	299	299	299
	Resource						27	27	27	84	84	84
	Others						83	83	83	241	241	241
	Mixed collection	940	940	940	940	940	740	740	740	316	316	316
	Total	940	940	940	940	940	940	940	940	940	940	940
Material utilization	Recycle by UPPH	10	10	10	10	10	13	16	19	47	53	59
	Recycle at plant in calle100						13	16	19	27	30	33
	Recycle at plant in New Guanabacoa									20	23	26
	Composting Facility	3	3	3	3	3	45	45	45	108	108	108
	Composting yard in calle100									60	60	60
	Composting yard in New Guanabacoa						45	45	45	48	48	48
	Home Compost	0	5	10	15	20	25	30	35	40	46	51
	Total	13	18	23	28	33	84	91	99	195	206	217
	Residue from Material Recovery						13	11	8	33	29	25
	Residue from composting facility						52	52	52	125	125	125
Loss in composting process (gas, moisture)						53	53	53	126	126	126	
Amount to be dumped at landfill site (ton/day)	Calle100	2,157	2,151	2,147	2,140	2,133	2,028	2,024	2,017	1,848	1,841	1,829
	New Site1							1,650	1,640	1,414	1,408	1,399
	New Guanabacoa					360	323	323	326	383	382	380
	Guanabacoa											
	Campo Florido	110	110	110	110	1	1	1	1	1	1	1
	Special Period Landfill	80	80	80	80							
	Ocho Vias (temporary)	250	250	250	250							
	Amount if final disposal covered by M/P (ton/day)	2,107	2,101	2,097	2,090	2,082	1,979	1,974	1,967	1,798	1,791	1,778

A. MSW Generation, Recycle and Composting:

A4 Technical Note : Experience of Community

Compost in Dhaka

A4 TECHNICAL NOTE: EXPERIENCE OF COMMUNITY COMPOST IN DHAKA

Technical Note

Experience of Community Compost in Dhaka

Waste Concern is a non-government organization (NGO) in Bangladesh. It was established in 1995 and carries out various kinds of community based composting projects in close relations with the government, private sector, and local communities. It also carries out other environmental and solid waste management projects. It has had many experiences with community composting through the implementation of pilot projects in Bangladesh, mainly in Dhaka city. Some of the projects could help with the implementation and continuation of projects in Cuba in the future. The projects are briefly summarized in the following table.

Major Projects by Waste Concern for Community Compost in Bangladesh

Concerned Organization	Title	Summary
Waste Concern	Pilot Schemes on Solid Waste Management and Composting in Bangladesh, September 2003 – December 2005	The purpose of this project is the promotion of the concept of community based solid waste management by decentralized composting and recycling. This project has the effect of generating income and employment opportunities for the urban poor. The types of composting are selected to meet the conditions of each city and include the windrow method with passive aeration, the box method, and the barrel method. http://www.wasteconcern.org/OnGoingProject/Project2.html
Waste Concern MoEF UNDP	Community Based Urban Solid Waste Management in Dhaka, 1998-2005	The purpose of this project is to solve the issues regarding SWM by promoting community based solid waste recycling activities in five communities. It provides adequate training to carry out proper segregation and recycling of solid waste. http://www.wasteconcern.org/OnGoingProject/Project1.html
Waste Concern UNDP	Barrel Type Composting for Slums in Dhaka, 1998-2000	Waste Concern has supplied barrel type-composting to slum dwellers for composting, which not only solves the waste disposal problem at source but has created income generating activities for slum dwellers. Compost is harvested from the barrel after 4 months of fermentation. http://www.wasteconcern.org/OnGoingProject/completed_projects
Waste Concern USAID	Community Based Decentralized Composting in Dhaka, 1998-2001	This project has the objective of evaluating the technical and economic viability of community based decentralized aerobic composting. Waste Concern increased the capacity of the community based waste management project from 1 ton/day to 3 tons/day with the support of USAID. http://www.wasteconcern.org/OnGoingProject/completed_projects
Waste Concern	Assessment of a Decentralized Composting Scheme in Dhaka, Bangladesh	In Mirpur, a pilot project for a treatment system for the decentralized composting of organic waste was started in 1995. The study showed that waste collection and composting schemes are a good alternative to conventional SWM systems due to the reduction of waste quantity to be transported and dumped at the disposal sites. http://www.wasteconcern.org/Publication/Isabelle.html

MoEF : Ministry of Environment and Forests

UNDP : United Nations Development Program

USAID : United States Agency for International Development

A. MSW Generation, Recycle and Composting:

A5 Example of Home Compost Bins used

Around the World

A5 EXAMPLE OF HOME COMPOST BINS USED AROUND THE WORLD



Materials: Wood, Porous Plastic Pipe

Reference; Shopping Matchmaker

URL;

http://shoppingmatchmaker.com/compost_bins.htm

Title; Free Plans for Building a Compost Bin



Materials: Steel Wire Net

Reference; Tinker's Gardens

URL;

<http://www.tinkersgardens.com/vegetables/composting.asp>

Title; Black Gold for Your Soil



Material: Wide-use Plastic Container with handmade holes

Reference; Ernie Colantonio

URL;

<http://www.colantonio.net/home/compost-bin.jpg>

Title; Home Improvement



Material: Wood and Steel Wire Net

Reference; Garden Action

URL;

<http://www.gardenaction.co.uk/techniques/compost2.asp>

Title; Garden Compost



Material: Punched Plastic Sheet

Reference; TheBestLinks.com

URL;

http://www.thebestlinks.com/Image__3A__CompostBin

Tube_wb.jpg.html

Title; Commercial Tube Compost Bin



Material: Molded Plastic Sheet

Reference; Royal Oak

URL; <http://www.ci.royal-oak.mi.us/dps/compobin.html>

Title; Presto Brand Compost Bins

B. Collection and Transportation:

B1 Collection and Transportation Plan

B1 COLLECTION AND TRANSPORTATION PLAN

Appendix-1

Required Number of 18 m³ C/T and bins for Mixed Collection (UPPH)

A-1-1 Mixed Collection			Summary of Required Number of 18m3 C/T and Bins										
Municipalities	Description		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Playa	MSW (t/d)		149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
	No. of Vehicles (units)		13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
	No. of Bins (units)		2,483.3	2,483.3	2,483.3	2,483.3	2,483.3	2,483.3	2,483.3	2,483.3	2,483.3	2,483.3	2,483.3
Plaza	MSW (t/d)		121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
	No. of Vehicles (units)		7.0	7.0	7.0	7.0	7.0	7.0	11.0	11.0	11.0	11.0	11.0
	No. of Bins (units)		2,016.7	2,016.7	2,016.7	2,016.7	2,016.7	2,016.7	2,016.7	2,016.7	2,016.7	2,016.7	2,016.7
C. Havana	MSW (t/d)		74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
	No. of Vehicles (units)		5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
	No. of Bins (units)		1,233.3	1,233.3	1,233.3	1,233.3	1,233.3	1,233.3	1,233.3	1,233.3	1,233.3	1,233.3	1,233.3
H. Vieja	MSW (t/d)		71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
	No. of Vehicles (units)		4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0
	No. of Bins (units)		1,183.3	1,183.3	1,183.3	1,183.3	1,183.3	1,183.3	1,183.3	1,183.3	1,183.3	1,183.3	1,183.3
H. Del Este	MSW (t/d)		51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	No. of Vehicles (units)		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	No. of Bins (units)		850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0
Diez de Octubre	MSW (t/d)		78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
	No. of Vehicles (units)		5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
	No. of Bins (units)		1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0
Cerro	MSW (t/d)		80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
	No. of Vehicles (units)		5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
	No. of Bins (units)		1,333.3	1,333.3	1,333.3	1,333.3	1,333.3	1,333.3	1,333.3	1,333.3	1,333.3	1,333.3	1,333.3
Marianao	MSW (t/d)		20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	No. of Vehicles (units)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	No. of Bins (units)		333.3	333.3	333.3	333.3	333.3	333.3	333.3	333.3	333.3	333.3	333.3
La Lisa	MSW (t/d)		19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
	No. of Vehicles (units)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	No. of Bins (units)		316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7
Boyerros	MSW (t/d)		19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
	No. of Vehicles (units)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	No. of Bins (units)		316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7
Arroyo Naranjo	MSW (t/d)		21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	No. of Vehicles (units)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	No. of Bins (units)		350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0
Total	MSW (t/d)		703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0
	No. of Vehicles (units)		50.0	50.0	50.0	50.0	50.0	50.0	62.0	62.0	62.0	62.0	62.0
	Operation rate (C/T)	0.85	59.0	59.0	59.0	59.0	59.0	59.0	73.0	73.0	73.0	73.0	73.0
	No. of Bins (units)		11,717.0	11,717.0	11,717.0	11,717.0	11,717.0	11,717.0	11,717.0	11,717.0	11,717.0	11,717.0	11,717.0
Number of Bins for replacement for 10 years (units)	0.10	0.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	
Scrape Schedule	(units)	0	6	3	2	2	1	7	0	0	0	0	
Estimated number of C/T in operation provided by UPPH	(units)	45	39	36	34	32	31	24	24	24	24	24	
Required number of vehicles to be purchased	2005	0	0	0	0	0	0	0	0	0	0	0	
	2006 (Original Plan)	20	20	20	20	20	20	20	20	20	20	20	
	2006 (Revised Plan)	0	0	0	0	0	0	0	0	0	0	0	
	2007 (Original Plan)	3	3	3	3	3	3	3	3	3	3	3	
	2007 (Revised Plan)	0	0	0	0	0	0	0	0	0	0	0	
	2008 (Original Plan)	2	2	2	2	2	2	2	2	2	2	2	
	2008 (Revised Plan)	25	25	25	25	25	25	25	25	25	25	25	
	2009	2				2							
	2010	1					1						
	2011	21						21					
	2012	0							0				
	2013	0								0			
	2014	0									0		
	2015	0										0	
	Total (unit: Original Plan)	74	45	59	59	59	59	59	73	73	73	73	
Total (unit: Revised Plan)	74	45	39	36	34	32	31	24	24	24	24		

Note: "Original Plan" is the plan prepared for DF/R on September 2005 based on the discussion between Cuban C/P and Study Team during the Study period.
"Revised Plan" is the plan finally prepared for the M/P in F/R finalised in March 2007 based on the assumption of that no investment is done in 2006 and 2007.

A-1-2

18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Plaza C/T (1/15)													
Mixed Collection		MSW (t/d)	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
MSW		s-total (t/d)	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
Required number of vehicles	Qo		149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
	18 m ³ C/T	7.4	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
	trip	2.0	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
Operation rate	Or	1.0	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
Loading ratio	Ld	0.8	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
Total (units)			13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	8x2=16	16.0	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-
New Guanabacoa(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
(Hrs)	trip	2.0	0.6	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	1.5	1.5	1.5	1.5	1.5
Dumping Time	hrs	0.25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		7.2	7.2	7.2	7.2	7.2	7.2	6.4	6.4	6.4	6.4	6.4
Required number of Bins													
	MSW per bin	0.06	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
Total		(t/d)	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
Required Number of Vehicles													
Other(MSW)		(units)	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Total		(units)	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Required Number of bins		(units)	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483	2,483

A-1-3

18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Plaza C/T (2/15)													
Mixed Collection		MSW (t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
MSW		s-total (t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
Required number of vehicles	Qo		121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
	18 m ³ C/T	7.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4
	trip	3.0	5.5	5.5	5.5	5.5	5.5	5.5	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	8.2	8.2	8.2	8.2	8.2
Operation rate	Or	1.0	5.5	5.5	5.5	5.5	5.5	5.5	8.2	8.2	8.2	8.2	8.2
Loading ratio	Ld	0.8	6.8	6.8	6.8	6.8	6.8	6.8	10.2	10.2	10.2	10.2	10.2
Total (units)			7.0	7.0	7.0	7.0	7.0	7.0	11.0	11.0	11.0	11.0	11.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	8x2=16	16.0	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-
New Guanabacoa(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	1.1	1.1	1.1	1.1	1.1
(Hrs)	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	2.2	2.2	2.2	2.2	2.2
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		7.7	7.7	7.7	7.7	7.7	7.7	7.1	7.1	7.1	7.1	7.1
Required number of Bins													
	MSW per bin	0.06	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
Total		(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	7.0	7.0	7.0	7.0	7.0	7.0	11.0	11.0	11.0	11.0	11.0
Total		(units)	7.0	7.0	7.0	7.0	7.0	7.0	11.0	11.0	11.0	11.0	11.0
Required Number of Bins		(units)	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017	2,017

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18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
C. Havana C/T (3/15)													
Mixed Collection		MSW (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
MSW		s-total (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
Required number of vehicles	Qo		74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
	18 m ³ C/T	7.4	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	trip	3.0	3.3	3.3	3.3	3.3	3.3	3.3	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	5.0	5.0	5.0	5.0	5.0
Operation rate	Or	1.0	3.3	3.3	3.3	3.3	3.3	3.3	5.0	5.0	5.0	5.0	5.0
Loading ratio	Ld	0.8	4.2	4.2	4.2	4.2	4.2	4.2	6.3	6.3	6.3	6.3	6.3
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	11x2=22	22.0	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-
New Guanabacoa(km)	20x2=40	40.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
(Hrs)	trip	3.0	1.2	1.2	1.2	1.2	1.2	1.2	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	1.5	1.5	1.5	1.5	1.5
Dumping Time	hrs	0.3	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.1	8.1	8.1	8.1	8.1	8.1	6.4	6.4	6.4	6.4	6.4
Required number of Bins													
	MSW per bin	0.06	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
Total		(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Required Number of Bins		(units)	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233

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18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
H.Vieja C/T (4/15)													
Mixed Collection		MSW (t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
MSW		s-total (t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
Required number of vehicles	Qo		71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
	18 m ³ C/T	7.4	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	trip	3.0	3.2	3.2	3.2	3.2	3.2	3.2	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	4.8	4.8	4.8	4.8	4.8
Operation rate	Or	1.0	3.2	3.2	3.2	3.2	3.2	3.2	4.8	4.8	4.8	4.8	4.8
Loading ratio	Ld	0.8	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0
Total (units)			4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1					
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	11x2=22	22.0	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-
New Guanabacoa(km)	17x2=34	34.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	0.6	0.6	0.6	0.6	0.6
(Hrs)	trip	3.0	1.2	1.2	1.2	1.2	1.2	1.2	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	1.2	1.2	1.2	1.2	1.2
Dumping Time	hrs	0.3	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.1	8.1	8.1	8.1	8.1	8.1	6.1	6.1	6.1	6.1	6.1
Required number of Bins													
	MSW per bin	0.06	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
Total		(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0
Total		(units)	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0
Required Number of Bins		(units)	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183	1,183

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18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
H.del Este C/T (5/15)													
Mixed Collection		MSW (t/d)	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
MSW		s-total (t/d)	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Required number of vehicles	Qo		51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	18 m ³ C/T	7.4	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
	trip	3.0	2.3	2.3	2.3	2.3	2.3	2.3	-	-	-	-	-
	trip	3.0	-	-	-	-	-	-	2.3	2.3	2.3	2.3	2.3
Operation rate	Or	1.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Loading ratio	Ld	0.8	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Total (units)			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	3.0	-	-	-	-	-	-	5.1	5.1	5.1	5.1	5.1
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	33x2=66	66.0	-	-	-	-	-	-	-	-	-	-	-
New Guanabacoa(km)	16x2=32	32.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
(Hrs)	trip	3.0	1.7	1.7	1.7	1.7	1.7	1.7	-	-	-	-	-
(Hrs)	trip	3.0	-	-	-	-	-	-	1.7	1.7	1.7	1.7	1.7
Dumping Time	hrs	0.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
Required number of Bins													
	MSW per bin	0.06	850	850	850	850	850	850	850	850	850	850	850
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Total		(t/d)	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total		(units)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Required Number of Bins		(units)	850	850	850	850	850	850	850	850	850	850	850

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18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Diez de Octubre C/T (6/15)													
Mixed Collection	MSW	MSW (t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
		s-total (t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Required number of vehicles	Qo		78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
	18 m ³ C/T	7.4	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	trip	3.0	3.5	3.5	3.5	3.5	3.5	3.5	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	5.3	5.3	5.3	5.3	5.3
Operation rate	Or	1.0	3.5	3.5	3.5	3.5	3.5	3.5	5.3	5.3	5.3	5.3	5.3
Loading ratio	Ld	0.8	4.4	4.4	4.4	4.4	4.4	4.4	6.6	6.6	6.6	6.6	6.6
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	11x2=22	22.0	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-
New Guanabacoa(km)	16x2=32	32.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	25x2=50	50.0	-	-	-	-	-	-	0.9	0.9	0.9	0.9	0.9
(Hrs)	trip	3.0	1.2	1.2	1.2	1.2	1.2	1.2	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	1.8	1.8	1.8	1.8	1.8
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.1	8.1	8.1	8.1	8.1	8.1	6.7	6.7	6.7	6.7	6.7
Required number of Bins													
	MSW per bin	0.06	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Total		(t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Required Number of Bins		(units)	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300

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18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cerro C/T (7/15)													
Mixed Collection	MSW	MAW (t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
		s-total (t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
Required number of vehicles	Qo		80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
	18 m ³ C/T	7.4	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
	trip	3.0	3.6	3.6	3.6	3.6	3.6	3.6	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	5.4	5.4	5.4	5.4	5.4
Operation rate	Or	1.0	3.6	3.6	3.6	3.6	3.6	3.6	5.4	5.4	5.4	5.4	5.4
Loading ratio	Ld	0.8	4.5	4.5	4.5	4.5	4.5	4.5	6.8	6.8	6.8	6.8	6.8
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	13x2=16	16.0	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-
New Guanabacoa(km)	20x2=40	40.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	25x2=50	50.0	-	-	-	-	-	-	0.9	0.9	0.9	0.9	0.9
(Hrs)	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	1.8	1.8	1.8	1.8	1.8
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		7.7	7.7	7.7	7.7	7.7	7.7	6.7	6.7	6.7	6.7	6.7
Required number of Bins													
	MSW per bin	0.06	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MSW		(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
Total		(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0
Required Number of Bins		(units)	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333

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18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Marianao C/T (8/15)													
Mixed Collection		MSW (t/d)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
MSW		s-total (t/d)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	Qo		20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	18 m ³ C/T	7.4	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4
Operation rate	Or	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.4	1.4	1.4	1.4	1.4
Loading ratio	Ld	0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.7	1.7	1.7	1.7	1.7
Total (units)			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	5x2=10	10.0	0.2	0.2	0.2	0.2	0.2	0.2	-	-	-	-	-
New Guanabacoa(km)	26x2=52	52.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
(Hrs)	trip	3.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	1.5	1.5	1.5	1.5	1.5
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		7.4	7.4	7.4	7.4	7.4	7.4	6.4	6.4	6.4	6.4	6.4
Required number of Bins													
	MSW per bin	0.06	333	333	333	333	333	333	333	333	333	333	333
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total		(t/d)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Required Number of Bins		(units)	333	333	333	333	333	333	333	333	333	333	333

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18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
La Lisa C/T (9/15)													
Mixed Collection		MSW (t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
MSW		s-total (t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Required number of vehicles	Qo		19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
	18 m ³ C/T	7.4	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	-	-	-	-	-
	trip	3.0	-	-	-	-	-	-	0.9	0.9	0.9	0.9	0.9
Operation rate	Or	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Loading ratio	Ld	0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Total (units)			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	3.0	-	-	-	-	-	-	5.1	5.1	5.1	5.1	5.1
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	13x2=26	26.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
New Guanabacoa(km)	40x2=80	80.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	10x2=20	20.0	-	-	-	-	-	-	0.4	0.4	0.4	0.4	0.4
(Hrs)	trip	3.0	1.4	1.4	1.4	1.4	1.4	1.4	-	-	-	-	-
(Hrs)	trip	3.0	-	-	-	-	-	-	1.1	1.1	1.1	1.1	1.1
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.3	8.3	8.3	8.3	8.3	8.3	7.9	7.9	7.9	7.9	7.9
Required number of Bins													
	MSW per bin	0.06	317	317	317	317	317	317	317	317	317	317	317
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mixed Collection		(t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Total		(t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Required Number of Bins		(units)	317	317	317	317	317	317	317	317	317	317	317

A-1-11

18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Boveros C/T (10/15)													
Mixed Collection		MSW (t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
MSW		s-total (t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Required number of vehicles	Qo		19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
	18 m ³ C/T	7.4	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	trip	3.0	-	-	-	-	-	-	0.9	0.9	0.9	0.9	0.9
Operation rate	Or	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Loading ratio	Ld	0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Total (units)			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-
(Hrs)	trip	3.0	-	-	-	-	-	-	5.1	5.1	5.1	5.1	5.1
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	13x2=26	26.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
New Guanabacoa(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	15x2=30	30.0	-	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5
(Hrs)	trip	3.0	1.4	1.4	1.4	1.4	1.4	1.4	-	-	-	-	-
(Hrs)	trip	3.0	-	-	-	-	-	-	1.6	1.6	1.6	1.6	1.6
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.3	8.3	8.3	8.3	8.3	8.3	8.5	8.5	8.5	8.5	8.5
Required number of Bins													
	MSW per bin	0.06	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7	316.7
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MSW		(t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Total		(t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Required Number of Bins		(units)	317	317	317	317	317	317	317	317	317	317	317

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18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Arroyo C/T (11/15)													
Mixed Collection		MSW (t/d)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
MSW		s-total (t/d)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Required number of vehicles	Qo		21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	18 m ³ C/T	7.4	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	trip	2.0	1.4	1.4	1.4	1.4	1.4	1.4	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4
Operation rate	Or	1.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Loading ratio	Ld	0.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Total (units)			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	2.0	3.4	3.4	3.4	3.4	3.4	3.4	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	23x2=46	46.0	0.8	0.8	0.8	0.8	0.8	0.8	-	-	-	-	-
New Guanabacoa(km)	16x2=32	32.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	1.1	1.1	1.1	1.1	1.1
(Hrs)	trip	2.0	1.7	1.7	1.7	1.7	1.7	1.7	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	2.2	2.2	2.2	2.2	2.2
Dumping Time	hrs	0.25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		6.6	6.6	6.6	6.6	6.6	6.6	7.1	7.1	7.1	7.1	7.1
Required number of Bins													
	MSW per bin	0.06	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0	350.0
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MSW		(t/d)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total		(t/d)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	2	2	2	2	2	2	2	2	2	2	2
Total		(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Required Number of Bins		(units)	350	350	350	350	350	350	350	350	350	350	350

A-1-13 Mixed Collection

Compactor Trucks (18m3 C/T)	Phase-1									Phase-2					Total	
	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-Total		
Existing C/T (units)	ND	0	6	9	11	13	14	-	21	21	21	21	21	21	21	
Total Scraps/Not in operation	ND	0	6	9	11	13	14	-	21	21	21	21	21	21	21	
Scraps/Not in operation	ND	0	6	3	2	2	1	-	7	0	0	0	0	7	21	
Total vehicles (units)	ND	45	39	36	34	32	31	-	74	74	74	74	74	74	74	
Plan of Replacement (unit)	ND	0	0	0	25	2	1	28	21	0	0	0	0	21	49	
Replacement (units)	ND	0	0	0	25	2	1	28	21	0	0	0	0	21	49	
Total In operation Vehicles (units)	ND	0	39	36	59	59	59	-	73	73	73	73	73	-	-	
Standby (units)	ND	-73	-14	-14	-14	-14	-14	-	0	0	0	0	0	-	-	
Required Vehicles (units)	73															
Unit Price (US\$)	130,000															
Total Cost	JY (Japanese yen)	0	0	0	0	357,500,000	28,600,000	14,300,000	400,400,000	300,300,000	0	0	0	0	300,300,000	700,700,000
JY/US\$=110		0	0	0	0	3,250,000	260,000	130,000	3,640,000	2,730,000	0	0	0	0	2,730,000	6,370,000
Operation cost = Unit operation cost * No. of vehicles in operation																
Total Cost	JY (Japanese yen)	0	0	0	0	241,817,400	241,817,400	241,817,400	725,452,200	299,197,800	299,197,800	299,197,800	299,197,800	299,197,800	1,495,989,000	2,221,441,200
JY/US\$=110		0	0	0	0	2,198,340	2,198,340	2,198,340	6,595,020	2,719,980	2,719,980	2,719,980	2,719,980	13,599,900	20,194,920	
Maintenance Cost = 5% * unit cost * Spare Parts																
130,000CUC*0.05=6,500CUC		0	0	0	0	42,185,000	42,185,000	42,185,000	126,555,000	52,195,000	52,195,000	52,195,000	52,195,000	260,975,000	387,530,000	
CUC/year	6,500															

ND: No Data

Unit Operation Cost (O/C)

Item (18 m3 C/T)	2015		Peso Currency			Remarks
	Unit cost	Unit	Quantity	Price(Mon)	Price(year)	
Labor costs	500	CUP/capM	4	2,000	24,000	4cap/dunit
Water	0.5	CUP/m3	150	75	900	5m3/dunit
Fuel	0.3	CUP/m3	2,000	600	7,200	3km/liter*200km
Power rates	0.1	CUP/kwh	300	30	360	
lubricant	1	LS	200	200	2,400	10%of Fuel
Others	1	LS	200	200	2,400	
Total					37,260	

A-1-14 Mixed Collection

New Bins (770 liter Steel)	Phase-1								Phase-2					Total		
	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015		S-Total	
Plan of Replacement (unit)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scraps	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Bins (units)	0	0	0	0	3,516	4,688	5,860	5,860	7,032	8,204	9,376	10,548	11,720	11,720	11,720	
Replacement (units)	0	0	0	0	3,516	1,172	1,172	5,860	1,172	1,172	1,172	1,172	1,172	5,860	11,720	
Total In operation Bins (units)	0	0	0	0	3,516	4,688	5,860	5,860	7,032	8,204	9,376	10,548	11,720	11,720	11,720	
Required bins (units)	11,720															
Unit Price (JY)	0	-11,720	-11,720	-11,720	-8,204	-7,032	-5,860	-	-4,688	-3,516	-2,344	-1,172	0	0	-	
770 liter Bins(US\$)	260															
Total Cost	JY (Japanese yen)	0	0	0	0	100,557,600	33,519,200	33,519,200	167,596,000	33,519,200	33,519,200	33,519,200	33,519,200	33,519,200	167,596,000	335,192,000
JY/US\$	110	0	0	0	0	914,160	304,720	304,720	1,523,600	304,720	304,720	304,720	304,720	304,720	1,523,600	3,047,200
Maintenance Cost = 5% * unit cost * No. of Bins in operation																
JY/year	0.05	0	0	0	0	5,027,880	1,675,960	1,675,960	8,379,800	1,675,960	1,675,960	1,675,960	1,675,960	1,675,960	8,379,800	16,759,600

Note: Expected bin's life(10 years):

Capacity	2005-2010	2011-2015	Total
Steel, 770 liter	5,860	5,860	11,720
Total	5,860	5,860	11,720
Capacity (770-Bins)	2005-2010	2011-2015	Total
Total Budget (JY)	167,596,000	167,596,000	335,192,000
Total Budget (US)	1,523,600	1,523,600	3,047,200

Appendix-2

Required Number of 18 m³ C/T and bins for Segregated Collection (UPPH)

Appendix-2-1 Segregated Collection (Kitchen waste: Daily collection)			Summary of Required Number of 18m ³ C/T										
Municipalities	Description		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Playa	Kitchen (t/d)	(t/d)	149.0	149.0	149.0	149.0	149.0	66.0	66.0	66.0	66.0	66.0	66.0
	No. of Vehicles (units)	(units)	13.0	13.0	13.0	13.0	13.0	12.0	12.0	12.0	12.0	12.0	12.0
Plaza	Kitchen (t/d)	(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	58.0	58.0	58.0
	No. of Vehicles (units)	(units)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0	5.0	5.0
C. Havana	Kitchen (t/d)	(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	37.0	37.0	37.0
	No. of Vehicles (units)	(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0
H. Vieja	Kitchen (t/d)	(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	34.0	34.0	34.0
	No. of Vehicles (units)	(units)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0
H. Del Este	Kitchen (t/d)	(t/d)	51.0	51.0	51.0	51.0	51.0	24.0	24.0	24.0	24.0	24.0	24.0
	No. of Vehicles (units)	(units)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Diez de Octubre	Kitchen (t/d)	(t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	40.0	40.0	40.0
	No. of Vehicles (units)	(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0
Cerro	Kitchen (t/d)	(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	40.0	40.0	40.0
	No. of Vehicles (units)	(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0
Marianao	MSW (t/d)	(t/d)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	No. of Vehicles (units)	(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
La Lisa	MSW (t/d)	(t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
	No. of Vehicles (units)	(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Boyerros	MSW (t/d)	(t/d)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
	No. of Vehicles (units)	(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arroyo Naranjo	MSW (t/d)	(t/d)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	No. of Vehicles (units)	(units)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total (11Municipalities)	Kitchen (7) (t/d)	(t/d)	0.0	0.0	0.0	0.0	0.0	90.0	90.0	90.0	299.0	299.0	299.0
	MSW (4) (t/d)	(t/d)	703.0	703.0	703.0	703.0	703.0	613.0	613.0	613.0	404.0	404.0	404.0
	S-total (t/d)	(t/d)	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0	703.0
	No. of Vehicles (units)	(units)	50.0	50.0	50.0	50.0	50.0	49.0	49.0	49.0	43.0	43.0	43.0

A-2-2			calle	calle	calle	calle	calle	NG	NG	NG	calle/NS	calle/NS	calle/NS
18m ³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Playa C/T (1/15) Kitchen													
Segregated Collection		Kitchen (t/d)	149.0	149.0	149.0	149.0	149.0	66.0	66.0	66.0	66.0	66.0	66.0
Kitchen		s-total (t/d)	149.0	149.0	149.0	149.0	149.0	66.0	66.0	66.0	66.0	66.0	66.0
Required number of vehicles	Qo		149.0	149.0	149.0	149.0	149.0	66.0	66.0	66.0	66.0	66.0	66.0
	18 m ³ C/T	7.4	20.1	20.1	20.1	20.1	20.1	8.9	8.9	8.9	8.9	8.9	8.9
	trip	2.0	10.1	10.1	10.1	10.1	10.1	-	-	-	-	-	-
	trip	1.0	-	-	-	-	-	8.9	8.9	8.9	8.9	8.9	8.9
Operation rate	Or	1.0	10.1	10.1	10.1	10.1	10.1	8.9	8.9	8.9	8.9	8.9	8.9
Loading ratio	Ld	0.8	12.6	12.6	12.6	12.6	12.6	11.1	11.1	11.1	11.1	11.1	11.1
Total (units)			13.0	13.0	13.0	13.0	13.0	12.0	12.0	12.0	12.0	12.0	12.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	2.0	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
	trip												
	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
	15x2=30	30.0	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-	-
Calle 100 Extension/N. Sw (km)	40x2=80	80.0	-	-	-	-	-	-	-	-	-	-	-
	30x2=60	60.0	-	-	-	-	-	1.1	1.1	1.1	-	-	-
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	-	-	0.7	0.7	0.7
(Hrs)	trip	2.0	1.5	1.5	1.5	1.5	1.5	2.2	2.2	2.2	1.4	1.4	1.4
	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Dumping Time	hrs	0.25	0.5	0.5	0.5	0.5	0.5	1.8	1.8	1.8	1.8	1.8	1.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		6.4	6.4	6.4	6.4	6.4	8.4	8.4	8.4	7.6	7.6	7.6
Summary of Playa			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Kitchen	(t/d)		149.0	149.0	149.0	149.0	149.0	66.0	66.0	66.0	66.0	66.0	66.0
Total	(t/d)		149.0	149.0	149.0	149.0	149.0	66.0	66.0	66.0	66.0	66.0	66.0
Required Number of Vehicles	(units)												
Other(MSW)	(units)		13.0	13.0	13.0	13.0	13.0	12.0	12.0	12.0	12.0	12.0	12.0
Total	(units)		13.0	13.0	13.0	13.0	13.0	12.0	12.0	12.0	12.0	12.0	12.0

A-2-3			Calle	Calle	Calle	Calle	Calle	Calle	NS	NS	calle/NS	calle/NS	calle/NS
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Plaza C/T (2/15)Kitchen													
Segregated Collection		Kitchen (t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	58.0	58.0	58.0
Kitchen		s-total (t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	58.0	58.0	58.0
Required number of vehicles	Qo		121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	58.0	58.0	58.0
	18 m ³ C/T	7.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	7.8	7.8	7.8
	trip	3.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	3.9	3.9	3.9
	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Operation rate	Or	1.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.9	3.9	3.9
Loading ratio	Ld	0.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	4.9	4.9	4.9
Total (units)			7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0	5.0	5.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	3.4	3.4	3.4
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	15x2=30	30.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
Calle 100 Extension /N. Sw (km)	40x2=80	80.0	-	-	-	-	-	-	-	-	-	-	-
New Guanabacoa(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
(Hrs)	trip	3.0	1.5	1.5	1.5	1.5	1.5	1.5	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Dumping Time	hrs	0.25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.8	1.8	1.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.1	8.1	8.1	8.1	8.1	8.1	8.0	8.0	7.6	7.6	7.6
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Kitchen		(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	58.0	58.0	58.0
Total		(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	58.0	58.0	58.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0	5.0	5.0
Total		(units)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0	5.0	5.0

A-2-4			Calle	Calle	Calle	Calle	Calle	Calle	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
C. Havana C/T (3/15)Kitchen													
Segregated Collection		Kitchen (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	37.0	37.0	37.0
Kitchen		s-total (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	37.0	37.0	37.0
Required number of vehicles	Qo		74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	37.0	37.0	37.0
	18 m ³ C/T	7.4	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	5.0	5.0	5.0
	trip	3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	2.5	2.5	2.5
Operation rate	Or	1.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	2.5	2.5	2.5
Loading ratio	Ld	0.8	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.1	3.1	3.1
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	3.4	3.4	3.4
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	15x2=30	30.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
Calle 100 Extension /N. Sw (km)	40x2=80	80.0	-	-	-	-	-	-	-	-	-	-	-
New Guanabacoa(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
(Hrs)	trip	3.0	1.5	1.5	1.5	1.5	1.5	1.5	3.3	3.3	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	2.2	2.2	2.2
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.8	1.8	1.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.4	8.4	8.4	8.4	8.4	8.4	7.6	7.6	8.4	8.4	8.4
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Segregated Collection		(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	37.0	37.0	37.0
Total		(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	37.0	37.0	37.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0

A-2-5			Calle	Calle	Calle	Calle	Calle	Calle	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
H.Vieja C/T (4/15)Kitchen													
Segregated Collection		Kitchen (t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	34.0	34.0	34.0
Kitchen		s-total (t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	34.0	34.0	34.0
Required number of vehicles	Qo		71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	34.0	34.0	34.0
	18 m ³ C/T	7.4	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	4.6	4.6	4.6
	trip	3.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	2.3	2.3	2.3
Operation rate	Or	1.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	2.3	2.3	2.3
Loading ratio	Ld	0.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2.9	2.9	2.9
Total (units)			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	3.4	3.4	3.4
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	20x2=40	40.0	0.7	0.7	0.7	0.7	0.7	0.7	-	-	-	-	-
Calle 100 Extension /N. Sw (km)	15x2=30	30.0											
New Guanabacoa(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
(Hrs)	trip	3.0	1.5	1.5	1.5	1.5	1.5	1.5	2.1	2.1	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	1.4	1.4	1.4
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.8	1.8	1.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.4	8.4	8.4	8.4	8.4	8.4	9.0	9.0	7.6	7.6	7.6
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Kitchen		(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	34.0	34.0	34.0
Total		(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	34.0	34.0	34.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0
Total		(units)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0

A-2-6			Ocho	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
H.del Este C/T (5/15)Kitchen													
Segregated Collection		Kitchen (t/d)	51.0	51.0	51.0	51.0	51.0	24.0	24.0	24.0	24.0	24.0	24.0
Kitchen		s-total (t/d)	51.0	51.0	51.0	51.0	51.0	24.0	24.0	24.0	24.0	24.0	24.0
Required number of vehicles	Qo		51.0	51.0	51.0	51.0	51.0	24.0	24.0	24.0	24.0	24.0	24.0
	18 m ³ C/T	7.4	6.9	6.9	6.9	6.9	6.9	3.2	3.2	3.2	3.2	3.2	3.2
	trip	3.0	2.3	2.3	2.3	2.3	2.3	-	-	-	-	-	-
	trip	2.0	-	-	-	-	-	1.6	1.6	1.6	1.6	1.6	1.6
Operation rate	Or	1.0	2.3	2.3	2.3	2.3	2.3	1.6	1.6	1.6	1.6	1.6	1.6
Loading ratio	Ld	0.8	2.9	2.9	2.9	2.9	2.9	2.0	2.0	2.0	2.0	2.0	2.0
Total (units)			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-	-
	trip	2.0	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4	3.4
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	33x2=66	66.0											
Calle 100 Extension /N. Sw (km)	40x2=80	80.0											
New Guanabacoa(km)	16x2=32	32.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
(Hrs)	trip	3.0	1.7	1.7	1.7	1.7	1.7	-	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	1.2	1.2	1.2	1.2	1.2	1.2
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	1.8	1.8	1.8	1.8	1.8	1.8
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.6	8.6	8.6	8.6	8.6	7.3	7.3	7.3	7.3	7.3	7.3
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Kitchen		(t/d)	51.0	51.0	51.0	51.0	51.0	24.0	24.0	24.0	24.0	24.0	24.0
Total		(t/d)	51.0	51.0	51.0	51.0	51.0	24.0	24.0	24.0	24.0	24.0	24.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total		(units)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

A-2-7			Calle	Calle	Calle	Calle	Calle	Calle	Calle	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Diez de Octubre C/T (6/15)Kitchen														
Segregated Collection		Kitchen (t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	40.0	40.0	40.0	
Kitchen		s-total (t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	40.0	40.0	40.0	
Required number of vehicles	Qo		78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	40.0	40.0	40.0	
	18 m ³ C/T	7.4	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	5.4	5.4	5.4	
	trip	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	-	-	-	
	trip	2.0	-	-	-	-	-	-	-	-	2.7	2.7	2.7	
	trip	1.0	-	-	-	-	-	-	-	-	-	-	-	
Operation rate	Or	1.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	2.7	2.7	2.7	
Loading ratio	Ld	0.8	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	3.4	3.4	3.4	
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7												
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1			-	-	-	
(Hrs)	trip	2.0							3.4	3.4	3.4	3.4	3.4	
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-	
Transportation Time														
(Hrs)	Speed(km/hr)	55.0												
Calle 100 Extension(km)	11x2=22	22.0	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-	
New Guanabacoa(km)	16x2=32	32.0	-	-	-	-	-	-	0.6	0.6	0.6	0.6	0.6	
New Southwest(km)	25x2=50	50.0	-	-	-	-	-	-	-	-	-	-	-	
(Hrs)	trip	3.0	1.2	1.2	1.2	1.2	1.2	1.2	-	-	-	-	-	
(Hrs)	trip	2.0							1.8	1.8	1.2	1.2	1.2	
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-	
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.8	1.8	1.8	
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	
Total	hrs		8.1	8.1	8.1	8.1	8.1	8.1	7.0	7.0	8.4	8.4	8.4	
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Kitchen		(t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	40.0	40.0	40.0	
Total		(t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	40.0	40.0	40.0	
Required Number of Vehicles		(units)												
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	

A-2-8			Calle	Calle	Calle	Calle	Calle	Calle	Calle	NS	NS	Calle/NSCalle/NS	Calle/NS	NS
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Cerro C/T (7/15)Kitchen														
Segregated Collection		Kitchen (t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	40.0	40.0	40.0	
Kitchen		s-total (t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	40.0	40.0	40.0	
Required number of vehicles	Qo		80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	40.0	40.0	40.0	
	18 m ³ C/T	7.4	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	5.4	5.4	5.4	
	trip	3.0	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	-	-	-	
	trip	2.0	-	-	-	-	-	-	-	-	2.7	2.7	2.7	
	trip	1.0	-	-	-	-	-	-	-	-	-	-	-	
Operation rate	Or	1.0	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	2.7	2.7	2.7	
Loading ratio	Ld	0.8	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	3.4	3.4	3.4	
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7												
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	
(Hrs)	trip	2.0									3.4	3.4	3.4	
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-	
Transportation Time														
(Hrs)	Speed(km/hr)	55.0												
Calle 100 Extension(km)	13x2=16	16.0	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	
Calle 100 Extension /NS (km)	40x2=80	80.0	-	-	-	-	-	-	-	-	-	-	-	
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7	
(Hrs)	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	-	-	-	-	-	
(Hrs)	trip	2.0	-	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4	
(Hrs)	trip	1.0	-	-	-	-	-	-	-	-	-	-	-	
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	1.8	1.8	1.8	
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.8	1.8	1.8	
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Total	hrs		7.7	7.7	7.7	7.7	7.7	7.7	8.0	8.0	7.6	7.6	7.6	
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Kitchen		(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	40.0	40.0	40.0	
Total		(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	40.0	40.0	40.0	
Required Number of Vehicles		(units)												
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	

A-2-9 Segregated Collection			Summary of Required Number of 18m ³ C/T (Resource 2-days/Week + Other 5-days/Week)												
Municipalities	Description		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
	Playa	MSW	(t/d)	-	-	-	-	-	126.0	126.0	126.0	126.0	126.0	126.0	
No. of Vehicles		(units)	-	-	-	-	-	11.0	11.0	11.0	11.0	11.0	11.0		
Plaza	MSW	(t/d)	-	-	-	-	-	-	-	-	92.0	92.0	92.0		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	8.0	8.0	8.0		
C. Havana	MSW	(t/d)	-	-	-	-	-	-	-	-	54.0	54.0	54.0		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	5.0	5.0	5.0		
H. Vieja	MSW	(t/d)	-	-	-	-	-	-	-	-	54.0	54.0	54.0		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	5.0	5.0	5.0		
H. Del Este	MSW	(t/d)	-	-	-	-	-	38.0	38.0	38.0	38.0	38.0	38.0		
	No. of Vehicles	(units)	-	-	-	-	-	4.0	4.0	4.0	3.0	3.0	3.0		
Diez de Octubre	MSW	(t/d)	-	-	-	-	-	-	-	-	56.0	56.0	56.0		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	4.0	4.0	4.0		
Cerro	MSW	(t/d)	-	-	-	-	-	-	-	-	58.0	58.0	58.0		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	5.0	5.0	5.0		
Marianao	MSW	(t/d)	-	-	-	-	-	-	-	-	-	-	-		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	-	-	-		
La Lisa	MSW	(t/d)	-	-	-	-	-	-	-	-	-	-	-		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	-	-	-		
Boyeros	MSW	(t/d)	-	-	-	-	-	-	-	-	-	-	-		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	-	-	-		
Arroyo Naranjo	MSW	(t/d)	-	-	-	-	-	-	-	-	-	-	-		
	No. of Vehicles	(units)	-	-	-	-	-	-	-	-	-	-	-		
Total (7 Municipalities)	MSW	(t/d)	-	-	-	-	-	164.0	164.0	164.0	478.0	478.0	478.0		
	No. of Vehicles	(units)	-	-	-	-	-	15.0	15.0	15.0	41.0	41.0	41.0		
	Operation rate		0.85	-	-	-	-	-	18.0	18.0	18.0	49.0	49.0	49.0	

Note: Waste quantity for segregated collection shown as "MSW (t/d)" is the two days' quantity of other waste to estimate maximum capacity of collection vehicles.

A-1-10		Calle	Calle	Calle	Calle	Calle	Calle	Calle	Calle/NS	Calle/NS	Calle/NS	Calle/NS	Calle/NS
18m³ C/T		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Playa C/T (1/15)		149.0	149.0	149.0	149.0	149.0	126.0	126.0	126.0	126.0	126.0	126.0	
Segregated Collection	Resource + MSW (t/d)	149.0	149.0	149.0	149.0	149.0	126.0	126.0	126.0	126.0	126.0	126.0	
Resource + Other	s-total (t/d)	149.0	149.0	149.0	149.0	149.0	126.0	126.0	126.0	126.0	126.0	126.0	
Required number of vehicles	Qo	149.0	149.0	149.0	149.0	149.0	126.0	126.0	126.0	126.0	126.0	126.0	
	18 m ³ C/T	7.4	20.1	20.1	20.1	20.1	17.0	17.0	17.0	17.0	17.0	17.0	
	trip	3.0	6.7	6.7	6.7	6.7	-	-	-	-	-	-	
	trip	2.0	-	-	-	-	8.5	8.5	8.5	8.5	8.5	8.5	
Operation rate	Or	1.0	6.7	6.7	6.7	6.7	6.7	8.5	8.5	8.5	8.5	8.5	
Loading ratio	Ld	0.8	8.4	8.4	8.4	8.4	8.4	10.6	10.6	10.6	10.6	10.6	
Total (units)		9.0	9.0	9.0	9.0	9.0	9.0	11.0	11.0	11.0	11.0	11.0	
Loading & Moving Time (Hrs)	7.4t ÷ 4.5t/hr=1.7hr	1.7	-	-	-	-	-	-	-	-	-	-	
	trip	3.0	5.1	5.1	5.1	5.1	5.1	-	-	-	-	-	
	trip	2.0	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4	
Transportation Time (Hrs)	Speed(km/hr)	55.0	-	-	-	-	-	-	-	-	-	-	
	15x2=30	30.0	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-	
	30x2=60	60.0	-	-	-	-	-	1.1	1.1	1.1	1.1	1.1	
	20x2=40	40.0	-	-	-	-	-	-	-	-	-	-	
	trip	3.0	1.5	1.5	1.5	1.5	-	-	-	-	-	-	
	trip	2.0	-	-	-	-	-	2.2	2.2	2.2	2.2	2.2	
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5	
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Total	hrs	8.4	8.4	8.4	8.4	8.4	7.1	7.1	7.1	7.1	7.1	7.1	
Summary		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Resource + Other	(t/d)	149.0	149.0	149.0	149.0	149.0	126.0	126.0	126.0	126.0	126.0	126.0	
Total	(t/d)	149.0	149.0	149.0	149.0	149.0	126.0	126.0	126.0	126.0	126.0	126.0	
Required Number of Vehicles	(units)												
Other(MSW)	(units)	9	9	9	9	9	11	11	11	11	11	11	
Total	(units)	9.0	9.0	9.0	9.0	9.0	11.0	11.0	11.0	11.0	11.0	11.0	

A-2-11			Calle	Calle	Calle	Calle	Calle	Calle	NS	NS	Calle/NS	Calle/NS	Calle/NS
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Plaza C/T (2/15)													
Segregated Collection		Resource + MSW (t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	92.0	92.0	92.0
Resource + Other		s-total (t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	92.0	92.0	92.0
Required number of vehicles	Qo		121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	92.0	92.0	92.0
	18 m ³ C/T	7.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	12.4	12.4	12.4
	trip	3.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	6.2	6.2	6.2
Operation rate	Or	1.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6.2	6.2	6.2
Loading ratio	Ld	0.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	7.8	7.8	7.8
Total (units)			7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	8.0
Loading & Moving Time (Hrs)	7.4t ÷ 4.5t/hr=1.7hr	1.7											
	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-
	trip		-	-	-	-	-	-	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	3.4	3.4	3.4
Transportation Time (Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	15x2=30	30.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
Calle 100 Extension /N S(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	1.1	1.1	1.1
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	-	-	-
	trip	3.0	1.5	1.5	1.5	1.5	1.5	1.5	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	2.1	2.1	2.2	2.2	2.2
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.4	8.4	8.4	8.4	8.4	8.4	9.0	9.0	7.1	7.1	7.1
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Resource + Other		(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	92.0	92.0	92.0
Total		(t/d)	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	92.0	92.0	92.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	8.0
Total		(units)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	8.0

A-2-12			Calle	Calle	Calle	Calle	Calle	Calle	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
C. Havana C/T (3/15)													
Segregated Collection		Resource + MSW (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	54.0	54.0	54.0
Resource + Other		s-total (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	54.0	54.0	54.0
Required number of vehicles	Qo		74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	54.0	54.0	54.0
	18 m ³ C/T	7.4	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7.3	7.3	7.3
	trip	3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	3.6	3.6	3.6
Operation rate	Or	1.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.6	3.6	3.6
Loading ratio	Ld	0.8	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.6	4.6	4.6
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Loading & Moving Time (Hrs)	7.4t ÷ 4.5t/hr=1.7hr	1.7											
	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-
	trip		-	-	-	-	-	-	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	3.4	3.4	3.4
Transportation Time (Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension(km)	15x2=30	30.0	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-
New Guanabacoa(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
	trip	3.0	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-	-
	trip	2.0	-	-	-	-	-	-	2.1	2.1	1.4	1.4	1.4
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.5	8.5	8.5	8.5	8.5	8.5	7.6	7.6	6.3	6.3	6.3
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Resource + Other		(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	54.0	54.0	54.0
Total		(t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	54.0	54.0	54.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

A-2-13			Calle	Calle	Calle	Calle	Calle	Calle	Calle	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
H.Vieja C/T (4/15)														
Segregated Collection		Resource + MSW (t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	54.0	54.0	54.0
Resource + Other		s-total (t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	54.0	54.0	54.0
Required number of vehicles	Qo		71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	54.0	54.0	54.0	
	18 m ³ C/T	7.4	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	7.3	7.3	7.3	
	trip	3.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	-	-	-	
	trip	2.0	-	-	-	-	-	-	-	-	3.6	3.6	3.6	
Operation rate	Or	1.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.6	3.6	3.6	
Loading ratio	Ld	0.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.6	4.6	4.6	
Total (units)			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7												
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	3.4	3.4	3.4	
Transportation Time														
(Hrs)	Speed(km/hr)	55.0												
Calle 100 Extension(km)	20x2=40	40.0	0.7	0.7	0.7	0.7	0.7	0.7	-	-	-	-	-	
New Guanabacoa(km)	17x2=34	34.0	-	-	-	-	-	-	0.6	0.6	0.6	0.6	0.6	
New Southwest(km)	30x2=60	60.0												
(Hrs)	trip	3.0	2.1	2.1	2.1	2.1	2.1	2.1	-	-	-	-	-	
(Hrs)	trip	2.0	-	-	-	-	-	-	1.2	1.2	1.2	1.2	1.2	
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Total	hrs		9.0	9.0	9.0	9.0	9.0	9.0	8.1	8.1	6.1	6.1	6.1	
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Resource + Other		(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	54.0	54.0	54.0	
Total		(t/d)	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	54.0	54.0	54.0	
Required Number of Vehicles		(units)												
Other(MSW)		(units)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	
Total		(units)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	

A-2-14			Ocho	NG	NG	NG	NG	Calle/NS	Calle/NS	Calle/NS	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
H.del Este C/T (5/15)													
Segregated Collection		Resource + MSW (t/d)	51.0	51.0	51.0	51.0	51.0	38.0	38.0	38.0	38.0	38.0	38.0
Resource + Other		s-total (t/d)	51.0	51.0	51.0	51.0	51.0	38.0	38.0	38.0	38.0	38.0	38.0
Required number of vehicles	Qo		51.0	51.0	51.0	51.0	51.0	38.0	38.0	38.0	38.0	38.0	38.0
	18 m ³ C/T	7.4	6.9	6.9	6.9	6.9	6.9	5.1	5.1	5.1	5.1	5.1	5.1
	trip	3.0	2.3	2.3	2.3	2.3	2.3	-	-	-	1.7	1.7	1.7
	trip	2.0	-	-	-	-	-	2.6	2.6	2.6	-	-	-
Operation rate	Or	1.0	2.3	2.3	2.3	2.3	2.3	2.6	2.6	2.6	1.7	1.7	1.7
Loading ratio	Ld	0.8	2.9	2.9	2.9	2.9	2.9	3.2	3.2	3.2	2.1	2.1	2.1
Total (units)			3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7											
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	-	-	-	5.1	5.1	5.1
(Hrs)	trip	2.0	-	-	-	-	-	3.4	3.4	3.4	-	-	-
Transportation Time													
(Hrs)	Speed(km/hr)	55.0											
Calle 100 Extension /N. Sw (km)	40x2=80	80.0	-	-	-	-	-	1.5	1.5	1.5	-	-	-
New Guanabacoa(km)	16x2=32	32.0	0.6	0.6	0.6	0.6	0.6	-	-	-	0.6	0.6	0.6
New Southwest(km)	30x2=60	60.0	-	-	-	-	-	-	-	-	-	-	-
(Hrs)	trip	3.0	1.7	1.7	1.7	1.7	1.7	-	-	-	-	-	-
(Hrs)	trip	2.0	-	-	-	-	-	2.9	2.9	2.9	1.8	1.8	1.8
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.6	8.6	8.6	8.6	8.6	7.8	7.8	7.8	8.4	8.4	8.4
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Resource + Other		(t/d)	51.0	51.0	51.0	51.0	51.0	38.0	38.0	38.0	38.0	38.0	38.0
Total		(t/d)	51.0	51.0	51.0	51.0	51.0	38.0	38.0	38.0	38.0	38.0	38.0
Required Number of Vehicles		(units)											
Other(MSW)		(units)	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0
Total		(units)	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0

A-2-15			Calle	Calle	Calle	Calle	Calle	Calle	Calle	NG	NG	NG	NG	NG
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Diez de Octubre C/T (6/15)														
Segregated Collection		Resource + MSW (t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	56.0	56.0	56.0
Resource + Other		s-total (t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	56.0	56.0	56.0
Required number of vehicles	Qo		78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	56.0	56.0	56.0
	18 m ³ C/T	7.4	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	7.6	7.6	7.6
	trip	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	2.5	2.5	2.5
	trip	2.0	-	-	-	-	-	-	-	-	-	-	-	-
Operation rate	Or	1.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	2.5	2.5	2.5
Loading ratio	Ld	0.8	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	3.2	3.2	3.2
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7												
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	-	-	-	-
Transportation Time														
(Hrs)	Speed(km/hr)	55.0												
Calle 100 Extension(km)	11x2=22	22.0	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-	-
New Guanabacoa(km)	16x2=32	32.0	-	-	-	-	-	-	0.6	0.6	0.6	0.6	0.6	0.6
New Southwest(km)	25x2=50	50.0												
(Hrs)	trip	3.0	1.2	1.2	1.2	1.2	1.2	1.2	1.8	1.8	1.8	1.8	1.8	1.8
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	-	-	-	-
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		8.1	8.1	8.1	8.1	8.1	8.1	8.4	8.4	8.4	8.4	8.4	8.4
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Resource + Other		(t/d)	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	56.00	56.00	56.00
Total		(t/d)	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	56.00	56.00	56.00
Required Number of Vehicles		(units)												
Other(MSW)		(units)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00
Total		(units)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00

A-2-16			Calle	Calle	Calle	Calle	Calle	Calle	Calle	NS	NS	Calle/NS	Calle/NS	Calle/NS
18m³ C/T			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Cerro C/T (7/15)														
Segregated Collection		Resource + MSW (t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	58.0	58.0	58.0
Resource + Other		s-total (t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	58.0	58.0	58.0
Required number of vehicles	Qo		80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	58.0	58.0	58.0
	18 m ³ C/T	7.4	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	7.8	7.8	7.8
	trip	3.0	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	-	-	-
	trip	2.0	-	-	-	-	-	-	-	-	-	3.9	3.9	3.9
Operation rate	Or	1.0	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.9	3.9	3.9
Loading ratio	Ld	0.8	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.9	4.9	4.9
Total (units)			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Loading & Moving Time	7.4t ÷ 4.5t/hr=1.7hr	1.7												
(Hrs)	trip	3.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-	-	-	
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	-	3.4	3.4	3.4
Transportation Time														
(Hrs)	Speed(km/hr)	55.0												
Calle 100 Extension(km)	13x2=16	16.0	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	
Calle 100 Extension /N. Sw (km)	40x2=80	80.0	-	-	-	-	-	-	-	-	-	-	-	
New Southwest(km)	20x2=40	40.0	-	-	-	-	-	-	0.7	0.7	0.7	0.7	0.7	
(Hrs)	trip	3.0	0.9	0.9	0.9	0.9	0.9	0.9	2.1	2.1	-	-	-	
(Hrs)	trip	2.0	-	-	-	-	-	-	-	-	1.4	1.4	1.4	
Dumping Time	hrs	0.25	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5	
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Total	hrs		7.7	7.7	7.7	7.7	7.7	7.7	8.2	8.2	6.3	6.3	6.3	
Summary			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Resource + Other		(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	58.0	58.0	58.0
Total		(t/d)	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	58.0	58.0	58.0
Required Number of Vehicles		(units)												
Other(MSW)		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Total		(units)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	

A-2-17 Segregated Collection		Summary of Required Number of 18m3 C/T											
Municipalities	Description	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Total of Recyclable & Other waste collection (7)	MSW (t/d)	0.0	0.0	0.0	0.0	0.0	164.0	164.0	164.0	478.0	478.0	478.0	
	No. of Vehicles (units)	0.0	0.0	0.0	0.0	0.0	15.0	15.0	15.0	41.0	41.0	41.0	
	No. of Bins (units)	0.0	0.0	0.0	0.0	0.0	6,668.0	0.0	0.0	14,134.0	0.0	0.0	
Total of MSW & Kitchen waste collection (7)	MSW (t/d)	0.0	0.0	0.0	0.0	0.0	90.0	90.0	90.0	299.0	299.0	299.0	
	No. of Vehicles (units)	0.0	0.0	0.0	0.0	0.0	15.0	15.0	15.0	35.0	35.0	35.0	
	No. of Bins (units)	0.0	0.0	0.0	0.0	0.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	
Others: Mixed Collection	MSW (t/d)	0.0	0.0	0.0	0.0	0.0	503.0	503.0	503.0	79.0	79.0	79.0	
	No. of Vehicles (units)	0.0	0.0	0.0	0.0	0.0	35.0	35.0	35.0	8.0	8.0	8.0	
	MSW (t/d)	0.0	0.0	0.0	0.0	0.0	703.0	703.0	703.0	703.0	703.0	703.0	
Total	No. of Vehicles (units)	0.0	0.0	0.0	0.0	0.0	65.0	65.0	65.0	84.0	84.0	84.0	
	Operation rate (C/T)	0.85	0.0	0.0	0.0	0.0	76.5	76.5	76.5	98.8	98.8	98.8	
	No. of Bins (units)	0.0	0.0	0.0	0.0	0.0	7,840.0	1,172.0	1,172.0	15,306.0	1,172.0	1,172.0	
Detail of required additional bins (Segregated Collection)	(units)	0.0	0.0	0.0	0.0	0.0	2,483.3	0.0	0.0	0.0	0.0	0.0	
	Playa	0.0	0.0	0.0	0.0	0.0	850.0	0.0	0.0	0.0	0.0	0.0	
	H. Del Este	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,016.7	0.0	0.0	
	Plaza	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,233.3	0.0	0.0	
	C. Havana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,183.3	0.0	0.0	
	H. Vieja	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,300.0	0.0	0.0	
	Diez de Octubre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,333.3	0.0	0.0	
Cerro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,334.0	0.0	0.0		
S-total (2 bins /point for segregated waste)	2	0.0	0.0	0.0	0.0	0.0	6,668.0	0.0	0.0	14,134.0	0.0	0.0	
Required replacement bins for MSW	(units)	0.0	0.0	0.0	0.0	0.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	1,172.0	
Steel Bins s-total	(units)	0.0	0.0	0.0	0.0	0.0	7,840.0	1,172.0	1,172.0	15,306.0	1,172.0	1,172.0	
Cumulative Total of Bins (units)		0.0	0.0	0.0	0.0	0.0	7,840.0	9,012.0	10,184.0	25,490.0	26,662.0	27,834.0	
Scrape Schedule	(units)	0	6	3	2	2	1	7	0	0	0	0	
Estimated number of C/T in operation provided by UPPH	(units)	45	39	36	34	32	31	24	24	24	24	24	
Required number of vehicles to be purchased	2005	0	0	0	0	0	0	0	0	0	0	0	
	2006 (Original Plan)	20	20	20	20	20	20	20	20	20	20	20	
	2006 (Revised Plan)	0	0	0	0	0	0	0	0	0	0	0	
	2007 (Original Plan)	3	3	3	3	3	3	3	3	3	3	3	
	2007 (Revised Plan)	0	0	0	0	0	0	0	0	0	0	0	
	2008 (Original Plan)	2	2	2	2	2	2	2	2	2	2	2	
	2008 (Revised Plan)	25	25	25	25	25	25	25	25	25	25	25	
	2009	2				2	2	2	2	2	2	2	
	2010	18					18	18	18	18	18	18	
	2011	7						7	7	7	7	7	
	2012	0							0	0	0	0	
	2013	0								23	23	23	
	2014	23									0	0	
	2015	0										0	
Total (unit: Original Plan)	100	45	59	59	59	59	76	76	76	99	99	99	
Total (unit: Revised Plan)	100	45	39	36	34	32	31	24	24	24	24	24	

Note: "Original Plan" is the plan prepared for DF/R on September 2005 based on the discussion between Cuban C/P and Study Team during the Study period.
"Revised Plan" is the plan finally prepared for the M/P in F/R finalised in March 2007 based on the assumption of that no investment is done in 2006 and 2007.

A-2-18 Segregated Collection Summary of Required Number of 18 m3 CT

Compressor Trucks (18m3 CT)	Phase-1									Phase-2						Total
	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-Total		
Existing CT (units)	ND	0	6	9	11	13	14	-	21	21	21	21	21	21	21	
Plan of Replacement (unit)	ND	0	6	3	2	2	1	14	7	0	0	0	0	7	21	
Scrap/Not in operation	ND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Number (units)	ND	45	39	36	34	57	58	-	65	65	88	88	88	88	88	
Replacement (units)	ND	0	0	0	25	2	18	45	7	0	23	0	0	30	75	
Total In operation Vehicles (units)	ND	45	39	36	59	59	76	76	76	76	99	99	99	99	99	
Standby (units)	ND	-34	-60	-63	-40	-40	-23	-23	-23	-23	0	0	0	0	-	
Required Vehicles (units)	99															
Unit Price (CUC)	130,000															
Total Cost	JY (Japanese yen)	0	0	0	0	357,500,000	28,600,000	257,400,000	643,500,000	100,100,000	0	328,900,000	0	429,000,000	1,072,500,000	
	JY/US\$=110	0	0	0	0	3,250,000	260,000	2,340,000	5,850,000	910,000	0	2,990,000	0	3,900,000	9,750,000	
Operation Cost =5%*unit cost * No. of Vehicles in operation	JY/US\$=110															
Total Cost	CUP	0	0	0	0	2,198,340	2,198,340	2,831,760	7,228,440	2,831,760	2,831,760	3,688,740	3,688,740	3,688,740	16,729,740	23,958,180
Maintenance Cost =5%*unit cost * Spare Parts																
	130,000CUC*0.05=6,500CUC					0	42,185,000	42,185,000	54,340,000	138,710,000	54,340,000	54,340,000	70,785,000	70,785,000	321,035,000	459,745,000
US/Year	6,500					0	383,500	383,500	494,000	1,261,000	494,000	494,000	643,500	643,500	2,918,500	4,179,500

ND: No Data

Item (18m3CT)	O/C (CUP)		2015			Remarks
	Unit cost	Unit	Quantity	CUP/Mon	Pric/year	
Labor costs	500	CUP/cap/M	4	2,000	24,000	4cap/d/unit
Water	0.5	CUP/m3	150	75	900	5m3/d/unit
Fuel	0.3	CUP/m3	2,000	600	7,200	3km/liter *200km
Power rates	0.1	CUP/kwh	300	30	360	
lubricant	1	LS	200	200	2,400	10%of Fuel
Others	1	LS	200	200	2,400	
Total				3,105	37,260.0	

A-2-19 Segregated Collection Summary of Required Number of Bins (Steel 770liter)

New Bins (770 liter Steel)	Phase-1									Phase-2						Total
	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-Total		
Existing Bins (units)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Plan of Replacement (unit)	0	0	0	0	3,516	4,688	12,528	12,528	13,700	14,872	30,178	31,350	32,522	32,522	32,522	
Scrap/Not in operation	0	0	0	0	3,516	1,172	7,840	12,528	1,172	1,172	15,306	1,172	1,172	19,994	32,522	
Total Number (units)	0	0	0	0	3,516	4,688	12,528	12,528	13,700	14,872	30,178	31,350	32,522	32,522	32,522	
Replacement (units)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total In operation Bins (units)	0	0	0	0	3,516	4,688	12,528	12,528	13,700	14,872	30,178	31,350	32,522	32,522	32,522	
Required bins (units)	32,522	0	-32,522	-32,522	-29,006	-27,834	-19,994	-	-18,822	-17,650	-2,344	-1,172	0	-	-	
Unit Price (JY)	260															
770 liter Bins	260															
Total Cost	JY (Japanese yen)	0	0	0	0	100,557,600	33,519,200	224,224,000	358,300,800	33,519,200	33,519,200	437,751,600	33,519,200	571,828,400	930,129,200	
	JY/US\$=110	0	0	0	0	914,160	304,720	2,038,400	3,257,280	304,720	304,720	3,979,560	304,720	5,198,440	8,455,720	
Maintenance Cost =5%*unit cost * No. of bins in																
	0.05	0	0	0	0	5,027,880	1,675,960	11,211,200	17,915,040	1,675,960	1,675,960	21,887,580	1,675,960	1,675,960	28,591,420	28,591,420

Note: Expected bin's life(10 years):

Capacity	2005-2010	2011-2015	Total
770 liter	12,528	19,994	32,522
Total	12,528	32,522	32,522
Capacity (770-Bins)	2005-2010	2011-2015	Total
Total Budget (JY)	358,300,800	571,828,400	930,129,200

Appendix-3

Required Number of 12 m³ C/T (DMSC)

Appendix-3-1			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
DMSC 12m ³ C/T													
MSW (t/d)	Substitute for H/C 12m ³ C/T	For New Guanabacoa	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
		For new Southwest	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
		s-total (t/d)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
Required number of vehicle	Qo		74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
	12 m ³ (New Guanabacoa)	5.0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
	trip	1.0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
	Operation rate	Or	1.0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
	Loading ratio	Ld	0.8	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	Total (units)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	12 m ³ (New Southwest)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	trip	1.0	10.0	10.0	10.0	10.0	10.0	-	-	-	-	-	-
	Operation rate	Or	1.0	-	-	-	-	10.0	10.0	10.0	10.0	10.0	10.0
	Loading ratio	Ld	0.8	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
	Total (units)		13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Loading & Moving Time													
	(12m ³ C/T)	Trip	1.0	-	-	-	-	-	-	-	-	-	-
	(Hrs)		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	(12m ³ C/T)	trip	1.0	-	-	-	-	-	-	-	-	-	-
	(Hrs)		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Transportation Time	12 m ³ (New Guanabacoa)											
	(Hrs)	Speed(km/hr)	55.0	-	-	-	-	-	-	-	-	-	-
	Calle 100 Extension(km)	10x2=20	20.0	-	-	-	-	-	-	-	-	-	-
	New Guanabacoa(km)	10x2=20	20.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	New Southwest(km)	15x2=30	30.0	-	-	-	-	-	-	-	-	-	-
	(Hrs)	trip	1.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Dumping Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Total	hrs	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
	Transportation Time	12 m ³ (Calle 100 Expansion / New Southwest)											
	(Hrs)	Speed(km/hr)	55.0	-	-	-	-	-	-	-	-	-	-
	Calle 100 Extension(km)	10x2=20	20.0	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-
	New Guanabacoa(km)	10x2=20	20.0	-	-	-	-	-	-	-	-	-	-
	New Southwest(km)	15x2=30	30.0	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5
	(Hrs)	trip	1.0	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-
	Dumping Time	hrs	0.25	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Total	hrs	6.6	6.6	6.6	6.6	6.6	6.6	6.8	6.8	6.8	6.8	6.8
	Total	12 m ³ C/T(New Guanabacoa)	(t/d)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
		12 m ³ C/T(New Southwest)	(t/d)	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
		total		74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
Required Number of Vehicles			(units)										
	Total	12m ³ C/T(New Guanabacoa)	(units)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
		Operation rate	0.85	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
		12m ³ C/T(New southwest)	(units)	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
		Operation rate	0.85	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
		total	(units)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Estimated number of Existing C/T in operation			4m ³ (units)	0	0	0	0	0	0	0	0	0	0
12m ³ /d capacity: Required number of vehicles to be purchased	2005		0	0	0	0	0	0	0	0	0	0	0
	-		0	0	0	0	0	0	0	0	0	0	0
	2008		8			8	8	8	8	8	8	8	8
	2009		0				0	0	0	0	0	0	0
	2010		0					0	0	0	0	0	0
	2011		0						0	0	0	0	0
	2012		0							0	0	0	0
	2013		0								0	0	0
	2014		0									0	0
	2015		0										0
	Total (unit)		8	0	0	0	8	8	8	8	8	8	8
Estimated number of Existing C/T in operation			8m ³ (units)	0	0	0	0	0	0	0	0	0	0
12m ³ /d capacity: Required number of vehicles to be purchased	2005		0	0	0	0	0	0	0	0	0	0	0
	0		0	0	0	0	0	0	0	0	0	0	0
	2008		16			16	16	16	16	16	16	16	16
	2009		0				0	0	0	0	0	0	0
	2010		0					0	0	0	0	0	0
	2011		0						0	0	0	0	0
	2012		0							0	0	0	0
	2013		0								0	0	0
	2014		0									0	0
	2015		0										0
	Total (unit)		16	0	0	0	16	16	16	16	16	16	16
G-tol			(units)	24	0	0	24	24	24	24	24	24	24

Note: This is the plan prepared for the M/P in F/R finalised in March 2007 based on the assumption of that no investment is done in 2006 and 2007.

A-3.2 12m3 C/T (DMSC)		Phase-1										Phase-2					Total
New Compactor Truck (12m3Capacity Vehicles)		2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-total	Total	
Scraps (units)	Total Scraps (units)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	12m3 C/T vehicles(C100 E.N.SW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	12m3 C/T vehicles(N.G.B.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Plan of Replacement (unit)	12m3 C/T vehicles(C100 E.N.SW)	0	0	0	0	16	0	0	16	0	0	0	0	0	0	16	
	12m3 C/T vehicles(N.G.B.)	0	0	0	0	8	0	0	8	0	0	0	0	0	0	8	
	Total Vehicles (unit)	0	0	0	0	24	0	0	24	0	0	0	0	0	0	24	
Total In Operation Vehicles (units)	12m3 C/T vehicles(C100 E.N.SW)	0	0	0	0	16	16	16	16	16	16	16	16	16	16	16	
	12m3 C/T vehicles(N.G.B.)	0	0	0	0	8	8	8	8	8	8	8	8	8	8	8	
	Total	0	0	0	0	24	24	24	24	24	24	24	24	24	24	24	
Required Vehicle (units)	Standby (units)	0	-	-	-	0	-	-	-	-	-	-	-	-	-	-	
	2m3 (C100E.N.SW)	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12m3(N.G.B.)	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unit Price (JY)																	
12m3 Vehicles	12,000,000	0	0	0	0	#####	0	0	#####	0	0	0	0	0	0	#####	
12m3 vehicles	12,000,000	0	0	0	0	96,000,000	0	0	96,000,000	0	0	0	0	0	0	96,000,000	
Total Cost	JY	0	0	0	0	#####	0	0	#####	0	0	0	0	0	0	#####	
JOYIUS\$	110	0	0	0	0	2,618,182	0	0	2,618,182	0	0	0	0	0	0	2,618,182	
Maintenance Cost =5%*unit cost * No. of Vehicles in operation																	
JY/year	0.05	0	0	0	0	14,400,000	14,400,000	14,400,000	43,200,000	14,400,000	14,400,000	14,400,000	14,400,000	14,400,000	72,000,000	#####	

O/C (CUP)		Unit		CUP Currency		Remarks
Item (C/C)	Unit cost	Quantity	Price(Mon)	Price(Year)		
Labor costs	500 CUP/cap	72	36,000	432,000		3cap/d/unit*24units
Water	0.5 CUP/m3	1536	768	9,216		2m3/d/unit*24units
Gas(LPG)	- CUP/liter	0	0	0		
Fuel	0.3 CUP/m3	20,571	6,171	74,057		3.5 km/liter per
Power rates	0.1 CUP/kwh	7,200	720	8,640		
Total			43,659	523,913		25CUP/US
Expenses (CUP/day)				1,435		
Expenses (CUP/t/d)				19		7.4 t/day(MSW)
				74		

Appendix-4

Required Number of 15 m³ T/C (DMSC)

Appendix-4-1

DMSC 15 m ³ T/C collection (2.0 ton)			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MSW (t/d)	MSW (t/d)	For New Guanabacoa	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
		For new Southwest	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
		s-total (t/d)	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0
Required number of vehicles	Qo		162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0
	15 m ³ (New Guanabacoa)	2.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
	trip	2.0	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
	trip	0.0	-	-	-	-	-	-	-	-	-	-	-
Operation rate	Or	1.0	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
Loading ratio	Ld	0.6	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
	Total (units)		33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
	15 m ³ (New Southwest)	2.0	42	42	42	42	42	42	42	42	42	42	42
	trip (Calle 100 Expansion)	2.0	21	21	21	21	21	21	-	-	-	-	-
	trip(New Southwest)	1.0	-	-	-	-	-	-	42	42	42	42	42
Operation rate	Or	1.0	21	21	21	21	21	21	42	42	42	42	42
Loading ratio	Ld	0.6	35.0	35.0	35.0	35.0	35.0	35.0	70.0	70.0	70.0	70.0	70.0
	Total (units)		35.0	35.0	35.0	35.0	35.0	35.0	70.0	70.0	70.0	70.0	70.0
Loading & Moving Time	2/1=2	2.0											
(Hrs)	trip (For New Guanabacoa)	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
(Hrs)	trip (Calle 100 Expansion	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	-	-	-	-
(Hrs)	trip (New Southwest)	1.0	-	-	-	-	-	-	-	2.0	2.0	2.0	2.0
Transportation Time	15 m ³ (New Guanabacoa)												
(Hrs)	Speed(km/hr)	25.0	-	-	-	-	-	-	-	-	-	-	-
	30x2=60	10.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
(Hrs)	trip(New Guanabacoa)	2.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Dumping Time	hrs/time	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Preparation Time	hrs/time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs/time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Transportation Time	15 m ³ (New Southwest)												
(Hrs)	Speed(km/hr)	25.0	-	-	-	-	-	-	-	-	-	-	-
Calle 100 Extension(km)	15x2=30	20.0	0.8	0.8	0.8	0.8	0.8	0.8	-	-	-	-	-
New Southwest(km)	30x2=60	40.0	-	-	-	-	-	-	1.6	1.6	1.6	1.6	1.6
(Hrs)	trip (Calle 100 Expansion	2.0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-	-	-	-
(Hrs)	trip (New Southwest)	1.0	-	-	-	-	-	-	-	1.6	1.6	1.6	1.6
Dumping Time	hrs	0.25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Preparation Time	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Break/lunch	hrs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	hrs		7.1	7.1	7.1	7.1	7.1	7.1	7.1	5.1	5.1	5.1	5.1
Total	15 m ³ T/C(New Guanabacoa)	(t/d)	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
	15 m ³ T/C(New Southwest)	(t/d)	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
	total		162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0
Required Number of Vehicles		(units)											
Total	15 m ³ T/C(New Guanabacoa)	(units)	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
	Operation rate	0.85	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
	15 m ³ T/C(New Southwest)	(units)	35.0	35.0	35.0	35.0	35.0	35.0	70.0	70.0	70.0	70.0	70.0
	Operation rate	0.85	42.0	42.0	42.0	42.0	42.0	42.0	83.0	83.0	83.0	83.0	83.0
	total	(units)	81.0	81.0	81.0	81.0	81.0	81.0	122.0	122.0	122.0	122.0	122.0
Estimated number of Existing T/C in operation provided by DMSC		(units)	62	62	62	62	62	62	62	62	62	62	62
Required number of vehicles to be purchased	2005	0	0	0	0	0	0	0	0	0	0	0	0
	-	0	0	0	0	0	0	0	0	0	0	0	0
	-	0	0	0	0	0	0	0	0	0	0	0	0
	2008	19			19	19	19	19	19	19	19	19	19
	2009	0				0	0	0	0	0	0	0	0
	2010	0					0	0	0	0	0	0	0
	2011	41						41	41	41	41	41	41
	2012	0							0	0	0	0	0
	2013	0								0	0	0	0
	2014	0									0	0	0
	2015	0										0	0
	Total (unit)	60	62	62	62	81	81	81	122	122	122	122	

Note: This is the plan prepared for the M/P in F/R finalised in March 2007 based on the assumption of that no investment is done in 2006 and 2007.

A-4.2 15 m3 T/C (DMSC)

New T/C(15m3)	Phase-1								Phase-2					Total	
	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015		S-total
Total Scraps (units)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plan of Replacement (unit)	Total Vehicles (units)	0	0	0	0	62	81	81	-	81	122	122	122	122	62
	Replacement (units)	0	0	0	0	19	0	0	19	41	0	0	0	0	41
	Total In operation Vehicles (units)	0	0	0	0	81	81	81	-	122	122	122	122	122	122
	Standby (units)		-122	-122	-122	-41	-41	-41	-	0	0	0	0	0	-
Required Vehicles (units)	Unit Price (Y)	122													
Unit Cost of T/C Vehicles	2,800,000	0	0	0	0	53,200,000	0	0	53,200,000	114,800,000	0	0	0	0	114,800,000
JYIUS\$=	110	0	0	0	0	483,636	0	0	483,636	1,043,636	0	0	0	0	1,043,636
Maintenance Cost =5%*unit cost* No. of Vehicles JY/year	0.05	0	0	0	0	11,340,000	11,340,000	11,340,000	34,020,000	17,080,000	17,080,000	17,080,000	17,080,000	17,080,000	85,480,000
															119,420,000

Item (T/C)	Unit cost	Unit cost	CUP Currency		Remarks
CUP	CUP	CUP	Quantity	Price(Mon)	Pric/year
Labor costs	500	CUP/cap	610	305,000	3,660,000
Water	0.5	CUP/m3	7,360	3,660	43,920
Gas(LPG)	-	CUP/liter	0	-	-
Fuel	0.3	CUP/m3	104,571	31,371	376,457
Power rates	0.1	CUP/kwh	36,600	3,660	43,920
Total				343,691	4,124,297
Expenses (CUP/day)					11,299
Expenses (CUP/dg)					69.7162/day(MSW)

Appendix-5

Summary of Cost for Collection and Transportation System (UPPU and DMSC)

Appendix-5-1 Summary of Collection & Transportation Cost

Description			Mixed Collection	Segregated Collection	(Mixed Collection) - (Segregated Collection)=	
Vehicles	Type of Vehicles					
	Total Number in operation vehicles	18m3 C/T (units)	(units)	73	99	26
		15m3 T/C(units)	(units)	122	122	0
		12m3 C/T (units)	(units)	24	24	0
		S-Total	(units)	219	245	26
	Required Number of replacement	18m3 C/T (units)	(units)	21	75	54
		15m3 T/C(units)	(units)	60	60	0
		12m3 C/T (24 units)	(units)	24	24	0
		S-Total	(units)	105	159	54
	Capital Cost	18m3 C/T (units)	(US\$/year)	6,370,000	9,750,000	3,380,000
		15m3 T/C(units)	(US\$/year)	1,527,273	1,527,273	0
		12m3 C/T (units)	(US\$/year)	2,618,182	2,618,182	0
		S-Total	(US\$/year)	10,515,455	13,895,455	3,380,000
	O/C	18m3 C/T (units)	(CUP/year)	20,194,920	23,958,180	3,763,260
		15m3 T/C(units)	(CUP/year)	28,836,274	28,836,275	0
		12m3 C/T (units)	(CUP/year)	4,191,305	4,191,305	0
		S-Total	(CUP/year)	53,222,499	56,985,760	3,763,260
	M/C	18m3 C/T (units)	(US\$/year)	3,523,000	4,179,500	656,500
		15m3 T/C(units)	(US\$/year)	1,085,636	1,085,636	0
		12m3 C/T (units)	(US\$/year)	1,047,273	1,047,273	0
S-Total		(US\$/year)	5,655,909	6,312,409	656,500	
Bins	Total Number in operation vehicles		(units)	11,720	32,522	20,802
	Required Number of replacement		(units)	11,720	32,522	20,802
	Capital Cost	(units)	(US\$/year)	3,047,200	8,455,720	5,408,520
	O/C	(units)	(CUP/year)	0	0	0
	M/C	(units)	(US\$/year)	152,360	422,786	270,426
Work shop	Type of Equipment					
	Capital Cost	Machine Tools	set	697,623	697,623	0
		Equipment	set	604,255	604,255	0
		Various Tools	set	152,582	152,582	0
		Mechanical Cleaning Equ.	set	1,501,818	1,501,818	0
		Inspection / Communication	set	38,909	38,909	0
		Office equipment	set	353,636	353,636	0
		S-Total	set	3,348,823	3,348,823	0
	O/C			8,484,642	8,484,642	0
	M/C			950,731	950,731	0
G Total						
Capital Cost	(US\$/year)		16,911,477	25,699,997	8,788,520	
O/C	(CUP/year)		61,707,141	65,470,402	3,763,260	
M/C	(US\$/year)		6,759,000	7,685,926	926,926	

A-5-2 Mixed Collection

Description		Units	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-total	Total		
Vehicles	Type of Vehicles																		
	Total Number in operation vehicles	18m3 C/C (73 units)	(units)	0	0	39	36	59	59	59	-	73	73	73	73	73	-	73	
		15m3 T/C(122 units)	(units)	0	0	0	0	81	81	81	-	122	122	122	122	122	-	122	
		12m3 C/C(24 units)	(units)	0	0	0	0	24	24	24	-	24	24	24	24	24	-	24	
		S-Total	(units)	0	0	39	36	164	164	164	-	219	219	219	219	219	-	219	
	Required Number of replacement	18m3 C/C (73 units)	(units)	0	0	0	0	0	25	2	1	28	21	0	0	0	0	21	
		15m3 T/C(122 units)	(units)	0	0	0	0	19	0	19	41	0	0	0	0	0	0	41	
		12m3 C/C(24 units)	(units)	0	0	0	0	24	0	24	0	0	0	0	0	0	0	24	
		S-Total	(units)	0	0	0	0	43	25	2	71	62	0	0	0	0	0	62	
	Capital Cost	18m3 C/C (73 units)	(US\$year)	0	0	0	0	3,250,000	260,000	130,000	3,640,000	2,730,000	0	0	0	0	0	2,730,000	6,370,000
		15m3 T/C(122 units)	(US\$year)	0	0	0	0	483,636	0	0	483,636	1,043,636	0	0	0	0	0	1,043,636	1,527,273
		12m3 C/C(24 units)	(US\$year)	0	0	0	0	2,618,182	0	0	2,618,182	0	0	0	0	0	0	0	2,618,182
		S-Total	(US\$year)	0	0	0	0	6,351,818	260,000	130,000	6,741,818	3,773,636	0	0	0	0	0	3,773,636	10,515,455
	OC	18m3 C/C (73 units)	(CUP/year)	0	0	0	0	2,198,340	2,198,340	2,198,340	6,595,020	2,719,980	2,719,980	2,719,980	2,719,980	2,719,980	2,719,980	13,599,900	20,194,920
		15m3 T/C(122 units)	(CUP/year)	0	0	0	0	2,738,263	2,738,263	2,738,263	8,214,789	4,124,297	4,124,297	4,124,297	4,124,297	4,124,297	20,621,486	28,836,274	
		12m3 C/C(24 units)	(CUP/year)	0	0	0	0	523,913	523,913	523,913	1,571,739	523,913	523,913	523,913	523,913	523,913	2,619,566	4,191,305	
		S-Total	(CUP/year)	0	0	0	0	5,460,516	5,460,516	5,460,516	16,381,548	7,368,190	7,368,190	7,368,190	7,368,190	7,368,190	36,840,951	53,222,499	
	MC	18m3 C/C (73 units)	(US\$year)	0	0	0	0	383,500	383,500	383,500	1,150,500	474,500	474,500	474,500	474,500	474,500	2,372,500	3,523,000	
15m3 T/C(122 units)		(US\$year)	0	0	0	0	103,091	103,091	103,091	309,273	155,273	155,273	155,273	155,273	155,273	776,364	1,085,636		
12m3 C/C(24 units)		(US\$year)	0	0	0	0	130,909	130,909	130,909	392,727	130,909	130,909	130,909	130,909	130,909	654,545	1,047,273		
S-Total		(US\$year)	0	0	0	0	617,500	617,500	617,500	1,852,500	760,682	760,682	760,682	760,682	760,682	3,803,409	5,655,909		
Bins	Type of Bins	Steel 770 liter (11,720 units)	(units)	0	0	0	0	3,516	4,688	5,860	5,860	7,032	8,204	9,376	10,548	11,720	11,720	11,720	
	Capital Cost	(US\$year)	0	0	0	0	914,160	304,720	304,720	1,523,600	304,720	304,720	304,720	304,720	304,720	1,523,600	3,047,200		
	OC	(CUP/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	MC	0.025	(US\$year)	0	0	0	0	45,708	15,236	15,236	76,180	15,236	15,236	15,236	15,236	15,236	76,180	152,360	
Work shop	Type of Equipment																		
	Capital Cost	Machine tools	set	0	0	0	0	0	0	0	0	697,623	0	0	0	0	0	697,623	
		Equipment	set	0	0	0	0	604,255	0	0	604,255	0	0	0	0	0	0	604,255	
		Various Tools	set	0	0	0	0	152,582	0	0	152,582	0	0	0	0	0	0	152,582	
		Mechanical Cleaning Equip.	set	0	0	0	0	0	0	0	0	1,501,818	0	0	0	0	0	1,501,818	
	OC	Inspection/ Communication	set	0	0	0	0	0	0	0	0	38,909	0	0	0	0	0	38,909	
		Office Equipment	set	0	0	0	0	0	0	0	0	353,636	0	0	0	0	0	353,636	
		S-Total	set	0	0	0	0	756,836	0	0	756,836	2,591,986	0	0	0	0	0	2,591,986	
		MC	0.05	(US\$year)	0	0	0	0	1,020,939	1,020,939	3,062,817	1,084,365	1,084,365	1,084,365	1,084,365	1,084,365	5,421,825	8,484,642	
	G Total	Capital Cost	(US\$year)	0	0	0	0	8,022,815	564,720	434,720	9,022,255	6,670,343	304,720	304,720	304,720	304,720	7,889,223	16,911,477	
		OC	(CUP/year)	0	0	0	0	6,481,455	6,481,455	6,481,455	19,444,365	8,452,555	8,452,555	8,452,555	8,452,555	8,452,555	42,262,776	61,707,141	
		MC	(US\$year)	0	0	0	0	701,050	670,578	670,578	2,042,205	943,359	943,359	943,359	943,359	943,359	4,716,795	6,759,000	
		S-Total	(CUP/year)	0	0	0	0	5,460,516	5,460,516	5,460,516	16,381,548	7,368,190	7,368,190	7,368,190	7,368,190	7,368,190	36,840,951	53,222,499	

A-5-3 Segregated Collection

Description		Units	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-total	Total		
Vehicles	Type of Vehicles																		
	Total Number in operation vehicles	18m3 C/C (107 units)	(units)	0	0	39	36	59	59	76	-	76	76	99	99	99	-	99	
		15m3 T/C(122 units)	(units)	0	0	0	0	81	81	81	-	122	122	122	122	122	-	122	
		12m3 C/C(24 units)	(units)	0	0	0	0	24	24	24	-	24	24	24	24	24	-	24	
		S-Total	(units)	0	0	39	36	164	164	181	-	222	222	245	245	245	-	245	
	Required Number	18m3 C/C (107 units)	(units)	0	0	0	0	25	2	18	45	7	0	23	0	0	0	30	
		15m3 T/C(122 units)	(units)	0	0	0	0	19	0	19	41	0	0	0	0	0	0	41	
		12m3 C/C(24 units)	(units)	0	0	0	0	24	0	24	0	0	0	0	0	0	0	24	
		S-Total	(units)	0	0	0	0	68	2	18	88	48	0	23	0	0	0	71	
	Capital Cost	18m3 C/C (107 units)	(US\$year)	0	0	0	0	3,250,000	260,000	2,340,000	5,850,000	910,000	0	2,990,000	0	0	0	3,900,000	9,750,000
		15m3 T/C(122 units)	(US\$year)	0	0	0	0	483,636	0	0	483,636	1,043,636	0	0	0	0	0	1,043,636	1,527,273
		12m3 C/C(24 units)	(US\$year)	0	0	0	0	2,618,182	0	0	2,618,182	0	0	0	0	0	0	0	2,618,182
		S-Total	(US\$year)	0	0	0	0	6,351,818	260,000	2,340,000	8,951,818	1,953,636	0	2,990,000	0	0	0	4,943,636	13,895,455
	OC	18m3 C/C (107 units)	(CUP/year)	0	0	0	0	2,198,340	2,198,340	2,831,760	7,228,440	2,831,760	2,831,760	3,688,740	3,688,740	3,688,740	16,729,740	23,958,180	
		15m3 T/C(122 units)	(CUP/year)	0	0	0	0	2,738,263	2,738,263	2,738,263	8,214,789	4,124,297	4,124,297	4,124,297	4,124,297	4,124,297	20,621,485	28,836,273	
		12m3 C/C(24 units)	(CUP/year)	0	0	0	0	523,913	523,913	523,913	1,571,739	523,913	523,913	523,913	523,913	523,913	2,619,566	4,191,305	
		S-Total	(CUP/year)	0	0	0	0	5,460,516	5,460,516	6,093,936	17,014,968	7,479,970	7,479,970	8,336,950	8,336,950	8,336,950	39,970,791	56,985,760	
	MC	18m3 C/C (107 units)	(US\$year)	0	0	0	0	383,500	383,500	494,000	1,261,000	494,000	494,000	643,500	643,500	643,500	2,918,500	4,179,500	
15m3 T/C(122 units)		(US\$year)	0	0	0	0	103,091	103,091	103,091	309,273	155,273	155,273	155,273	155,273	155,273	776,364	1,085,636		
12m3 C/C(24 units)		(US\$year)	0	0	0	0	130,909	130,909	130,909	392,727	130,909	130,909	130,909	130,909	130,909	654,545	1,047,273		
S-Total		(US\$year)	0	0	0	0	617,500	617,500	728,000	1,963,000	780,182	780,182	929,682	929,682	929,682	4,349,409	6,312,409		
Bins	Type of Bins	Steel, 770 liter (32,522 units)	(units)	0	0	0	0	3,516	4,688	12,528	12,528	13,700	14,872	30,178	31,350	32,522	32,522	32,522	
	Capital Cost	(US\$year)	0	0	0	0	914,160	304,720	2,038,400	3,257,280	304,720	304,720	3,979,560	304,720	304,720	5,198,440	8,455,720		
	OC	(CUP/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	MC	0.025	(US\$year)	0	0	0	0	45,708	15,236	101,920	162,864	15,236	15,236	198,978	15,236	15,236	259,922	422,780	
Work shop	Type of Equipment																		
	Capital Cost	Machine tools	set	0	0	0	0	0	0	0	0	697,623	0	0	0	0	0	697,623	
		Equipment	set	0	0	0	0	604,255	0	0	604,255	0	0	0	0	0	0	604,255	
		Various Tools	set	0	0	0	0	152,582	0	0	152,582	0	0	0	0	0	0	152,582	
		Mechanical Cleaning Equip.	set	0	0</														

Appendix-6

Staffing Schedule (UPPH and DMSC)

Description	Actual			2010			2013			2015(M/P)			
	UPPH	DMSC	S-total	UPPH	DMSC	S-total	UPPH	DMSC	S-total	UPPH	DMSC	S-total	
1. Mixed Collection	Collection Crew	277	1,276	1,553	332	405	737	388	610	998	388	610	998
	Engineers	40	44	83	33	25	58	39	37	76	39	37	76
	Tech. staff	130	106	235	125	41	166	146	61	207	146	61	207
	Workmen	45	40	85	59	41	100	68	61	129	68	61	129
	Bin cleaning staff	6	0	6	13	0	13	20	0	20	25	0	25
	Inspectors	18	165	183	17	162	179	20	244	264	20	244	264
	Data Operator	1	0	1	2	15	17	2	15	17	2	15	17
	S-total	517	1,630	2,147	582	689	1,271	683	1,028	1,711	688	1,028	1,716
2. Segregated Collection	Collection Crew	277	1,276	1,553	380	405	785	560	610	1,170	560	610	1,170
	Engineers	40	44	83	52	25	77	56	37	93	56	37	93
	Tech. staff	130	106	235	195	41	236	210	61	271	210	61	271
	Workmen	45	40	85	91	41	132	98	61	159	98	61	159
	Bin cleaning staff	6	0	6	56	0	56	64	0	64	68	0	68
	Inspectors	18	165	183	27	162	189	29	244	273	29	244	273
	Data Operator	1	0	1	2	15	17	2	15	17	2	15	17
	S-total	517	1,630	2,147	803	689	1,492	1,019	1,028	2,047	1,023	1,028	2,051

A-6-2 Staffing Schedule

Description	2004	2005	2006	2007	2008	2009	2010	S-Total	2011	2012	2013	2014	2015	S-total	Total
18m3C/T (units)	0	0	0	0	59	59	59	-	73	73	73	73	73	-	73
15m3T/C (units)	0	0	0	0	81	81	81	-	122	122	122	122	122	-	122
12m3C/T (units)	0	0	0	0	24	24	24	-	24	24	24	24	24	-	24
S-total (units)	0	0	0	0	164	164	164	0	219	219	219	219	219	0	219
Bins (units)	0	0	0	0	3,516	4,688	5,860	5,860	7,032	8,204	9,376	10,548	11,720	11,720	11,720
UPPH															
Collection Crew	0	0	0	0	332	332	332	332	388	388	388	388	388	388	388
Engineers	0	0	0	0	33	33	33	33	39	39	39	39	39	39	39
Tech. staff	0	0	0	0	125	125	125	125	146	146	146	146	146	146	146
Workmen	0	0	0	0	59	59	59	59	68	68	68	68	68	68	68
Bin cleaning staff	0	0	0	0	8	10	13	13	15	18	20	23	25	25	25
Inspectors	0	0	0	0	17	17	17	17	20	20	20	20	20	20	20
Data Operator	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2
S-total	0	0	0	0	577	579	582	582	678	681	683	686	688	688	688
DMSC															
Collection Crew	0	0	0	0	405	405	405	405	610	610	610	610	610	610	610
Engineers	0	0	0	0	25	25	25	25	37	37	37	37	37	37	37
Tech. staff	0	0	0	0	41	41	41	41	61	61	61	61	61	61	61
Workmen	0	0	0	0	41	41	41	41	61	61	61	61	61	61	61
Bin cleaning staff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inspectors	0	0	0	0	162	162	162	162	244	244	244	244	244	244	244
Data Operator	0	0	0	0	15	15	15	15	15	15	15	15	15	15	15
S-total	0	0	0	0	689	689	689	689	1,028	1,028	1,028	1,028	1,028	1,028	1,028
Total	0	0	0	0	1,266	1,268	1,271	1,271	1,706	1,709	1,711	1,714	1,716	1,716	1,716
18m3C/T (units)	0	0	0	0	59	59	76	-	76	76	99	99	99	-	99
15m3T/C (units)	0	0	0	0	81	81	81	-	122	122	122	122	122	-	122
12m3C/T (units)	0	0	0	0	24	24	24	-	24	24	24	24	24	-	24
S-total (units)	0	0	0	0	164	164	181	0	222	222	245	245	245	0	245
Bins (units)	0	0	0	0	10,184	11,356	26,662	26,662	27,834	29,006	30,178	31,350	32,522	32,522	32,522
UPPH															
Collection Crew	0	0	0	0	332	332	380	380	380	380	560	560	560	560	560
Engineers	0	0	0	0	33	33	52	52	52	52	56	56	56	56	56
Tech. staff	0	0	0	0	125	125	195	195	195	195	210	210	210	210	210
Workmen	0	0	0	0	59	59	91	91	91	91	98	98	98	98	98
Bin cleaning staff	0	0	0	0	3	3	56	56	56	56	64	66	68	68	68
Inspectors	0	0	0	0	17	17	27	27	27	27	29	29	29	29	29
Data Operator	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2
S-total	0	0	0	0	572	572	803	803	803	803	1,019	1,021	1,023	1,023	1,023
DMSC															
Collection Crew	0	0	0	0	405	405	405	405	610	610	610	610	610	610	610
Engineers	0	0	0	0	25	25	25	25	37	37	37	37	37	37	37
Tech. staff	0	0	0	0	41	41	41	41	61	61	61	61	61	61	61
Workmen	0	0	0	0	41	41	41	41	61	61	61	61	61	61	61
Bin cleaning staff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inspectors	0	0	0	0	162	162	162	162	244	244	244	244	244	244	244
Data Operator	0	0	0	0	15	15	15	15	15	15	15	15	15	15	15
S-total	0	0	0	0	689	689	689	689	1,028	1,028	1,028	1,028	1,028	1,028	1,028
Total	0	0	0	0	1,361	1,363	1,632	1,632	2,042	2,044	2,047	2,049	2,052	2,052	2,052

A-6-3 1. Mixed Collection Note: Basic unit value was provided by UPPH at June 6, 2005

1-1. Description		Actual (As of September, 2004)				Future (2015)			
		Collection (head/unit)	No. existing (units)	Total (personal)	Remarks	Collection (head/unit)	Required (units)	Total (personal)	Remarks
UPPH	18 m3C/T	7.7	36	277	2 shifts	4	73	292	shift +1standb
	12m3C/T	-	-	-	-	4	24	96	shift +1standb
	s-total	-	-	277	-	-	-	388	-
DMSC	D/T	8	25	200	2 shifts	-	-	-	-
	T/C	10	62	620	2 shifts	5	122	610	1 shift
	H/C	1.5	304	456	-	-	-	-	-
	s-total	-	-	1,276	-	-	122	610	-
G total		-	-	1,553	-	-	-	998	-

1-2. Description		Actual (As of September, 2004)				Future			
		Engineers (head/unit)	Existing (units)	Total (personal)	Remarks	Engineers (head/unit)	Required (units)	Total (personal)	Remarks
UPPH	18 m3C/T	1.1	36	40	-	0.4	73	29	-
	12m3C/T	-	-	-	-	0.4	24	10	For DMSCs
	s-total	-	-	40	-	-	-	39	-
DMSC	D/T	0.5	25	13	-	-	-	-	-
	T/C	0.5	62	31	-	0.3	122	37	-
	s-total	-	-	44	-	-	122	37	-
G total		-	-	83	-	-	-	75	-

1-3. Description		Actual (As of September, 2004)				Future			
		Tech. staff (head/unit)	Existing (units)	Total (personal)	Remarks	Tech. staff (head/unit)	Required (units)	Total (personal)	Remarks
UPPH	18 m3C/T	3.6	36	130	-	1.5	73	110	-
	12m3C/T	-	-	-	-	1.5	24	36	For DMSCs
	s-total	-	-	130	-	-	97	146	-
DMSC	D/T	1	25	25	-	-	-	-	-
	T/C	1.3	62	81	-	0.5	122	61	-
	s-total	-	-	106	-	-	122	61	-
G total		-	-	235	-	-	-	207	-

1-4. Description		Actual (As of September, 2004)				Future			
		Workmen (head/area)	Existing (units)	Total (personal)	Remarks	Workmen (head/area)	Required (units)	Total (personal)	Remarks
UPPH	18 m3C/T	-	-	45	-	0.7	73	51	-
	12m3C/T	-	-	-	-	0.7	24	17	-
	s-total	-	-	45	-	-	97	68	-
DMSC	D/T,T/C	-	-	40	-	0.5	122	61	-
	s-total	-	-	40	-	-	-	61	-
G total		-	-	85	-	-	-	129	-

1-5. Description (770 liters)		Actual (As of September, 2004)				Future			
		Bin cleaning staff (head/unit)	Existing (units)	Total (personal)	Remarks	Bin cleaning (head/unit)	Required (units)	Total (personal)	Remarks
UPPH	Steel	-	3,000	6	15 days/one, 200bins/d/6	0.0021	11,720	25	13,000/3,000 =4.3*6=26
	s-total	-	-	6	-	-	-	25	-
G total		-	-	6	-	-	-	25	-

1-6 Description		Actual (As of September, 2004)				Future			
		Inspectors (head/unit)	Municipalities (units)	Total (personal)	Remarks	Inspectors (head/munic)	Municipalities (units)	Total (personal)	Remarks
UPPH 13,000/13,000=1	1	0.21	87	18	Inspection of bins and illegal dumping	0.21	97	20	Inspection of bins and illegal
	s-total	-	-	18		-	-	20	
DMSC	1	11	15	165	15 DMSC areas	2.0	122	244	15 DMSC area
	s-total	-	-	165		-	-	244	
G total		-	-	183	-	-	-	264	-

1-7 Description		Actual (As of September, 2004)				Future			
		Data Operator (head/UPPH)	Computer (units)	Total (personal)	Remarks	Data Operator (head/UPPH)	Computer (units)	Total (personal)	Remarks
UPPH		1	1	1	-	1	2	2	-
	s-total	-	-	1	-	-	-	2	-
DMSC		0	0	0	-	1	15	15	-
	s-total	-	-	0	-	-	-	15	-
G total		-	-	1	-	-	-	17	-

A-6-4 2. Segregated Collector Note: Basic unit value was provided by UPPH at June 6, 2005

1-1. Description		Actual (As of September, 2004)			Remarks	Future (2015)			Remarks
		Collection (head/unit)	No. existing (units)	Total (personal)		Collection Crew (head/unit)	Required (units)	Total (personal)	
UPPH	18 m3C/T	7.7	36	277	2 shifts	4	116	464	1 shift +1standby
	12m3C/T	-	-	-	-	4	24	96	-
	s-total	-	-	277	-	-	-	560	-
DMSC	D/T	8	25	200	2 shifts	-	-	-	-
	T/C	10	62	620	2 shifts	5	122	610	1 shift
	H/C	1.5	304	456	-	-	-	-	-
	s-total	-	-	1,276	-	-	122	610	-
G total		-	-	1,553	-	-	-	1,170	-

1-2. Description		Actual (As of September, 2004)			Remarks	Future			Remarks
		Engineers (head/unit)	Existing (units)	Total (personal)		Engineers (head/unit)	Required (units)	Total (personal)	
UPPH	18 m3C/T	1.1	36	40	-	0.4	116	46	-
	12m3C/T	-	-	-	-	0.4	24	10	For DMSCs
	s-total	-	-	40	-	-	-	56	-
DMSC	D/T	0.5	25	13	-	-	-	-	-
	T/C	0.5	62	31	-	0.3	122	37	-
	s-total	-	-	44	-	-	122	37	-
G total		-	-	83	-	-	-	93	-

1-3. Description		Actual (As of September, 2004)			Remarks	Future			Remarks
		Tech. staff (head/unit)	Existing (units)	Total (personal)		Tech. staff (head/unit)	Required (units)	Total (personal)	
UPPH	18 m3C/T	3.6	36	130	-	1.5	116	174	-
	12m3C/T	-	-	-	-	1.5	24	36	For DMSCs
	s-total	-	-	130	-	-	140	210	-
DMSC	D/T	1	25	25	-	-	-	-	-
	T/C	1.3	62	81	-	0.5	122	61	-
	s-total	-	-	106	-	-	122	61	-
G total		-	-	235	-	-	-	271	-

1-4. Description		Actual (As of September, 2004)			Remarks	Future			Remarks
		Workmen (head/area)	Existing (units)	Total (personal)		Workmen (head/area)	Required (units)	Total (personal)	
UPPH	18 m3C/T	-	-	45	-	0.7	116	81	-
	12m3C/T	-	-	-	-	0.7	24	17	-
	s-total	-	-	45	-	-	-	98	-
DMSC	D/T,T/C	-	-	40	-	0.5	122	61	-
	s-total	-	-	40	-	-	-	61	-
G total		-	-	85	-	-	-	159	-

1-5. Description (770 liters)		Actual (As of September, 2004)			Remarks	Future			Remarks
		Bin cleaning (head/unit)	Existing (units)	Total (personal)		Bin cleaning (head/unit)	Required (units)	Total (personal)	
UPPH	Steel	-	3,000	6	15 days/one, 200bins/d/6	0.00210	32,522	68	13,000/3,000=4.3*6=26
	s-total	-	-	6	staff w/2 trucks+water tank	-	-	68	w/new 4trucks +4Washers
G total		-	-	6	-	-	-	68	-

1-6 Description		Actual (As of September, 2004)			Remarks	Future			Remarks
		Inspectors (head/munic)	Municipalities (units)	Total (personal)		Inspectors (head/munic)	Municipalities (units)	Total (personal)	
UPPH	1.66	0.21	87	18	Inspection of bins and illegal dumping including 15 municipalities	0.21	140	29	Inspection of bins and illegal dumping including 15 municipalities
	s-total	-	-	18		-	-	29	
DMSC	1	11	15	165	15 DMSC areas	2.0	122.0	244	15 DMSC areas
	s-total	-	-	165		-	-	244	
G total		-	-	183	-	-	-	273	-

1-7 Description		Actual (As of September, 2004)			Remarks	Future			Remarks
		Data Operator (head/UPPH)	Computer (units)	Total (personal)		Data Operator (head/UPPH)	Computer (units)	Total (personal)	
UPPH		1	1	1	-	1	2	2	-
	s-total	-	-	1	-	-	-	2	-
DMSC		0	0	0	-	1	15	15	-
	s-total	-	-	0	-	-	-	15	-
G total		-	-	1	-	-	-	17	-

Appendix-7 A list of Quotation

Type of Vehicles	Capacity	15 February 2005					Feb. 2005				05 May 2005				09 April 2004				13 October 2004				
		Comercial Hifigal . S.L (Spain) inbrokers@hifigal.com					BDC International (France) Habana 204-3724				Planalto Industrial mechanical (Brazil) danillo@grupoplanalto.com.br				SimMaywa (Japan) http://www.shinmaywa.co.jp/				UPPH/Raorn Pena/Astillero Chullima				
		Euro	US\$	JY/Euro	Ref. no.	Applied	US\$	JY/US\$	Ref. no.	Applied	US\$	JY/US\$	Ref. no.	Applied	US\$	JY/US\$	Ref. no.	Applied	CUC	US\$	JY/US\$	Ref. no.	Applied
Bins (770 liter)	HIPE	-	110	137	No-1	⊙	110	110	-	-	110	110	-	-	110	110	-	-	-	110	110	-	-
	Metal	288	359	39,456	No.2	-	-	-	-	-	-	-	-	-	-	-	-	-	259	-	28,490	No.47	⊙
	Metal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	290	-	31,900	No.48	-
	Polyurethane	432	538	59,184	No.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C/T (French) (Renault) (Iveco)	18m ³	103,811	129,292	14,222,107	No.4	⊙	-	-	-	-	109,025	11,992,750	No.5	-	163,636	18,000,000	No.11	-	-	-	-	-	-
	18m ³	139,210	173,380	19,071,770	-	-	137,414	15,115,540	No.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	16m ³	97,703	121,685	13,385,311	No.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15.3 m ³	-	-	-	-	-	-	-	-	-	-	-	-	-	150,000	16,500,000	No.12	-	-	-	-	-	-
	12 m ³	-	-	-	-	-	-	-	-	-	-	-	-	-	109,091	12,000,000	No.13	⊙	-	-	-	-	-
	10 m ³	-	-	-	-	-	-	-	-	-	-	-	-	-	100,000	11,000,000	No.14	-	-	-	-	-	-
	8m ³	91,360	113,785	12,516,320	No.7	-	-	-	-	-	-	-	-	-	90,909	10,000,000	No.15	-	-	-	-	-	-
	8m ³	89,366	111,301	12,243,142	No.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8m ³	79,209	98,651	10,851,633	No.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5m ³	78,634	97,935	10,772,858	No.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4m ³	-	-	-	-	-	-	-	-	-	-	-	-	-	63636.3636	7,000,000	No.16	-	-	-	-	-	-	
D/T																							
(Man)	18 ton(18m ³)	64,425	80,238	8,826,225	No.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Ivrco)	18 ton (18m ³)	58,045	72,292	7,952,165	No.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(DAF)	18 ton (18m ³)	63,195	78,707	8,657,715	No.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Renault)	8 ton(Alum materia	60,030	74,765	8,224,110	No.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Renault)	10ton(10m ³)	55,719	69,395	7,633,452	No.21	-	112,792	12,407,120	No.44	-	-	-	-	-	-	-	-	-	68,500	7,600,000	No.46	⊙	
(VW)	10m ³	-	-	-	-	-	-	-	-	69,457	7,640,270	No.23	-	-	-	-	-	-	-	-	-	-	-
(VW)	6.0m ³	-	-	-	-	-	-	-	-	59,060	6,496,600	No.22	-	-	-	-	-	-	-	-	-	-	-
	10 tons(High wall)	-	-	-	-	-	-	-	-	-	-	-	-	95,455	10,500,000	No.26	-	-	-	-	-	-	-
	7 tons(High wall)	-	-	-	-	-	-	-	-	-	-	-	-	69,091	7,600,000	No.27	-	-	-	-	-	-	-
	4 tons(High wall)	-	-	-	-	-	-	-	-	-	-	-	-	45,455	5,000,000	No.28	⊙	-	-	-	-	-	-
	2 tons(High wall)	-	-	-	-	-	-	-	-	-	-	-	-	31,818	3,500,000	No.29	-	-	-	-	-	-	-
T/C (Russia)																							
Only Cart (16m ³)																			9,900	-	1,188,000	No.32	-
Tractor Cart (15m ³)		87,439	108,901	11,979,105	No.31	-	-	-	-	46,634	5,129,740	No.24	-	-	-	-	-	-	-	25,000	2,800,000	No.46	⊙
Motor scooter		320	399	43,840	No.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mechanical sweeper										244,273	26,870,030	No.25	-	-	-	-	-	-	-	-	-	-	-
Bins Washing Vehicles																							
(Fiat)	Machine (2 bins/tim	144,500	179,968	19,796,500	No.29	⊙	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water truck w/ pres	-	-	-	-	-	-	-	-	-	-	-	-	72,727	8,000,000	No.30	⊙	-	-	-	-	-	-
Equipmet for work shop																							
	Ref. No.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

B. Collection and Transportation:

B2 Maintenance Workshop of UPPH

B2 MAINTENANCE WORKSHOP OF UPPH

UPPH's Maintenance Plan (1/4)

NO.	OPERATIONS	FREQUENCY OF MAINTENANCE			
		DAILY MAINT.	MAINT. I 3 000 KM	MAINT. II 12 000 KM	MAINT. III 48 000 KM
1	Before leaving the yard vehicle condition must be checked for:	x	x		x
	● Level of oil in the motor's carter	x	x		x
	● Level of coolant	x	x		x
	● Proper working condition of control/lighting/signaling devices	x	x		x
	● Brakes	x	x		x
	● Condition of tires	x	x		x

UPPH's Maintenance Plan (2/4)

NO.	OPERATIONS	FREQUENCY OF MAINTENANCE			
		DAILY MAINT.	MAINT. I 3 000 KM	MAINT. II 12 000 KM	MAINT. III 48 000 KM
2	● Belt tension (generator, compressor, water pump and HDCO steering servomotor pump)		X	X	X
	● Battery electrolyte		X	X	X
	● Tire air pressure and fastening		X	X	X
	● Free movement of wheel (must not exceed 25 ⁰)		X	X	X
	● Play (clearance) at coupling between connection rods' steering knuckles and the HDCO servomotor		X	X	X
	● Airtight of brake system		X	X	X
	● Safety of battery fastness		X	X	X
	● Regulation of clearance between tire brake lining and drums		X	X	X
	● Cleaning of oil filter				
	● Removal of oil filter sediments		X	X	X
	Checking of oil level:			X	X
	● At gear box carter		X	X	X
	● At intermediate cardan shaft bearing		X	X	X
	● At motor bridges carters		X	X	X
	● At gear mechanism carter		X	X	X
	● At the hydraulic servomotor's container		X	X	X
	● At the platform's dumper mechanism cylinders		X	X	X
	● At the suspension beams		X	X	X
	● Ball bearing lubrication		X	X	X
	● Oil filter cleaning		X	X	X

UPPH's Maintenance Plan (3/4)

NO.	OPERATIONS	FREQUENCY OF MAINTENANCE			
		DAILY MAINT.	MAINT. I 3 000 KM	MAINT. II 12 000 KM	MAINT. III 48 000 KM
3 (1/2)	● Check condition of towing equipment, body, cabin, step supports			x	x
	● Safety of water and oil radiators suspension			x	x
	● Free clutch stroke			x	x
	● Safety of transmission intermediate bearing fastening			x	x
	● Prevent clearance at steering knuckle pivot couplings with front shaft beam			x	x
	● Safety of steering trapezoid levers and the steering longitudinal connecting rod			x	x
	● Tires convergence angles (above 3-5 mm)			x	x
	● Good working order of safety valve (whether it is beyond the limits of $8.0 \pm 0.2 \text{ kg/cm}^2$)			x	x
	● Regulation of parking brakes (whether clearance between shoe lining and the drum exceeds 1 mm)			x	x
	● Safety of front suspension shock absorbers fastening and bearings			x	x
	● Rear and front spring fastening			x	x
	● Frame/upper frame fastening			x	x
	● Motor injectors			x	x
	● Drive angle of COMB injection			x	x
	● Battery charge			x	x
	● Regulator's electrical parameters			x	x
● Replace fuel filter fine and gross purification components			x	x	
● Remove and clean with gasoline filters from the steering hydraulic servomotor filters			x	x	

UPPH's Maintenance Plan (4/4)

NO.	OPERATIONS	FREQUENCY OF MAINTENANCE			
		DAILY MAINT.	MAINT. I 3 000 KM	MAINT. II 12 000 KM	MAINT. III 48 000 KM
3 (2/2)	● Lubricate bearings and replace oil			X	X
	● Support fastening and fuel tank clamps			X	X
	● Gear box fastening			X	X
	● Full brake pedal stroke (should range between 146-170 mm)			X	X
	● Condition of brake shoes and drums			X	X
	● Check and regulate, if necessary, wheel socket bearings			X	X
	● Check and regulate, if necessary, motor valve mechanism clearance			X	X
4	● Compressor maintenance				X
	● Generator maintenance				X
	● Starting motor maintenance				X

Data source : UPPH

B. Collection and Transportation:

B3 Development of Systems for Collection of Recyclable Waste in Japan

Technical Note

B3 DEVELOPMENT OF SYSTEMS FOR COLLECTION OF RECYCLABLE WASTE IN JAPAN

1. Introduction

In Japan, the various systems for collecting recyclables from the waste stream have been developed and promoted according to the prevailing conditions such as the recycling market, technical aspects of recycling or public awareness of 3R activities. This note briefly reviews and summarizes the development backgrounds of these collection systems as a reference for the establishment of a segregated collection system for Havana city.

2. Development and Transition of Recycling and the Collection System of Recyclable Waste

The “group collection system” is a specific type of recycling system used in Japan, as is the “Chirigami Kokan System”, a long-established collection system for used papers undertaken by private collectors and in which the public can exchange old news papers or magazines for new toilet paper. The group collection system utilizes “children’s association” (kodomo-kai) or “neighborhood association” (chounai-kai) to collect recyclable waste from each household and then those associations sell the collected recyclables to private recycling enterprises. Therefore, only profitable recyclable waste that can be sold in the market is usually collected to earn sales profit for the participating groups. The operation of the collection groups is generally covered by the profits gained from selling recyclable waste and subsidies from the local authorities such as municipalities. The local authority functions as a coordinator to introduce the recycling dealers to the groups who intend to collect the recyclables and also sometimes as a trainer to promote the appropriate discharge habits to the public and collection methods. Maintaining this system highly depends on the market for the collected recyclable waste and the willingness of the group to implement the system.

Beverage cans and disposable glass bottles increased around the 1970s, but they were not a target material for group collection due to the low sales price at that time. Nowadays, though, some of those items, such as aluminum or steel cans, are collected and recycled on a market base. The market for plastic or paper packaging waste has not developed so much, but its proportion of the waste stream has increased more and more. Therefore, in addition to the group collection system for recyclables, the segregated collection system has also been introduced by public participation.

A segregated collection system was introduced in Numazu City, Shizuoka Prefecture, in 1975 with public consensus. Waste was segregated into three categories, “combustible waste”, “direct landfill waste” and “recyclable waste”. Since then, Numazu City has

extended the segregation categories, adding a category for “non-combustible waste” for plastic waste (because their incinerator is not suited to burning such high calorific waste) and including PET bottles in “recyclable waste”. The success of the Numazu system with the well known slogan “If you segregate, it is resource, if you mix, it is waste” has encouraged other cities to introduce the segregated collection. The segregated collection system contributes to the collection of unprofitable but recyclable waste more than the above-mentioned group collection system. Segregated collection systems at other cities are slightly different from each other in various ways, such as the participation of the private sector, collection frequency, or how many separation processes are required and so on.

After gradual introduction to designated cities through local ordinances, more overarching recycling laws such as the “Law for the Promotion of Sorted Collection and Recycling Containers and Packaging”, the “Fundamental Law for Establishing a Sound Material-Cycle Society” or the “Law for Promotion of Effective Utilization of Resources” have been formulated, and the recycling system from collection to production has been developed. Segregated collection systems have been thoroughly established after the formulation of laws in many cities.

As time goes by, a segregated collection system has been established in most municipalities in co-existence with the ordinary group collection system. Municipalities do not interfere with the voluntary recycling activity by group collection and, rather, cover the areas that group collection does not so as to reduce the total amount of waste to be transported and treated for final disposal.

3. Collection Systems in Major Cities

Collection systems in major cities are summarized in the following table¹.

City	Segregated Collection	Group Collection
Sapporo	glass bottles, cans, PET bottles (collected once a week)	old papers (collected about once a month)
Sendai	glass bottles, cans, PET bottle, plastic bottle	-
Chiba	glass bottles, cans, PET bottles, plastic containers (collected once a week)	-
Kawasaki	glass bottles, cans, PET bottles, scrap metal (collect once a week)	old papers
Yokohama	glass bottles, cans, PET bottles, metal, clothes (collect once a week)	old papers
Nagoya	glass bottles, cans, PET bottles, plastic containers and packages, spray cans (collected once a week)	old papers, magazines, cartons, paper containers, clothes
Kyoto	glass bottles, cans, PET bottles (collected once a week)	-
Osaka	glass bottles, cans PET bottle, metal, plastic package (collected once a two weeks)	part of old newspapers
Kobe	glass bottles, cans, PET bottle	old papers, clothes
Hiroshima	glass bottles, cans, PET bottles, metal, old papers, magazines, cardboard, books, old clothes (collected twice a month)	-
Kitakyushu	glass bottles, cans (collected three times a month), cans, PET bottles (collect twice a month)	old newspapers (by contractor)
Fukuoka	glass bottles, PET bottle (collect once a month)	old papers, clothes

Note: Some cities have other collection methods such as storefront collection or direct collection by local contractors.

The above systems have been selected on the basis of the conditions of each region or the target recyclable waste. Papers and used clothes generally tend to be collected by the group collection system because they are easily handled and because of many years of experience by groups such as parents and teachers associations (PTA), children's associations, or neighborhood associations and the effect of environmental education in Japan. On the other hand, steel/aluminum cans, glass bottles, plastic containers or other metal items are mostly collected by the segregated collection system. The municipality fixes the collection day for each type of recyclable materials and other waste. Residents have to keep those recyclables or wastes in their house and discharge them at the designated waste collection station on the appropriate fixed day. The municipality or private hauler contracted by the municipality stops at the collection stations to collect the recyclables. In the early stages of introduction of the segregated collection system, or even after the establishment of the system, the collectors sometimes do not pick up the discharged recyclables that are mixed with other items and leave a warning sticker so that the residents can understand the appropriate segregation. The number of categories for segregated collection depends on the characteristics of the municipality and the circumstances of the recyclable market, and ranges from only two categories up to more than 20.

¹ Refer to " http://www.city.kyoto.jp/kankyo/recycle/pdf/meeting/h14/kyodo_2nd/kyodo_2nd2.pdf"

4. Case Study of Segregated Collection (Numazu Method)

As mentioned above, Numazu City was the first to introduce the segregated collection system to Japan. Firstly, the waste was segregated into the three categories of combustible waste, direct landfill waste, and recyclable waste. Secondly, plastic waste was added as a fourth category of segregated waste in 1999 as incombustible waste. After introduction of the segregation of plastic waste, the quantity of plastic waste mixed with direct landfill waste and the quantity of combustible waste decreased significantly, as shown in the following table.

Unit: [ton]

	Waste quantity				
	Discharged waste	Combustible waste	Incombustible waste	Recyclable waste	Plastic waste
1998	85,139	62,845	11,420	10,874	-
1999	73,325	49,823	3,967	12,283	7,252
2000	75,629	51,507	4,920	11,996	7,206
2001	76,160	51,749	5,055	12,193	7,163
2002	75,701	51,843	4,454	12,499	6,905
2003	74,785	53,085	2,365	11,435	7,900
2004	76,506	55,155	2,248	11,387	7,716

Source: Waste Management Research, vol. 16, No.5 (2005)

Although a large reduction in the amount of discharged waste occurs not only because of the introduction of segregated collection, but also from the introduction of transparent and semitransparent plastic bags for discharging waste, the segregated discharge raises public awareness of the issues surrounding solid waste disposal and reduces the amount of solid waste discharged. On the other hand, increasing the categories of segregated waste increases operation and maintenance costs and complicates the handling for the public².

² Refer to “Annual Report on Sound Cycle-Material Society in Japan (2005)”

C. Final Disposal:

C1 Final Disposal Plan

C1 FINAL DISPOSAL PLAN

1. Estimation of Bulk Density

Table 1 Waste Volume Hauled to Each Dumping Site

Dumping site	Classification	Total Volume (8 days)		Average volume per day		Bulk density (ton/m ³)
		(ton)	(m ³)	(ton)	(m ³)	
Calle 100	Provincial	12,086	30,856	1,511	3,857	0.39
Guanabacoa	Provincial	2,795	9,157	349	1,145	0.31
Ocho Vías	Provincial	2,625	10,901	328	1,363	0.24
Barreras	Municipal	374	1,571	47	196	0.24
Electrico	Special period	22.8	199	3	25	0.11
Fraternidad	Special period	36	360	5	45	0.10
Guaansimas	Special period	17.1	171	2	21	0.10
Lugardita	Special period	34	343	4	43	0.10
P.Latina	Special period	107	726	13	91	0.15
Rincon	Special period	39.5	395	5	49	0.10
Las Canas	Special period	20.7	208	3	26	0.10
El Vidrio	Special period	95.4	954	12	119	0.10
Los Perros	Special period	239	1,474	30	184	0.16
Campo Florido	Special period	7.3	73	1	9	0.10
Total		18,499	57,388	2,312	7,174	

Estimation of Bulk density for Calle 100, New Site 1 and New Guanabacoa

After closing special landfill waste disposal areas

Calle 100 or New Site 1 Calle 100, Electrico, Fraternidad, Guaansimas, Lugardita, P. Latina,
Rincon, Las Canas, El Vidrio

New Guanabacoa Guanabacoa, Los Perros

Bulk density of Calle 100 or New Guanabacoa

Average volume (m ³ /day)	4,277 m ³ /day
Average weight (tons/day)	1,557 tons/day
Bulk density	0.36 tons/m ³

Bulk density of New Guanabacoa

Average volume (m ³ /day)	1,329 m ³ /day
Average volume (tons/day)	379 tons/day
Bulk density	0.29 tons/m ³

For the M/P, these figures were used for both cases of with and without segregation because the waste composition was estimated and the planned segregation rate was 7.0% on average to the total weight of waste hauled to all landfills.

2. Bulk density of Campo Florido and Ocho Vias

Because of the closure of Guanabacoa dumping site, the waste normally disposed at it has been hauled and disposed at Campo Florido and Ocho Vias. Accordingly the bulk density of the waste will change from the original.

Table 2 Bulk Density of Campo Florido and Ocho Vias

			Ocho Vias	Campo Florido
Y 2004	Original	Waste weight (ton/day)	350	1.0
		Bulk density (ton/m ³)	0.24	0.10
		Waste Volume (m ³ /day)	1,453	9.1
	From Guanabacoa	Waste weight (ton/day)	0	0
		Bulk density (ton/m ³)	0.31	0.31
		Waste Volume (m ³ /day)	0	0
	Total	Waste weight (ton/day)	350	1
		Bulk density (ton/m ³)	0.24	0.10
		Waste Volume (m ³ /day)	1,453	9.1
Y2005	Original	Waste weight (ton/day)	350	1
		Bulk density (ton/m ³)	0.24	0.10
		Waste Volume (m ³ /day)	1,453	9.1
	From Guanabacoa	Waste weight (ton/day)	250	109
		Bulk density (ton/m ³)	0.31	0.31
		Waste Volume (m ³ /day)	806	352
	Total	Waste weight (ton/day)	600	110
		Bulk density (ton/m ³)	0.27	0.30
		Waste Volume (m ³ /day)	2,260	361
Y2006	Original	Waste weight (ton/day)	350	1
		Bulk density (ton/m ³)	0.24	0.1
		Waste Volume (m ³ /day)	1,453	9.1
	From Guanabacoa	Waste weight (ton/day)	250	109
		Bulk density (ton/m ³)	0.31	0.31
		Waste Volume (m ³ /day)	806	352
	Total	Waste weight (ton/day)	600	110
		Bulk density (ton/m ³)	0.27	0.30
		Waste Volume (m ³ /day)	2,260	361
Y2007- Y20015	Original	Total waste weight (ton/day)	350	1
		Bulk density (ton/m ³)	0.24	0.1
		Total waste Volume (m ³ /day)	1,453	9.1
	From Guanabacoa	Waste weight (ton/day)	0	0
		Bulk density (ton/m ³)	0.31	0.31
		Waste Volume (m ³ /day)	0	0
	Total	Waste weight (ton/day)	350	1
		Bulk density (ton/m ³)	0.24	0.1
		Waste Volume (m ³ /day)	1,453	9.1
Y2004 - Y2015	Average waste weight (ton/day)	392	19	
	Average bulk density (ton/m ³)	0.25	0.28	
	Average waste volume (m ³ /day)	1,588	68	

Based on "Material Balance"

3. Material Balance of Waste to be hauled to each Landfill

Table 3 Material Balance of Waste to be hauled to each Landfill

Unit: tons/day

Name of Landfill	Y 2004	Y2005	Y2006	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Total	Average
Calle 100	1,672	1,667	1,661	1,657	1,650	1,721	1,655						19,195	1,600
New Site 1								1,650	1,640	1,414	1,408	1,399		
New Guanabacoa						360	323	323	326	383	382	380	3,557	296
Guanabacoa	360													
Campo Florido		110	110	110	110	1	1	1	1	1	1	1	447	37
Special Period Landfill	80	80	80	80	80								400	33
Ocho Vias (temporary)		250	250	250	250								1,000	83
Ocho Vias	350	350	350	350	350	350	350	350	350	350	350	350	4,200	350
Barreras	50	50	50	50	50	50	50	50	50	50	50	50	600	50
Total hauled waste	2,512	2,507	2,501	2,497	2,490	2,482	2,378	2,374	2,367	2,198	2,191	2,180	28,679	
Total to be covered by M/P (ton/day)*	2,112	2,107	2,101	2,097	2,090	2,082	1,978	1,974	1,967	1,798	1,791	1,780	23,879	1,990
Total to be covered by M/P (ton/year)	770,900	769,100	766,900	765,500	762,900	760,000	722,100	720,400	717,900	656,100	653,700	649,800	8,715,300	726,275

* Ocho Vias is mainly for industrial waste and Barreras is operated by a Municipality. Therefore they are eliminated from M/P.

Note: Waste hauled to Guanabacoa was divided into Campo Florido and Ocho Vias from Y2005 to Y2008

Table 4 Back Data

Unit: tons/day

	Y 2004	Y2005	Y2006	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Total	Average
Collected waste	2,525	2,520	2,519	2,520	2,518	2,516	2,515	2,518	2,519	2,519	2,523	2,522	30,234	2,519
Material utilization from collected waste (recycling and composting)	13	13	18	23	28	33	84	91	99	195	206	217	1,022	85
Loss in composting as gas and moisture							52	52	52	126	126	126	534	45
Ocho Vias	350	350	350	350	350	350	350	350	350	350	350	350	4,200	350
Barreras	50	50	50	50	50	50	50	50	50	50	50	50	600	50
Hauled waste volume to landfills in M/P	2,112	2,107	2,101	2,097	2,090	2,082	1,978	1,974	1,967	1,798	1,791	1,779	23,878	1,990

Total weight of material recovered 1,022 tons

Total weight of waste hauled to all landfills 28,679 tons

Percent of hauled waste recovered (by weight for All Final Disposal Sites) 3.6 %

Table 5 Average reduction rate of waste hauled to landfills

Name of Landfill	Volume in 2004 (ton/day)	Average volume from 2004 to 2015 (ton/day)	Average reduction rate (%)
Calle 100 and New Site 1	1,672	1,613	3.5
Guanabacoa and New Guanabacoa	360	356	1.0

4. Estimated Life of Calle 100, Ocho Vias and Campo Florido

Actually, Y2005 and Y2006 are in a transition period because the existing 4 (four) dumping sites including Guanabacoa closed in April, 2005. The waste which used to have been hauled to Guanabacoa is hauled to Campo Florida and Ocho Vias in Y 2005 and Y 2006 as shown in "Material Balance". Therefore, the lives of the two dumping sites were estimated as follows based on the Material Balance. The life of Calle 100 was also recalculated based on the Material Balance.

Table 6 Estimated lives of Existing Calle 100, Guanabacoa, Ocho Vias and Campo Florido

Dumping site	Bulk density (ton/m ³)	Waste Volume in Y2004		Area (ha)	Available factor for landfill	Available area for landfill (ha)	Starting year	Average before Y2004				
		ton/day	m ³ /day					Factor ²⁾	Hauled volume (m ³ /day)	Compacted bulk density (ton/m ³)	Accumulated Compacted waste	Accumulated Compacted waste (m ³)
Calle 100	0.39	1,672	4,269	80	0.80	64	1976	0.75	3,202	1.0	458,000	12,824,000
Ocho Vias	0.24	350	1,453	30	0.75	23	1976	0.75	1,090	1.0	96,000	2,688,000
Campo Florido ¹⁾	0.10	1	9.1	5.0	0.85	4.3	1990	0.85	7.8	0.60	480	6,720

Dumping site	Bulk density (ton/m ³)	Accumulated waste volume until closing year after Y 2004			until Y2015			Closing year
		Hauled waste (ton)	Hauled waste (m ³)	Bulk density at landfill (m ³)	Compacted waste volume (m ³)	Total Compacted Volume (m ³)	Average height (m)	
Calle 100	0.39	5,475,000	13,978,000	0.75	7,301,000	20,125,000	31	2006
Ocho Vias	0.25	1,716,000	6,957,000	0.70	2,452,000	5,140,000	23	2015
Campo Florido ¹⁾	0.28	84,000	297,000	0.70	121,000	128,000	3.0	2015

1) If the area is extended from 1.8 to 5 ha, by applying a divider, the available factor is reduced from 0.95 to 0.85.

2) Hauled volume factor before Y2004

Note: For accumulated tons and m³ of Ocho Vias and Campo Florido, refer to "Ocho Vias and Campo Florido"-Supporting Report 2.

Without expansion of Campo Florido and without heavy equipment and cover soil,

Area	1.8 ha
Available factor for landfill area ¹⁾	0.55
Available landfill area	9,900 m ²
Average height of landfill area without cover soil ²⁾	3.8 m
Available landfill volume	37,600 m ³
Compacted waste volume before Y2004	6,720 m ³
Remaining available volume	30,880 m ³

Table 7 Estimated Waste Volume at Campo Florido

	Hauled volume				Bulk density at landfill (m ³)	Compacted waste volume (m ³ /year)	Accumulated compacted waste (m ³)
	ton/day	Bulk density (ton/m ³)	m ³ /day	m ³ /year			
Y2004	1	0.10	9.1	3,300	0.50	660	660
Y2005	110	0.30	361	131,700	0.70	57,400	58,000
Y2006	110	0.30	361	131,700	0.70	57,400	115,000

- 1) At present the number of cells in height is only one. If the number increases from one to three after the pilot project, available area factor becomes smaller.
- 2) At present the height of cells is 1.5 m (waste layer: 1.2 m and compacted cover soil layer 0.3 m for pilot project).

Therefore, if Campo Florido is not extended, its life is within Y2005 if waste with cover soil is compacted using heavy equipment.

5. Estimation of the average height in case of rehabilitation or expansion of Calle 100

Table 8 Estimated Height for Expansion of Calle 100 Landfill

Accumulated waste volume until Y2004
12,824,000 m³

		Y2005	Y2006	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
Hauled waste volume	ton/day	1,667	1,661	1,738	1,729	1,721	1,655	1,650	1,640	1,414	1,408	1,399
Bulk density before compaction	ton/m ³	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Hauled waste volume	m ³ /day	4,631	4,615	4,827	4,804	4,781	4,597	4,583	4,555	3,927	3,912	3,886
Bulk density of waste after compaction with natural decomposition	ton/m ³	0.90	0.90	0.95	0.95	1.00	1.00	1.00	1.00	1.05	1.05	1.05
Volume of waste after compaction with natural decomposition	m ³ /year	676,000	674,000	668,000	664,000	628,000	604,000	602,000	599,000	491,000	490,000	486,000
Accumulated waste volume	1,000 m ³	13,500	14,174	14,842	15,506	16,134	16,738	17,340	17,939	18,430	18,920	19,406

Cover soil (%)	20 %
Total volume of compacted cover soil	3,881 x 1000 m ³
Total volume of waste layer with cover soil	23,287 x 1000 m ³
Total area of Calle100	104 ha
Available factor for landfill	0.6
Landfill area	62.4 ha
	624000 m ²
Average height of waste layer with cover soil	37 m
Current height of accumulated waste layer	20 m
Additional height to be piled up to fulfill required capacity by utilization of Calle100 landfill	17 m

6. Dimensions of Calle 100 of Expansion area of 24 ha

Table 9 Required area for landfill and cover soil

	Year				Total
	2007	2008	2009	2010	
Hauled waste volume (tons/day)	1,738	1,729	1,721	1,655	
Bulk density of hauled waste (tons/ m ³)	0.36	0.36	0.36	0.36	
Hauled waste volume (m ³ /day)	4,770	4,750	4,730	4,540	
Bulk density of waste after compaction by heavy equipment (tons/m ³)	0.90	0.90	0.90	0.90	
Bulk density of waste after compaction with natural compaction(tons/m ³)	0.95	0.95	1.00	1.00	
Compacted daily waste volume (m ³ /day) by heavy equipment	1,930	1,920	1,910	1,840	
Ratio of cover soil towards daily compacted waste volume (%)	20	20	20	20	
Compacted daily cover soil volume (m ³ /day)	386	384	382	368	
Bulk density of cover soil after compaction (tons/m ³)	1.7	1.7	1.7	1.7	
Bulk density of cover soil before compaction (tons/m ³)	1.3	1.3	1.3	1.3	
Cover soil volume before compaction (m ³ /day)	505	502	500	481	
Waste volume with daily cover soil after compaction by heavy equipment (m ³ /day)	2,316	2,304	2,292	2,208	
Waste volume with daily cover soil after compaction by heavy equipment with natural compaction (m ³ /day)	2,214	2,205	2,104	2,021	
Waste volume with daily cover soil after compaction by heavy equipment with natural compaction (m ³ /year)	809,000	805,000	769,000	738,000	3,121,000
Accumulated waste volume with cover soil after compaction with natural compaction(m ³)	809,000	1,614,000	2,383,000	3,121,000	
Height of one cell (m)	1.75	1.75	1.75	1.75	
Number of cells in height direction	10	10	10	10	
Total height of waste layer with cover soil after compaction (m)	17.5	17.5	17.5	17.5	
Accumulated required area for landfill (ha)	4.6	9.2	13.6	17.8	

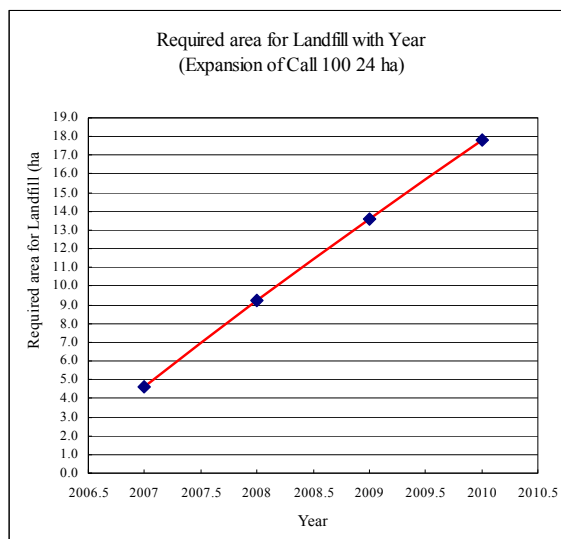


Figure 1 Required Area for Expansion of Calle 100

Assuming that available factor for landfill area is 0.6, the required total area will be 24 ha. Therefore the life of the Expansion of Calle 100 will be 4 years with compaction by heavy equipment.

Cell dimension and number of cells

Divided into two phases

Average waste volume with cover soil after compaction (m³/day) 2,136 m³/day

Dimensions of one cell: solid waste is placed in trenches varying from 30 to 120 m in length, 1 to 2 m in depth and 5 to 8m in width.

Table 10 Basic Cell Dimension

Dimension of one cell (m)		
Width	Length	Height
80	7	1.75

Average daily height of waste with cover soil 1.75 m

Total cell volume for average daily waste with cover soil 1,221 m³/day

First section until 2008 10.0 ha 100,000 m²

Second section until 2010 8.0 ha 80,000 m²

Table 11 Dimensions of Calle 100

	First stage	Second stage
Average daily area of cell (m ²)	560	560
Total number of cells in flat area	180	150
Total area (m ²)	100,800	84,000
Required area (m ²)	100,000	80,000
Average height of cell (m)	1.75	1.75
Number of cells in height direction	10	10
Total height of cells (m)	17.5	17.5
Total volume of waste layer with cover soil (m ³)	1,764,000	1,470,000
Required volume of area for landfill (m ³)	1,750,000	1,400,000
Total dimension of cells	80 m x 7 m x 180 x 1.75 mH x 10	80 m x 7 m x 150 x 1.75 mH x 10

7. Dimensions of New Site 1

Table 12 Required area for landfill and cover soil

	Year					Total
	2011	2012	2013	2014	2015	
Hauled waste volume (ton/day)	1,650	1,640	1,414	1,408	1,399	
Bulk density of hauled waste (ton/day)	0.36	0.36	0.36	0.36	0.36	
Hauled waste volume (m ³ /day)	4,530	4,500	3,880	3,870	3,840	
Bulk density of waste after compaction by heavy equipment (ton/m ³)	0.90	0.90	0.90	0.90	0.90	
Bulk density of waste after compaction with natural	0.95	0.95	0.95	1.00	1.00	
Compacted daily waste volume (m ³ /day) by heavy equipment	1,833	1,821	1,570	1,566	1,554	
Ratio of cover soil to daily compacted waste volume (%)	20	20	20	20	20	
Compacted daily cover soil volume (m ³ /day)	367	364	314	313	311	
Bulk density of cover soil after compaction (ton/m ³)	1.7	1.7	1.7	1.7	1.7	
Bulk density of cover soil before compaction (ton/m ³)	1.3	1.3	1.3	1.3	1.3	
Cover soil volume before compaction (m ³ /day)	479	476	411	410	406	
Waste volume with daily cover soil after compaction by heavy equipment (m ³ /day)	2,200	2,185	1,884	1,879	1,864	
Waste volume with daily cover soil after compaction by heavy equipment with natural compaction (m ³ /day)	2,103	2,089	1,801	1,722	1,709	
Waste volume with daily cover soil after compaction by heavy equipment with natural compaction (m ³ /year)	768,000	763,000	658,000	629,000	624,000	3,442,000
Accumulated waste volume with cover soil after compaction by heavy equipment with natural compaction(m ³)	768,000	1,531,000	2,189,000	2,818,000	3,442,000	
Height of one cell (m)	1.75	1.75	1.75	1.75	1.75	
Number of cells in height direction	10	10	10	10	10	
Total height of waste layer with cover soil after compaction (m)	17.5	17.5	17.5	17.5	17.5	
Accumulated required area for landfill (ha)	4.4	8.7	12.5	16.1	19.7	

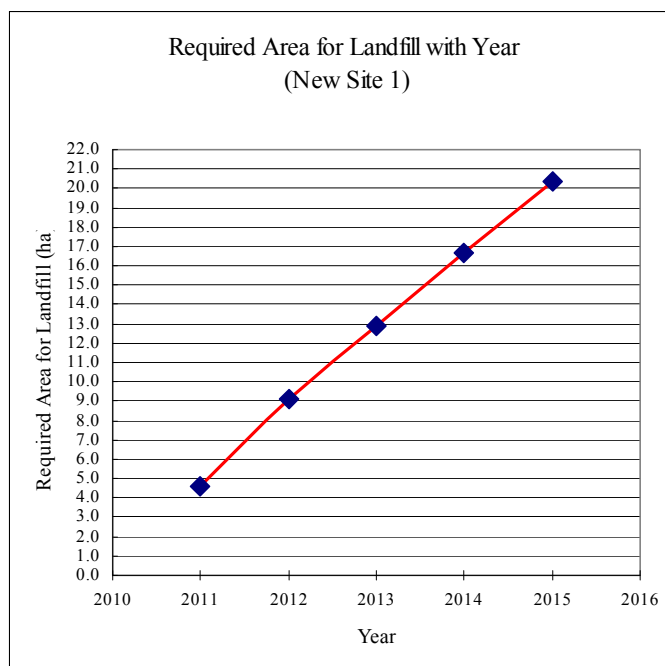


Figure 2 Required Area for New Site 1

Cell dimension and number of cells

Divided into two phases

Average waste volume with cover soil after compaction (m³/day) 2,002 m³/day

Dimensions of one cell: solid waste is placed in trenches varying from 30 to 120 m in length, 1 to 2 m in depth, and 5 to 8 m in width.

Table 13 Basic Cell Dimension

Dimension of one cell (m)		
Width	Length	Height
70	8	1.75

Average daily height of waste with cover soil 1.75 m

Total cell volume for average daily waste with cover soil 1,110 m³/day

First stage until 2013 13.0 ha 130,000 m²

Second stage until 2015 8.0 ha 80,000 m²

Table 14 Dimension of New Site 1

	First stage	Second stage
Average daily area of cell (m ²)	560	560
Total number of cells in flat area	240	150
Total area (m ²)	134,000	84,000
Required area (m ²)	130,000	80,000
Average height of cell (m)	1.75	1.75
Number of cells in height direction	10	10
Total height of cells (m)	17.5	17.5
Total volume of waste layer with cover soil (m ³)	2,345,000	1,470,000
Required volume of area for landfill (m ³)	2,275,000	1,400,000
Total dimension of cells	70 m x 8 m x 240 x 1.75mH x 10	70 m x 8 m x 150 x 1.75 mH x 10

8. Dimensions of New Guanabacoa

Table 15 Required area for landfill and cover soil

	Year									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Hauled waste volume (ton/day)	0	0	360	323	323	326	383	382	380	
Bulk density of hauled waste (ton/m ³)	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	
Hauled waste volume (m ³ /day)	0	0	1,260	1,130	1,130	1,140	1,340	1,340	1,330	
Bulk density of waste after compaction by	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Bulk density of waste after compaction by	0.90	0.95	1.00	1.00	1.00	1.05	1.05	1.05	1.10	
Compacted waste volume by heavy	0	0	400	358	358	361	425	425	422	
Ratio of cover soil towards compacted waste volume (%)	20	20	20	20	20	20	20	20	20	
Compacted cover soil volume (m ³ /day)	0	0	80	72	72	72	85	85	84	
Bulk density of cover soil after compaction (ton/m ³)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	
Bulk density of cover soil before compaction (ton/m ³)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	
Cover soil volume before compaction (m ³ /day)	0	0	104	94	94	95	111	111	110	
Waste volume with daily cover soil after compaction by heavy equipment (m ³ /day)	0	0	479	430	430	434	510	510	506	
Waste volume with cover soil after compaction by heavy equipment with natural compaction(m ³ /day)	0	0	440	394	394	382	449	449	429	
Waste volume with daily cover soil after compaction by heavy equipment with natural compaction (m ³ /Year)	0	0	161,000	144,000	144,000	140,000	164,000	164,000	157,000	1,074,000
Accumulated waste volume with cover soil after compaction by heavy equipment with natural compaction (m ³)	0	0	161,000	305,000	449,000	589,000	753,000	917,000	1,074,000	
Height of one cell (m)	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	
Number of cells in height direction	8	8	8	8	8	8	8	8	8	
Total height of waste layer with cover soil after compaction (m)	14	14	14	14	14	14	14	14	14	
Accumulated required area for landfill (ha)	0.0	0.0	1.2	2.2	3.2	4.2	5.4	6.6	7.7	

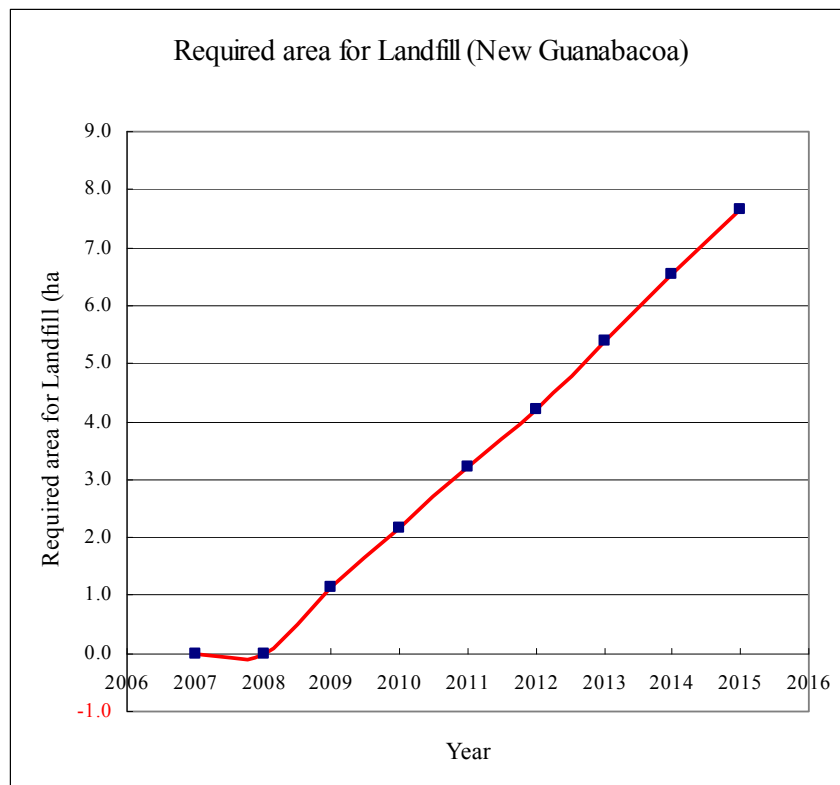


Figure 3 Required Area for New Guanabacoa

Cell dimension and number of cells

Divided into two phases

Average waste volume with cover soil after compaction (m³/day) 326m³/day

Dimensions of one cell: solid waste is placed in trenches varying from 30 to 120 m in length, 1 to 2 m in depth and 5 to 8m in width.

Table 16 Basic Cell Dimension

Dimension of one cell (m)		
Width	Length	Height
27	5	1.75

Average daily height of waste with cover soil 1.75m

Cell volume for average daily waste with cover soil 187m³/day

First stage until 2011 6ha 60,000m²

Second stage until 2015 4ha 40,000m²

Table 17 Dimension of New Guanabacoa

	First stage	Second stage
Average daily area of cell (m ²)	135	135
Total number of cells in flat area	450	300
Total area (m ²)	60,700	40,500
Required area (m ²)	60,000	40,000
Average height of cell (m)	1.75	1.75
Number of cells in height direction	8	8
Total height of cells (m)	14	14
Total volume of waste layer with cover soil (m ³)	849,000	567,000
Required volume of area for landfill (m ³)	840,000	560,000
Total dimension of cells	27 m x 5 m x 450 x 1.75 mH x 8	27 m x 5 m x 300 x 1.75 mH x 8

C. Final Disposal:

C2 Cost Estimation for Construction and
Closure of Landfill

C2 COST ESTIMATION FOR CONSTRUCTION AND CLOSURE OF LANDFILL

Table 1 Direct Construction Cost of New Site 1 Landfill

No.	Item	Unit	Qty	1st Stage Construction			2nd Stage Construction			Total Construction cost		
				2010 year			2013 year			Total	LC (1000 CUP)	FC (1000 US\$)
				Total	L/C (1000 CUP)	F/C (1000 US\$)	Total	L/C (1000 CUP)	F/C (1000 US\$)			
C-1	Landfill Area Work	unit	1	1,932	1,159	773	2,131	886	1,245	4,064	2,046	2,018
C-2	Road Work	unit	1	1,113	668	445	468	281	187	1,582	949	633
C-3	Leachate Treatment Pond Work	unit	1	705	160	545	167	100	67	871	260	611
C-4	Water Strom Drain Work	unit	1	204	122	82	98	59	39	302	181	121
C-5	Leachate Treatment Facility Installation Work	unit	1	95	57	38	95	57	38	190	114	76
C-6	Truck Scale Installation Work	unit	1	20	12	8	0	0	0	20	12	8
	Civil Work Total			4,069	2,179	1,890	2,958	1,382	1,576	7,028	3,561	3,467
A-1	Measuring Office	unit	1	2	1	1	0	0	0	2	1	1
A-2	Administration Facility	unit	1	94	56	38	0	0	0	94	56	38
A-3	Security Facility	unit	1	94	56	38	0	0	0	94	56	38
A-4	Operation Equipment Parking Area	unit	1	750	450	300	0	0	0	750	450	300
A-5	Supply Facility Installation work	unit	1	20	450	8	0	0	0	20	12	8
	Architecture Work Total			960	576	384	0	0	0	960	576	384
1	Primary Construction Cost	Civil + Archi.		5,029	2,755	2,274	2,958	1,382	1,576	7,988	4,137	3,851
2	Other work	1. x 10%		502	275	227	296	138	158	799	414	385
3	Net Construction Cost	(1. + 2.)		5,532	3,030	2,502	3,255	1,521	1,734	8,787	4,551	4,236
4	Managing Cast at Site	(3. x 25%)		1,383	758	625	814	380	434	2,197	1,138	1,059
5	The Cost of Works	(3. + 4.)		6,915	3,788	3,127	4,069	1,901	2,168	10,983	5,688	5,295
6	General Construction Cost	(5. x 15%)		1,037	568	469	610	285	325	1,647	853	794
7	Total Construction Cost	(5.+6.)		7,952	4,356	3,596	4,679	2,186	2,493	12,630	6,541	6,089

Table 2 Direct Construction Cost of New Guanabacoa Landfill

No.	Description	Unit	Qty	1st Stage Construction Cost			2nd Stage Construction Cost			Total Construction Cost		
				2008 year			2011 year			Total	LC (1000CUP)	FC (1000 US\$)
				Total	L/C (1000 CUP)	F/C (1000 US\$)	Total	L/C (1000 CUP)	F/C (1000 US\$)			
C-1	Landfill Area Work	unit	1	3,556	1,626	4,508	2,578	605	1,973	6,134	1,626	4,508
C-2	Road Work	unit	1	1,043	868	579	403	242	161	1,446	868	579
C-3	Leachate Treatment Pond Work	unit	1	93	49	84	39	10	29	132	49	84
C-4	Water Strom Drain Work	unit	1	38	45	30	37	22	15	75	45	30
C-5	Leachate Treatment Equipment Installation Work	unit	1	67	68	38	39	28	11	0	68	38
C-6	Truck Scale Installation Work	unit	1	80	48	32	0	0	0	0	48	32
	Civil Work Total			4,877	2,704	5,271	3,096	907	2,189	7,787	2,704	5,271
A-1	Measuring office	unit	1	2	1	1	0	0	0	2	1	1
A-2	Administration Facility	unit	1	125	75	50	0	0	0	125	75	50
A-3	Security Facility	unit	1	85	51	34	0	0	0	85	51	34
A-4	Operation Equipment Parking Area	unit	1	380	228	152	0	0	0	380	228	152
A-5	Power and water Supply Work	unit	1	20	12	8	20	12	8	20	12	8
	Architecture Work Total			612	367	245	20	12	8	612	367	245
1	Primary Construction Cost	Civil + Archi.		5,491	2,164	3,327	3,096	907	2,189	8,587	3,071	5,516
2	Other work	1. x 10%		549	216	333	310	91	219	859	307	552
3	Net Construction Cost	(1. + 2.)		6,040	2,380	3,660	3,406	998	2,408	9,446	3,378	6,068
4	Managing Cast at Site	(3. x 25%)		1,510	595	915	851	249	602	2,361	845	1,517
5	The Cost of Works	(3. + 4.)		7,550	2,976	4,575	4,257	1,247	3,010	11,807	4,223	7,585
6	General Construction Cost	(5. x 15%)		1,133	446	686	639	187	451	1,771	633	1,138
7	Total Construction Cost	(5.+6.)		8,683	3,422	5,261	4,896	1,434	3,461	13,578	4,856	8,722

Table 3 Direct Construction Cost for Calle 100 Expansion Area

No.	Item	Unit	Qty	1st Section Construction Cost			2nd Section Construction Cost			Total Construction Cost		
				2008 year			2008 year					
				Total	L/C (1000CUP)	F/C (1000 US\$)	Total	L/C (1000CUP)	F/C (1000 US\$)	Total	L/C (1000CUP)	F/C (1000 US\$)
C-1	Landfill Area Work	unit	1	6,174	1,932	4,242	6,150	2,168	3,982	12,324	4,100	8,224
C-2	Road Construction Work	unit	1	229	137	92	114	68	46	343	206	137
C-3	Leachate Treatment Pond Work	unit	1	56	14	42	56	13	43	112	27	85
C-4	Water Drain Work	unit	1	83	50	33	70	42	28	153	92	61
C-5	Leachate Treatment Equipment Installation W	unit	1	10	6	4	12	7	5	22	13	9
C-6	Truck Scale Installation Work	unit	1	25	15	10	0	0	0	25	15	10
	Civil Work Total			6,576	2,154	4,422	6,402	2,299	4,103	12,978	4,453	8,525
A-1	Measuring Office	unit	1	2	1	1	0	0	0	2	1	1
A-2	Administration Facility	unit	1	125	75	50	0	0	0	125	75	50
A-3	Security Facility	unit	1	77	46	31	0	0	0	77	46	31
A-4	Operation Equipment Parking Area	unit	-	0	0	0	0	0	0	0	0	0
A-5	Power and water Supply Work	unit	-	0	0	0	0	0	0	0	0	0
	Architecture Work Total			205	123	82	0	0	0	205	123	82
1	Primary Construction Cost	Civil +Architecture		6,780	2,276	4,504	6,402	2,299	4,103	13,182	4,575	8,607
2	Other work Cost	1. x 10%		678	228	450	640	230	410	1,319	458	861
3	Net Construction Cost	(1. + 2.)		7,458	2,504	4,954	7,043	2,529	4,514	14,501	5,033	9,468
4	Managing Cast at Site	(3. x 25%)		1,865	626	1,239	1,760	632	1,128	3,625	1,258	2,367
5	The Cost of Works	(3. + 4.)		6,291	3,130	6,193	8,803	3,161	5,642	18,126	6,291	11,835
6	General Construction Cost	(5. x 15%)		944	469	929	1,320	474	846	2,719	944	1,775
7	Total Construction Cost	(5.+6.)		7,235	3,599	7,122	10,123	3,635	6,488	20,845	7,235	13,610

Table 4 Direct Construction Cost of Closure of Existing Landfill

Note: Cover soil thickness is 60cm and be included venting pipe.

No.	Site Name	Unit	Qty	Unit Price (1000CUP)	Unit Price (1000US\$)	60%	40%	NOTE
						L/C (x1000 CUP)	F/C (x1000 US\$)	
D Special Period dumping site closing work								
1.	Electrico D.S. (A=0.5 ha)	unit	1	411	1	123	83	closing work in 2010 year
2.	Fraternidad D.S. (A=2.0 ha)	unit	1	411	1	469	314	closing work in 2010 year
3.	Guansimas D.S. (A=2.0 ha)	unit	1	411	1	469	314	closing work in 2010 year
4.	Lugardita D.S. (A=1.5 ha)	unit	1	411	1	346	232	closing work in 2010 year
5.	Prensa Latina D.S. (A=2.0 ha)	unit	1	411	1	469	314	closing work in 2010 year
6.	Rincon D.S. (A=0.5 ha)	unit	1	411	1	123	83	closing work in 2010 year
7.	Las Canas D.S. (A=1.0 ha)	unit	1	411	1	247	166	closing work in 2010 year
8.	El Vidrio D.S. (A=2.5 ha)	unit	1	411	1	593	397	closing work in 2010 year
9.	Los Perros D.S. (A=2.0 ha)	unit	1	411	1	469	314	closing work in 2010 year
	Sub total			-	-	3,308	2,217	
Existing Landfill closing work								
E	Existing Area of Calle 100 Landfill Site (A=80ha)	unit	1	4,754	43	2,852	1,945	Closing work in 2010 year
F	Expansion area of Calle100 Landfill Site (A=28ha)	unit	1	504	0	303	202	Closing work in 2013 year
G	Guanabacoa Landfill Site (A=28ha)	unit	1	2,903	14	1,742	1,175	Closing work in 2009 year
	TOTAL			-	-	8,205	5,539	

NOTE:

The rate of percent about F/C price (40%) and L/C price (60%) is configured by approximate Estimates
A is landfill totaly area

Table 5-1 Break Down for New Site 1 Landfill

No.	Items	Specifications	Unit	Qty	Unit Price (CUP)	Total Price	Unit Price (US\$)	Total Price	60% L/ C (CUP)	40% F/ C (US\$)
C-1	Landfill Area Work									
	1. Preparation Work			100m2	4.400	20.31	89.364		53.618	35.746
	2. Earth Work									
	2.1 Excavation and filling									
	Excavation	Ordinary Soil, backhoe 1.0m3	m3	635,660	0.43	273,334			164,000	109,334
	Excavated soil portage for filling	Dump truck 10m3 under 0.2km	m3	0	1.08	0			0	0
	Filling and compacting	Bulldozer 22t L=50m	m3	0	1.21	0			0	0
	2.2 Placement and compaction of embankment									
	Surplus soil portage temporary	Dump truck 10m3 under 0.2km	m3	227,300	1.08	245,484			147,290	98,194
	Placement and banking	Bulldozer 22t L=50m	m3	227,300	1.21	275,033			165,020	110,013
	Compaction and leveling	Road Roller	m3	227,300	0.29	65,917			39,550	26,367
	Surplus soil portage temporary	Dump truck 10m3 under 1km	m3	408,360	1.41	575,788			345,473	230,315
	Leveling surplus soil temporary	Bulldozer 22t L=50m	m3	408,360	1.21	494,116			296,470	197,646
	2.3 Turfing work for protective erosion			100m2	895	2.58	2,309		1,385	924
	Sub total of 2.					1,931,981			1,159,189	772,792
	3. Liner installation Work									
	3.1 Leveling and compaction work	Bulldozer 22t L=50m	m2	140,000	2.25	315,000			189,000	126,000
	3.2 Liner sheet installation work									
	Liner sheet installation	1.5mm double sided textured HDPE	m2	168,000			9.80	1,646,400	0	1,646,400
	Liner sheet installation	Double sided Geocomposite	m2	201,600			9.16	1,846,656	0	1,846,656
	Sheet fitting cost for installation	Sheet fitting cost for installation	unit	1			16,000.00	16,000	0	16,000
	3.2 Sheet Anchor work		m	3,050	3.70	11,285			6,771	4,514
	3.3 Protection soil layer work									
	Loading Soil	Shovel loader	m3	49,404	0.72	35,571			21,343	14,228
	Soil portage for filling	Dump truck 10m3 under 1km	m3	49,404	1.41	69,660			41,796	27,864
	Filling and compaction	Bulldozer 22t L=50m	m3	41,170	1.21	49,816			29,890	19,926
	Sub total of 3.					481,332		3,509,056	288,800	3,701,588
	4. Leachate Collection Pipe Installation Work									
	4.1 Main Pipe installation work	ID=600mm,RC perforated pipe with cobble cover layer	m	500	67.14	33,570			20,142	13,428
	4.2 Branch Pipe installation work	ID=200mm,PVC perforated pipe with cobble cover layer	m	5,000	3.75	18,750	7.25	36,250	11,250	43,750
	4.3 Connect pipe to leachate treatment pond	ID=600mm. PVC pipe	m	100	11.58	1,158	35.07	3,507	695	3,970
	4.4 Liner sheet installation work	1.5mm double sided textured HDPE, with double sided geocomposite	m2	250			18.96	4,740		4,740
	Sub total of 4.					53,478		44,497	32,087	65,888
	5. Gas vent installation Work	ID=300mm,PVC perforated pipe with Protection with cobble o scalloped construction waste	m	1,512	3.75	5,670	7.25	10,962	3,402	13,230
	6. Mobile type litter fence	H= 3m, Mobile type	m	500	35.06	17,529			10,517.0	7,012.0
	C1- Total					2,579,354		3,564,515	1,547,612	4,596,257
C-2	Road Work									
	1. Approach road type A	Asphalt pavement W = 8m	m	1,700	331.39	563,363			338,018	225,345
	2. Approach road type B	Asphalt pavement W=7m	m	900	242.86	218,574			131,144	87,430
	3. On site road	Gravel t=30cm , W=6m	m	700	210.36	147,252			88,351	58,901
	4. Maintenance road	Gravel t=30cm , W=5m	m	1,200	105.18	126,216			75,730	50,486
	5. Under cross drainage work		unit	30	1,931.03	57,931			34,759	23,172
	C-2 Total					1,113,336		0	668,002	445,334
C-3	Leachate Treatment Pond Work									
	1. Excavation work		m3	32,230	4.03	129,887			77,932	51,955
	2. Liner facility installation									
	Compaction and leveling work	Compaction existing Low permeability cla	m2	23,090	2.25	51,953			31,172	20,781
	Liner sheet installation		m2	23,090			18.96	437,786	0	437,786
	Liner sheet anchorage work		m	878	3.70	85,433			51,260	34,173
	C-3 Total					267,272		437,786	160,363	544,696
C-4	Water Strom Drain Work									
	1. Rainstorm drainage ditch work	B=0.5m, H=0.5m, with Riprap	m	6,610	6.61	43,692			26,215	17,477
		B=1.0m, H=1.0m, with Riprap	m	2,700	20.66	55,782			33,469	22,313
		B=2.0m, H=1.0m, with Riprap	m	2,810	37.19	104,504			62,702	41,802
	C-4. Total					203,978		0	122,387	81,591
C-5	Leachate Treatment Facility Installation Work									
	1. Equipment setting work	Setting pump and plumbing	unit	1	92,677	92,677			55,606	37,071
	2. Leachate recirculation pipe installation	Dia. = 75mm o 110mm	m	500	4.15	2,075			1,245	830
	C-5. Total					94,752		0	56,851	37,901
C-6	Truck Scale Installation Work									
	1. Foundation Support construction work		unit	1	2,400	2,400			1,440	960
	2. Truck scale setting work	Removing from Calle 100 landfill	unit	1	6,600	6,600			3,960	2,640
		Installation at New Site landfill	unit	1	11,000	11,000			6,600	4,400
	C-6. Total					20,000		0	12,000	8,000
C-1- C-6 Total						4,278,692		4,002,301	2,567,215	5,713,779

Note : shows Costs not Included equipments Costs, main unit of Pumps and Aerator, Truck Scale PC and Printer

Table 5-2 Breakdown of New Site 1 Landfill

(Second Stage) Construction Start in 2013
Operation Start from Y2014

No.	Items	Specifications	Unit	Qty	Unit Price (CUP)	Total Price	Unit Price (US\$)	Total Price	60% L/ C (CUP)	40% F/ C (US\$)
C-1	Landfill Area Work									
	1. Preparation Work	leveling and cut down tree	100m2	2,000	20.31	40,620			24,372	16,248
	2. Earth Work									
	2.1 Excavation and filling									
	Excavation and cutting	Natural Soil, backhoe 1.0m3	m3	403,160	0.43	173,359			104,015	69,344
	Excavated soil portage for filling	Dump truck 10m3 under 0.2km	m3	0	1.08	0			0	0
	Filling and compacting	Bulldozer 22t L=50m	m3	0	1.21	0			0	0
	2.2 Placement and compaction of embankment									
	Filling soil portage	Dump truck 10m3 under 0.2km	m3	201,600	1.08	217,728			130,637	87,091
	Placement and banking	Bulldozer 22t L=50m	m3	201,600	1.21	243,936			146,362	97,574
	Compaction and leveling	Road Roller	m3	201,600	0.29	58,464			35,078	23,386
	Surplus soil portage	Dump truck 10m3 the 1km	m3	201,560	1.41	284,200			170,520	113,680
	Leveling surplus soil temporal	Bulldozer 22t L=50m	m3	201,560	1.21	243,888			146,333	97,555
	2.3 Turfing work for protective erosion		100m2	721	2.58	1,860			1,116	744
	Sub total					1,223,435			734,061	489,374
	3.Liner instillation Work									
	3.1 Leveling and compaction work	Bulldozer 22t L=50m	m2	26,160	2.25	58,860			35,316	23,544
	Liner sheet installation	1.5mm double sided textured HDPE	m2	31,392			9.80	307,642	0	307,642
	Liner sheet installation	Double sided Geocomposite	m2	31,392			9.16	287,551	0	287,551
	Sheet fitting cost for installation	Sheet fitting cost for installation	unit	1			16,000.00	16,000	0	16,000
	3.2 Sheet Anchorage work		m	2,510	3.70	9,287			5,572	3,715
	3.3 Protection soil layer work					0			0	0
	Loading Soil	Shovel loader	m3	31,392	0.72	22,602			13,561	9,041
	Soil portage for filling	Dump truck 10m3under 1km	m3	31,392	1.41	44,263			26,558	17,705
	Filling and compaction	Bulldozer 22t L=50m	m3	26,160	1.21	31,654			18,992	12,662
	Sub total					166,666		611,192	100,000	677,858
	4. Leachate Collection Pipe Instillation Work									
	4.1 Main Pipe installation work	ID=600mm,RC pipe, perforated, with Cobble Cover layer	m	390	67.14	26,185			15,711	10,474
	4.2 Branch Pipe installation work	ID=200mm,PVC perforated pipe type,, with Cobble Cover layer	m	3,900	3.75	14,625	7.25	28,275	8,775	34,125
	4.3 Connect pipe to leachate treatment pond	ID=600mm, PVC pipe	m	100	11.58	1,158	35.07	3,507	695	3,970
	4.4 Liner sheet installation work	1.5mm double sided textured HDPE, Double sided Geocomposite	m2	250			18.96	4,740		4,740
	Sub total					41,968		36,522	25,181	53,309
	5. Gas Removing Facility Work	ID=200mm,PVC pipe with cobble o scalloned construction waste and used tire	m	980	3.75	3,675	7.25	7,105	2,205	8,575
	C1- Total					1,476,364		654,819	885,818	1,245,365
C-2	Road Work									
	1. Approach Road Type A work	Asphalt pavement W=8m	m	0	331.39	0		0	0	0
	2. Approach Road Type B work	Asphalt pavement W=7m	m	850	242.86	206,431			123,859	82,572
	3. On site Road work	Gravel t=30cm, W=6m	m	560	210.36	117,802			70,681	47,121
	4. Maintenance Road work	Gravel t=30cm, W=5m	m	1,000	105.18	105,180			63,108	42,072
	5. Drainage Pipe of under cross road work		unit	20	1,931.03	38,621			23,173	15,448
	C-2-Total					468,034		0	280,820	187,214
C-3	Leachate Treatment Pond Work									
	1. Excavation and compaction work		m3	21,100	4.03	85,033			0	51,020
	2. Liner facility instillation work									
	Compaction and Levering work	Compaction existing Low permeability soi	m2	13,710	2.25	30,848			18,509	12,339
	Liner Sheet Instillation		m2	13,710			18.96	259,942	0	259,942
	Liner Sheet anchorage		m	738	3.70	50,727			30,436	20,291
	C-3-Total					166,608			99,965	66,643
C-4	Water Strom Drain Work									
	1. Rainstorm drainage ditch work	B=0.5m, H=0.5m, with Riprap	m	5,780	6.61	38,206			22,923	15,283
		B=1.0m, H=1.0m, with Riprap	m	740	20.66	15,288			9,173	6,115
		B=2.0m, H=1.0m, with Riprap	m	1,200	37.19	44,628			26,777	17,851
	C-4-Total					98,122			58,873	39,249
C-5	Leachate Treatment Facility Installation Work									
	1. Recirculation pump setting work	Setting pump and plumbing	unit	1	93,841	92,677			55,606	37,071
	2. Recirculation pipe installation work	Dia. = 75mm o 110mm	m	500	4.15	2,075			1,245	830
	C-5- Total					94,752			56,851	37,901
	TOTAL of C-1- C-5					2,303,880		654,819	1,382,328	1,576,371

Table 5-3 Breakdown of New Site 1 Landfill

**Construction Cost of New site 1 Landfill Site, Mechanical Work
First Stage (LEVEL 4)**

No.	Items	specifications	Unit	Qty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	60%	40%
									L/ C (CUP)	F / C (US\$)
M-1	Leachate Treatment equipment installation work									
	<i>1.Main Body Cost</i>									
		<i>installation in 2010Y</i>								
		Aerator 1.6kg-O2/kwh x 11kW	unit	6			25,955	155,730		155,730
		Leachate Recirculation Pump 1.01m3/min x 50mH x 15kw	unit	3			8,483	25,449		25,449
		Sludge delivery pump 0.15m3/min x 80mH x 5.5kw	unit	2			4,200	8,400		8,400
		<i>Sub Total</i>						189,579		189,579
	<i>1.Main Body Cost (for replacement Unit)</i>									
		<i>Replacement Setting in 2015 year</i>								
		Aerator 1.6kg-O2/kwh x 11kW	unit	5			25,955	129,775		129,775
		Leachate Recirculation Pump 1.01m3/min x 50mH x 15kw	unit	2			8,483	16,966		16,966
		Sludge delivery pump 0.15m3/min x 80mH x 5.5kw	unit	1			4,200	4,200		4,200
		<i>Sub Total</i>						150,941		150,941
	2. Installation Work									
	2.1 Installation of equipment unit Work	25% of Equipment main unit Price	set	1	47,395	47,395			28,437	18,958
	2.2 Cable and Accessories setting Work	30% of Equipment main unit Price	set	1	45,282	45,282			27,169	18,113
	TOTAL of M-1									
									55,606	37,071
M-2	Truck Scale Installation Work									
	<i>1. Main Body Price</i>									
		<i>Main unit max 50ton</i>	unit	2				55,000	110,000	
	2. Truck Scale Installation Work in New s	6 % of Main Body Cost)	set	1	6,600	6,600			3,960	2,640
	3. Truck Scale Desinstallation Work in Ca	10 % of Main Body Unit Cost)	set	1	11,000	11,000			6,600	4,400
	Total of M-2									
									17,600	117,040
	TOTAL (M-1 + M-2)									
						110,277			66,166	154,111

**Construction Cost of New site 1 Landfill Site, Mechanical Work
Second Stage (LEVEL 4)**

No.	Items	specifications	Unit	Qty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	60%	40%
									L/ C (CUP)	F / C (US\$)
M-1	Leachate Treatment equipment installation work									
	<i>1.Main Body Cost</i>									
		<i>installation in 2013Y</i>								
		Aerator 1.6kg-O2/kwh x 11kW	unit	6			24,215	145,290		145,290
		Leachate Recirculation Pump 1.27m3/min x 50mH x 19kw	unit	2			9,425	18,850		18,850
		Sludge delivery pump 0.10m3/min x 80mH x 3.7kw	unit	2			3,240	6,480		6,480
		<i>Sub Total</i>						170,620		170,620
	2. Installation Work									
	2.1 Installation of equipment unit Work	25% of Equipment main unit Price	set	1	42,655	42,655			25,593	17,062
	2.2 Cable and Accessories setting Work	30% of Equipment main unit Price	set	1	51,186	51,186			30,712	20,474
	sub total									
					93,841	93,841			56,305	37,536
	TOTAL									
		(only Installation work only)				93,841			56,305	208,156

Table 5-4 Breakdown of New site1 Landfill

No.	Items	Specifications	Unit	Qty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	60%	40%
									Local Currency (CUP)	Foreign Currency (US\$)
A-1	Measuring office									
	Measures control office	3m x 5m	m2	15	146.43	2,196			1,318	878
	sub total					2,196		0	1,318	878
A-2	Administration Facility									
	1. Administration office	10 m x 30 m	m2	300	146.43	43,929			26,357	17,572
	2. Parking Area for visitor	5 m x 15m	m2	75	639.85	47,989			28,793	19,196
	3.Tire washing Pit	3m x 10m	unit	1	2,000.00	2,000			1,200	800
	Sub Total					93,918		0	56,350	37,568
A-3	Security Facility									
	1. Entrance Gate		unit	1	400.00	400			240	160
	2. Guard Office		m2	20	146.43	2,929			1,757	1,172
	3. lighting facility		unit	80	500.00	40,000			24,000	16,000
	4. Fence nearside of entrance Gate		m	500	2.58	1,290			774	516
	5. Wire Fence for boundary		m	4500	11.00	49,500			29,700	19,800
	Sub Total					94,119		0	56,471	37,648
A-4	Operation Equipment Parking Area									
	1.Operation Equipment Parking	RC base50m x 100m with roof	m2	5000	147.83	739,150			443,490	295,660
	2.Fuel Tank	5000 L	1000 liter	5	2,073.50	10,368			6,221	4,147
	Sub Total					749,518			449,711	299,807
A-5	Power and water Supply Work									
	1.Water and Electric Supply work		Unit	1	20,000.00	20,000			12,000	8,000
	Sub Total					20,000			12,000	8,000
	A-1- A-5 Total	Primary Construction Work				939,750			563,850	375,900

Table 6-1 Breakdown of New Guanabacoa Landfill (First Stage, Civil work)

Construction Cost of NEW GUANABACOA Landfill Site, Civil Work
at First Stage

Operation Period from year 2009 to 2011

No.	Items	Specifications	Unit	Q'ty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price	60% L/C (CUP)	40% F/C (US\$)	
C-1:	Landfill Area Work										
	1. Preparation Work	Bulldozer 22t L=50m,	100m2	1,550	20.31	31,481			18,889	12,592	
	2. Earth Work										
	2.1 Excavation and filling										
	Excavation	Natural Soil, backhoe 1.0m3	m3	356,900	0.43	153,467			92,080	61,387	
	Excavated soil portage for filling	Dump truck 10m3 under 0.2km	m3	219,722	1.08	237,300			142,380	94,920	
	Filling and compacting	Bulldozer 22t L=50m	m3	219,722	1.21	265,864			159,518	106,346	
	2.2 Placements and compaction of embankment										
	Surplus soil portage temporary	Dump truck 10m3 under 0.2km	m3	345,766	1.08	373,427			224,056	149,371	
	Placement and banking	Bulldozer 22t L=50m	m3	100,123	1.21	121,149			72,689	48,460	
	Compaction and leveling	Road Roller	m3	100,123	0.29	29,036			17,422	11,614	
	Surplus Soil Portage temporary	Dump truck 10m3 under 1km	m3	37,054	1.41	52,247			31,348	20,899	
	Leveling surplus soil temporary	Bulldozer 22t L=50m	m3	37,054	1.21	44,836			26,902	17,934	
	2.3 Turfing work for protection by erosion		100m2	511	2.58	1,318			791	527	
	<i>Sub total of 2.</i>					<i>1,278,644</i>			<i>767,186</i>	<i>511,458</i>	
	3. Liner Installation Work										
	3.1 Leveling and compaction work	Bulldozer 22t L=50m	m2	96,000	2.25	216,000			129,600	86,400	
	3.2 Liner sheet installation work										
	Liner sheet installation	1.5mm double sided textured HDPE	m2	96,000			9.80	940,800	0	940,800	
	Liner sheet installation	Double sided Geocomposite	m2	96,000			9.16	879,360	0	879,360	
	Sheet fitting cost for installation	Sheet fitting cost for installation	unit	1			16,000.00	16,000	0	16,000	
	3.3 Sheet Anchorage work		m	1,300	3.70	4,810			2,886	1,924	
	3.4 Protective soil layer work										
	Loading Soil	Shovel loader	m3	25,920	0.72	18,662			11,197	7,465	
	Soil portage for filling	Dump truck 10m3 under 1km	m3	25,920	1.41	36,547			21,928	14,619	
	Filling and compaction	Bulldozer 22t L=50m	m3	32,400	1.21	39,204			23,522	15,682	
	<i>Sub total of 3.</i>					<i>315,223</i>		<i>1,820,160</i>	<i>189,134</i>	<i>1,946,249</i>	
	4. Leachate Collection Pipe Installation Work										
	4.1 Main Pipe installation work	ID=600mm,RC perforated pipe with cobble cover layer	m	700	67.14	46,998			28,199	18,799	
	4.2 Branch Pipe installation work	ID=200mm,PVC perforated pipe with cobble cover layer	m	2,340	3.75	8,775	7.25	16,965	5,265	20,475	
	4.3 Connect pipe to leachate treatment pond	ID=600mm, PVC pipe	m	120	11.58	1,390	35.07	4,208	834	4,764	
	4.4 Liner sheet installation work	1.5mm double sided textured HDPE, with double sided geocomposite	m2	480			18.96	9,101	0	9,101	
	<i>Sub total of 4.</i>					<i>57,163</i>		<i>30,274</i>	<i>34,298</i>	<i>53,139</i>	
	5. Gas vent installation Work	ID=300mm,PVC perforated pipe with protectin layer by cobble o scrap construction waste	m	567	3.75	2,126	7.25	4,111	1,276	4,961	
	6. Mobile type litter fence	H= 2m, Mobile type	m	500	35.06	17,529			10,517.0	7,012.0	
	Total of C-1					1,702,166		1,854,545	1,021,300	2,535,411	
C-2:	Road Work										
	1. Approach Road Type A	Asphalt pavement W=8m	m	700	331.39	231,973			139,184	92,789	
	2. Approach Road Type B	Asphalt pavement W=7m	m	1,400	242.86	340,004			204,002	136,002	
	3. On site Road	Gravel t=30cm , W=6m	m	1,400	210.36	294,504			176,702	117,802	
	4. Maintenance Road	Gravel t=30cm , W=5m	m	1,500	105.18	157,770			94,662	63,108	
	5. Under cross Drainage work		unit	10	1,931.03	19,310			11,586	7,724	
	C-2 Total					1,043,561		0	626,137	417,424	
C-3:	Leachate Treatment Pond Work										
	1. Excavation work		m3	13,640	4.03	54,969			32,982	21,987	
	2. Liner facility installation work										
	Compaction and leveling	Compaction existing Low permeability so	m2	1,544	2.25	3,474			2,084	1,390	
	Liner sheet installation	1.5mm double sided textured HDPE + Do	m2	1,544			18.96	29,274	0	29,274	
	Liner Sheet anchorage		m	5,944	3.70	5,713			3,428	2,285	
	C-3-Total					64,156		29,274	38,494	54,936	
C-4:	Water Strom Drain Work										
	1. Drainage ditch type1	B=0.5m, H=0.5m, with Riprap	m	3,710	6.61	24,523			14,714	9,809	
	2. Drainage ditch type2	B=1.0m, H=1.0m, with Riprap	m	300	20.66	6,198			3,719	2,479	
	3. Drainage ditch type3	B=2.0m, H=1.0m, with Riprap	m	200	37.19	7,438			4,463	2,975	
	C-4. Total					38,159		0	22,895	15,264	
C-5:	Leachate Treatment Equipment Installation Work										
	1. Equipment p setting work	pit , Equipment setting and plumbing	unit	1	64,818	64,818			38,891	25,927	
	2. Recirculation pipe installation work	Dia. = 75mm o 110mm	m	500	4.15	2,075			1,245	830	
	C-5. Total					66,893		0	40,136	26,757	
C-6:	Truck Scale Installation Work										
	1. Foundation Support construction work		unit	1	2,400	2,400			1,440	960	
	2. Truck scale setting work		unit	1	78,018	78,018			46,811	31,207	
	C-6. Total					80,418		0	48,251	32,167	
	TOTAL of C-1- C-6					2,995,352		1,883,819	1,797,211	3,081,960	

Table 6-2 Breakdown of New Guanabacoa Landfill (Second Stage, Civil work)

Construction Cost of New GUANABACOA Landfill Site, Civil Work
at Second Stage

Operation Period is from 2012 year
Construction Work at 2011 year

No.	Items	Specifications	Unit	Pd	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	60%	40%
									Local Currency (CUP)	Foreign Currency (US\$)
C-1:	Landfill Area Work									
	1. Preparation Work		m2	950	20.31	19,295			11,577	7,718
	2. Earth Work									
	2.1 Excavation and filling	Natural Soil, backhoe 1.0m3	m3	226,175	0.43	97,255			58,353	38,902
	Excavated soil portage for filling	Dump truck 10m3 under 0.2km	m3	72	1.08	78			47	31
	Filling and compacting	Bulldozer 22t L=50m	m3	72	1.21	87			52	35
	2.2 Placement and compaction of embankment									
	Surplus soil portage temporary	Dump truck 10m3 under 0.2km	m3	110,474	1.08	119,312			71,587	47,725
	Placement and banking	Bulldozer 22t L=50m	m3	110,474	1.21	133,673			80,204	53,469
	Compaction and leveling	Road Roller	m3	110,474	0.29	32,037			19,222	12,815
	Surplus soil portage temporary	Dump truck 10m3 under 1km	m3	115,629	1.41	163,037			97,822	65,215
	Leveling surplus soil temporal	Bulldozer 22t L=50m	m3	115,629	1.21	139,911			83,947	55,964
	2.3 Turfing Work for Protective erosion		100m2	442	2.58	1,141			685	456
	<i>Sub total of 2.</i>					686,531			411,919	274,612
	3. Liner installation work									
	3.1 Leveling and compaction work	Bulldozer 22t L=50m	m2	80,000	2.25	180,000			108,000	72,000
	3.2 Liner sheet installation work	1.5mm double sided textured HDPE	m2	80,000			9.80	784,000	0	784,000
	Liner sheet installation	Double sided Geocomposite	m2	80,000			9.16	732,800	0	732,800
	Sheet fitting cost for installation	technical advice and supervision	unit	1			16,000.00	16,000	0	16,000
	3.2 Sheet Anchor work		m	1,500	3.70	5,550			3,330	2,220
	3.3 Protection soil layer work									
	Loading Soil	Shovel loader	m3	26,667	0.72	19,200			11,520	7,680
	Soil portage for filling	Dump truck 10m3 under 1km	m3	26,667	1.41	37,600			22,560	15,040
	Filling and compaction	Bulldozer 22t L=50m	m3	22,222	1.21	26,889			16,133	10,756
	<i>Sub total of 3.</i>					269,239		1,532,800	161,543	1,640,496
	4. Leachate Collection Pipe Installation Work									
	4.1 Main Pipe	ID=600mm,RC perforated pipe with cobble cover layer	m	300	67.14	20,142			12,085	8,057
	4.2 Branch Pipe	ID=200mm,PVC perforated pipe with cobble cover layer	m	1,650	3.75	6,188	7.25	11,963	3,713	14,438
	4.3 Connect pipe to leachate treatment pond	ID=600mm,PVC perforated pipe with cobble cover layer	m	120	11.58	1,390	35.07	4,208	834	4,764
	4.4 Liner sheet installation	1.5mm double sided textured HDPE, Double sided Geocomposite	m2	480			18.96	9,101		9,101
	<i>Sub total of 4.</i>					27,720		25,272	16,632	36,360
	5. Gas vent installation Work	ID=300mm,PVC perforated pipe with protecting layer by cobble o scrap construction waste	m	1,550	3.75	5,812	7.25	11,236	3,487	13,561
	C1- Total					1,008,597		1,569,308	605,158	1,972,747
C-2:	Road Work									
	1. Approach Road Type A	Asphalt pavement W=8m	m	-	331.39					
	2. Approach Road Type B	Asphalt pavement W=7m	m	500	242.86	121,430		0	72,858	48,572
	3. On site Road	Gravel t=30cm , W=6m	m	900	210.36	189,324		0	113,594	75,730
	4. Maintenance Road	Gravel t=30cm , W=5m	m	700	105.18	73,626		0	44,176	29,450
	5. Under cross Drainage Work		unit	10	1,931.03	19,310		0	11,586	7,724
	C-2-Total					403,690		0	242,214	161,476
C-3:	Leachate Treatment Pond Work									
	1. Excavation and compaction work		m3	2,590	4.03	10,438		0	6,263	4,175
	2. Liner facility installation									
	Compaction and Levering Work		m2	1,184	2.25	2,664			1,598	1,066
	Liner Sheet Installation	1.5mm textured HDPE + Double sided Ge	m2	1,184	0.00	0	18.96	22,449	0	22,449
	Liner Sheet anchorage Work		m	4,684	3.70	4,381			2,628	1,753
	C-3-Total					17,483		22,449	10,490	29,441
C-4:	Water Strom Drain Work									
	1. Rainstorm drainage ditch work	B=0.5m, H=0.5m, with Riprap	m	3,425	6.61	22,639			13,584	9,055
		B=1.0m, H=1.0m, with Riprap	m	300	20.66	6,198			3,719	2,479
		B=2.0m, H=1.0m, with Riprap	m	200	37.19	7,438			4,463	2,975
	C-4-Total					36,275			21,765	14,510
C-5:	Leachate Treatment Equipment Installation Work									
	1. Equipment setting work	pit , Setting pump plumbing and accessories	unit	1	25,438.50	25,439			15,263	10,176
	2. Recirculation pipe installation work	Dia = 75 or 110mm	m	500	4.15	2,075			1,245	830
	C-5- Total					27,514			16,508	11,006
C1- C-5 Total						1,493,559		1,591,756	896,135	2,189,180

Table 6-3 Breakdown of New Guanabacoa Landfill (Equipment Installation work)

Construction Cost of New GUANABACOA Landfill Site, Equipment Installation w
in First stage

No.	Items	Specifications	Unit	Qty	Unit Price (CUP)	Total Price	Unit Price (US\$)	Total Price	60% L/C (CUP)	40% F/C (US\$)	
M-1	Leachate treatment equipment installation work										
	1.Treatment equipment Main Body Cost	<i>Installation year 2006</i>									
	<i>Aerator</i>	1.6kg O ₂ /kwh x 11 kW	unit	4			25,955	103,820		103,820	
	<i>Leachate Recirculation pump</i>	0.92m ³ /min x 40mH x 11 kW	unit	2			4,495	8,990		8,990	
	<i>Sludge delivery pump</i>	0.07m ³ /min x 70mH x 2.2kW	unit	2			2,520	5,040		5,040	
		<i>sub total of Main Body Cost</i>						117,850		117,850	
	2.Replacement equipment Main Body Cos	<i>Replacement year 2011</i>									
	<i>Aerator</i>	1.6kg O ₂ /kwh x 11 kW	unit	3			25,955	77,865		77,865	
	<i>Leachate Recirculation pump</i>	0.92m ³ /min x 40mH x 11 kW	unit	1			4,495	4,495		4,495	
	<i>Sludge delivery pump</i>	0.07m ³ /min x 70mH x 2.2kW	unit	1			2,520	2,520		2,520	
		<i>sub total of Main Body Cost</i>						202,730		202,730	
	2. Equipment Installation Work										
	2.1 Installation Work	5% of Equipment main unit Price of 2006	set	1	29,463	29,463			17,678	11,785	
	2.2 Cable and Accessories setting work	30% of Equipment main unit Price	set	1	35,355	35,355			21,213	14,142	
		<i>sub total</i>				64,818			38,891	25,927	
M-2	Truck Scale Installation Work	<i>Main Body cost</i>		2			55,000	110,000		110,000	
	1.Truck Scale Installation Work										
	2. Installation Work	6% of Main Body Cost	set	2	6,600	13,200			7,920	5,280	
		<i>sub total</i>				78,018			46,811	31,207	

Construction Cost of New GUANABACOA Landfill Site, Equipment Installation w
in Second Stage

No.	Item	Specifications	Unit	Q'ty	Unit Price (CUP)	Total Price	Unit Price (US\$)	Total Price	L / C (CUP) 60%	F/ C (US\$) 40%	
M-1	Leachate Treatment equipment installation work										
	1.Treatment equipment Main Body Cost	<i>Installation year 2011</i>									
	<i>Aerator</i>	1.6kg O ₂ /kwh x 11 kW	unit	3			24,215	72,645		72,645	
	<i>Leachate Recirculation pump</i>	0.60 m ³ /min x 40mH x 7.5 kW	unit	2			3,915	7,830		7,830	
	<i>Sludge delivery pump</i>	0.05m ³ /min x 70mH x 1.5 kW	unit	2			2,160	4,320		4,320	
		<i>sub total of Main Body Cost</i>						84,795		84,795	
	2. Equipment Installation Work										
	2.1 Installation Work	5% of Equipment main unit Price of 2006	set	1	21,199	21,199			12,719	8,480	
	2.2 Cable and Accessories setting work	30% of Equipment main unit Price	set	1	25,439	25,439			15,263	10,175	
		<i>sub total</i>				46,637			27,982	18,655	

Table 6-4 Breakdown of New Guanabacoa Landfill (Architecture and other work)

No.	Items	Specifications	Unit	Q'ty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	L / C (CUP) 60%	F/ C (US\$) 40%	
A-1	Measuring office										
	Measures control office	3m x 5m	m2	15	146.43	2,196			1,318	878	
	<i>sub total</i>					2,196		0	1,318	878	
A-2	Administration Facility										
	1. Administration office	10 m x 30 m	m2	400	146.43	58,572			35,143	23,429	
	2. Parking for visitor	5 m x 15m	m2	100	639.85	63,985			38,391	25,594	
	3. Tre washing pit	3m x 10m	unit	1	2,000.00	2,000			1,200	800	
	<i>Sub Total</i>					124,557		0	74,734	49,823	
A-3	Security Facility										
	1. Entrance Gate		unit	1	200.00	200			120	80	
	2. Guard Office		m2	20	146.43	2,929			1,757	1,172	
	3. Lighting facility		unit	80	500.00	40,000			24,000	16,000	
	4. Fence nearside of entrance Gate		m	500	17.53	8,765			5,259	3,506	
	5. Boundary Wire Fence		m	3000	11.00	33,000			19,800	13,200	
	<i>Sub Total</i>					84,893		0	50,936	33,958	
A-4	Operation Equipment Parking Area										
	1.Operation Equipment Parking	Reinforced Concrete base t=20cm , 50m x 5	m2	2500	147.83	369,575			221,745	147,830	
	2.Fuel Tank	5000 Litter	1000 liter	5	2,073.50	10,368			6,221	4,147	
	<i>Sub Total</i>					379,943			227,966	151,977	
A-5	Power and water Supply Work										
	1.Water and Electric Supply installation work		Unit	1	20,000.00	20,000			12,000	8,000	
									0	0	
A-1- A-5 Total	Primary Construction Work										
						611,589			366,954	244,636	

Table 7-1 Break Down of Calle100 Landfill Expansion area (First Stage Civil work)

Construction Cost of Calle 100 Landfill Expansion Area,
(First Stage) Construction from Y2008
Operation Period from Y2009

Construction Cost of Calle 100 Landfill Expansion Area, (First Stage)									60%	40%
No.	Items	Specifications	Unit	Qty	Unit Price (CUP)	Total Price	Unit Price (US\$)	Total Price	LC (CUP)	FC(US\$)
C-1	Landfill Area Work									
	1. Preparation Work		100m2	1,392	20.31	28,272			16,963	11,309
	2. Earth Work									
	2.1 Excavation and filling									
	Excavation and cutting	Natural Soil, backhoe 1.0m3	m3	1,082,205	0.43	465,348			279,209	186,139
	Excavated soil portage for filling	Dump truck 10m3 under 0.2km	m3	0	1.08	0			0	0
	Filling and compacting	Bulldozer 22t L=50m	m3	0	1.21	0			0	0
	2.2 Placement and compaction of embankment									
	Surplus Soil Portage Temporary	Dump truck 10m3 under 0.2km	m3	159,934	1.08	172,729			103,637	69,092
	Placement and banking	Bulldozer 22t L=50m	m3	159,934	1.21	193,520			116,112	77,408
	Compaction and levering	Road Roller	m3	159,934	0.29	46,381			27,829	18,552
	Surplus soil portage temporary	Dump truck 10m3 under 0.2km	m3	922,271	1.08	996,053			597,632	398,421
	Leveling surplus soil temporary	Bulldozer 22t L=50m	m3	922,271	1.21	1,115,948			669,569	446,379
	2.3 Turfing Work for protection by erosion		100m2	1,160	2.58	2,993			1,796	1,197
	Sub total of 2.					2,992,972			1,795,783	1,197,189
	3.1 Leveling and compaction work	Bulldozer 22t L=50m	m2	127,177	2.25	286,149			171,689	114,460
	3.2 Liner sheet installation work	Bulldozer 22t L=50m								
	Liner sheet installation	1.5mm double sided textured HDPE	m2	152,613			9.80	1,495,605	0	1,495,605
	Liner sheet installation	Double sided Geocomposite	m2	152,613			9.16	1,397,933	0	1,397,933
	Sheet fitting cost for installation	Sheet fitting cost for installation	unit	1			16,000.00	16,000	0	16,000
	3.3 Sheet Anchor work		m	1,486	3.70	5,500			3,300	2,200
	3.4 Protection soil layer work									
	Loading Soil	Shovel loader	m3	38,153	0.72	27,470			16,482	10,988
	Filling soil portage	Dump truck 10m3 under 1km	m3	38,153	1.41	53,796			32,278	21,518
	Filling and compaction	Bulldozer 22t L=50m	m3	31,794	1.21	38,471			23,083	15,388
	Sub total of 3.					125,237		2,893,538	75,142	2,943,633
	4. Leachate Collection Pipe Installation Work									
	4.1 Main Pipe installation work	ID=600mm,RC perforated pipe with cobble cover layer	m	400	67.14	26,856			16,114	10,742
	4.2 Branch Pipe installation work	ID=200mm,PVC perforated pipe with cobble cover layer	m	6,000	3.75	22,500	7.25	43,500	13,500	52,500
	4.3 Connect pipe to Leachate treatment pond	ID=600mm, PVC pipe	m	50	11.58	579	35.07	1,754	347	1,986
	4.4 Liner sheet installation work	1.5mm double sided textured HDPE, with double sided Geo-composite	m2	200			18.96	3,792	0	3,792
	Sub total of 4.					49,935		49,046	29,961	69,020
	5. Gas Removing Facility Work	ID=300mm,PVC perforated pipe with protecting layer by cobble o scrap construction waste	m	1,575	3.75	5,906	7.25	11,419	3,544	13,781
	6. Mobile type litter fence	H=2m, Mobile type	m	500	35.06	17,529			10,517.0	7,012.0
	C1- Total					3,219,851		2,954,002	1,931,911	4,241,942
C-2	Road Construction Work									
	1. Access Road Type A	Asphalt pavement W=8m	m	0	331.39	0			0	0
	2. Access Road Type B	Asphalt pavement W=7m	m	300	242.86	72,858			43,715	29,143
	3. On site Road	Gravel t=30cm , W=6m	m	450	210.36	94,662			56,797	37,865
	4. Maintenance Road	Gravel t=30cm , W=5m	m	400	105.18	42,072			25,243	16,829
	5. Under cross Drainage Work		unit	10	1,931.03	19,310			11,586	7,724
	C-2 Total					228,902		0	137,341	91,561
C-3	Leachate Treatment Pond Work									
	1. Excavation and compaction work		m3	3,210	4.03	12,936			7,762	5,174
	2. Liner facility installation									
	Compaction and leveling work		m2	1,707	2.25	3,841			2,304	1,537
	Liner sheet installation		m2	1,707		0	18.96	32,365	0	32,365
	Liner sheet anchorage work		m	230	3.70	6,316			3,790	2,526
	C-3 Total					23,093		32,365	13,856	41,602
C-4	Water Drain Work									
	1. Rainstorm drainage ditch work	B=0.5m , H=0.5m with riprap	m	3,200	6.61	21,152			12,691	8,461
		B=1.0m , H=0.5m with riprap	m	1,900	20.66	39,254			23,552	15,702
		B=2.0m , H=1.0m with riprap	m	600	37.19	22,314			13,388	8,926
	C-4. Total					82,720		0	49,632	33,088
C-5	Leachate Treatment Equipment Installation Work									
	1. Equipment setting work	Setting main body and plumbing, accesso	unit	1	9,425	9,425			5,655	3,770
	2. Recirculation pipe installation work	Dia. = 75mm o 110mm	m	300	4.15	1,245			747	498
	C-5. Total					10,670		0	6,402	4,268
C-6	Truck Scale Installation Work									
	1. Foundation Support construction work	Rc Support construction and setting	unit	1	2,400	2,400			1,440	960
	2. Truck scale setting work	Installation work	unit	1	22,000	22,000			13,200	8,800
	C-6. Total					24,400		0	14,640	9,760
	C-1- C-6 Total	Primary Construction Cost				3,589,636		2,986,367	2,153,782	4,422,221

Table 7-2 Break Down of Calle100 Landfill Expansion Area (Second Stage, Civil Work)

Construction Cost of Calle 100 Landfill Expansion Area, (Second Stage)								60%	40%
Items	Specifications	Unit	Qty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	LC (CUP)	FC (US\$)
C-1: Landfill Area Work									
1. Preparation Work	Bulldozer 22t L=50m.	100m2	1,189	20.31	24,149			14,489	9,660
2. Earth Work									
2.1 Excavation and filling									
Excavation	Ordinary Soil, backhoe 1.0m3	m3	968,554	0.43	416,478			249,887	166,591
Filling soil portage	Dump truck 10m3 under 0.2km	m3	10,000	1.08	10,800			6,480	4,320
Filling and compacting	Bulldozer 22t L=50m	m3	10,000	1.21	12,100			7,260	4,840
2.2 Placement and compaction of embankment									
Filling soil portage	Dump truck 10m3 under 0.2km	m3	141,521	1.08	152,843			91,706	61,137
Placement and banking	Bulldozer 22t L=50m	m3	141,521	1.21	171,240			102,744	68,496
Compaction and leveling	Road Roller	m3	141,521	0.29	41,041			24,625	16,416
Surplus Soil Portage temporary	Dump truck 10m3 the 1km	m3	817,033	1.41	1,152,017			691,210	460,807
Leveling surplus soil temporary	Bulldozer 22t L=50m	m3	817,033	1.21	988,610			593,166	395,444
2.3 Turfing Work for protection by erosion		100m2	900	2.58	2,322			1,393	929
Sub total of 2.					2,947,451			1,768,471	1,178,980
3. Liner installation Work									
3.1 Leveling and compaction work	Bulldozer 22t L=50m	m2	107,957	2.25	242,904			145,742	97,162
3.2 Liner sheet installation work									
Liner sheet installation	1.5mm double sided textured HDPE	m2	129,549			9.80	1,269,576	0	1,269,576
Liner sheet installation	Double sided Geocomposite	m2	129,549			9.16	1,186,665	0	1,186,665
Sheet fitting cost for installation	Sheet fitting cost for installation	unit	1			16,000.00	16,000	0	16,000
3.3 Sheet Anchor work		m	1,098	3.70	4,062			2,437	1,625
3.4 Protection soil layer work									
Loading Soil	Shovel loader	m3	107,957	0.72	77,729			46,637	31,092
Soil portage for filling	Dump truck 10m3 under 1km	m3	107,957	1.41	152,220			91,332	60,888
Filling and compaction	Bulldozer 22t L=50m	m3	89,964	1.21	108,857			65,314	43,543
Sub total of 3.					585,772		2,472,240	351,463	2,706,549
4. Leachate Collection Pipe Installation Work									
4.1 Main Pipe installation work	ID=600mm,RC perforated pipe with cobble cover layer	m	450	67.14	30,213			18,128	12,085
4.2 Branch Pipe installation work	ID=200mm,PVC perforated pipe with cobble cover layer	m	5,400	3.75	20,250	7.25	39,150	12,150	47,250
4.3 Connect pipe to leachate treatment por	ID=600mm, PVC pipe with 1.5mm double sided textured HDPE, with double sided Geo-composite	m	50	11.58	579	35.07	1,754	347	1,986
4.4 Liner sheet installation work		m2	675			18.96	12,798	0	12,798
Sub total of 4.					51,042		53,702	30,625	74,119
5. Gas Removing Facility Work	ID=300mm,PVC pipe with cobble o scrap construction waste and used tire Cover	m	1,418	3.75	5,318	7.25	10,281	3,191	12,408
C1- Total					3,613,732		2,536,222	2,168,239	3,981,715
C-2 : Road Work									
1. Approach Road Type A	Asphalt pavement W=8m	m	0	331.39	0		0	0	0
2. Approach Road Type B	Asphalt pavement W=7m	m	0	242.86	0		0	0	0
3. On site Road	Gravel t=30cm , W=6m	m	300	210.36	63,108		0	37,865	25,243
4. Maintenance Road	Gravel t=30cm , W=5m	m	300	105.18	31,554		0	18,932	12,622
5. Under cross Drainage work		unit	10	1,931.03	19,310		0	11,586	7,724
C-2-Total					113,972		0	68,383	45,589
C-3 Leachate Treatment Pond Work									
1. Excavation work		m3	2,740	4.03	11,042		0	6,625	4,417
2. Liner facility installation work									
Compaction and leveling	Compaction existing Low permeability soil	m2	1,808	2.25	4,069			2,441	1,628
Liner sheet installation	1.5mm double sided textured HDPE + Do	m2	1,808	0.00	0	18.96	34,287	0	34,287
Liner Sheet anchorage		m	230	3.70	6,691			4,015	2,676
C-3-Total					21,802		34,287	13,081	43,008
C-4 Water Strom Drain Work									
1. Drainage ditch type1	B=0.5m, H=0.5m, with Riprap	m	2,500	6.61	16,525			9,915	6,610
2. Drainage ditch type2	B=1.0m, H=1.0m, with Riprap	m	1,900	20.66	39,254			23,552	15,702
3. Drainage ditch type3	B=2.0m, H=1.0m, with Riprap	m	400	37.19	14,876			8,926	5,950
C-4-Total					70,655			42,393	28,262
C-5 Leachate Treatment Equipment Installation Work									
1. Equipment setting work	pit , Setting pump plumbing and accessories	unit	1	10,368	10,368			6,221	4,147
2. Recirculation pipe installation work	Dia = 75 or 110mm	m	300	4.15	1,245			747	498
C-5. Total					11,613			6,968	4,645
C-1- C-5 Total	Direct Construction Cost				3,831,773		2,570,510	2,299,064	4,103,219

Table 7-3 Breakdown of Calle100 Landfill Expansion Area, (Equipment installation)

No.	Item	specification	Unit	Q'ty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	60% Local Currency (CUP)	40% Foreign Currency (US\$)
First Stage										
M-1	1. Treatment equipment installation Work									
	1.1 Main unit cost	<i>Leachate Recirculation pump</i>	unit	2			9,425	18,850		18,850
	installation at 2006 year	<i>1.52m3/min x 50mH x 19 kW</i>								
	sub total							18,850		18,850
	1.2 Installation Work	25% of Equipment main unit Price	set	1	3,770	3,770			2,262	1,508
	1.3 Cable and Accessories setting Work	30% of Equipment main unit Price	set	1	5,655	5,655			3,393	2,262
	sub total					9,425			5,655	3,770
	Replace work	<i>Leachate Recirculation pump</i>								
	Replacement at 2011 year	<i>1.52m3/min x 50mH x 19 kW</i>	unit	1			9,425	9,425		9,425
M-2	Main unit cost	main unit max 50ton		2			55,000	110,000		110,000
	Installation Work	10 % Main unit Price	set	2	11,000	22,000			13,200	8,800
	Removing Work	6 % Main unit Price	set	2	6,600	13,200			7,920	5,280
	sub total					35,200			21,120	14,080
Second Stage										
M-1	1. Treatment equipment installation work									
	1.1 Main unit cost	<i>Leachate Recirculation pump</i>	unit	2			9,425	18,850		18,850
	Installation at 2008 year	<i>1.27m3/min x 50mH x 19kw/1 kW</i>								
	sub total							18,850		18,850
	1.2 Installation Work	25% of Equipment main unit Price	set	1	4,713	4,713			2,828	1,885
	1.3 Cable and Accessories setting Work	30% of Equipment main unit Price	set	1	5,655	5,655			3,393	2,262
	sub total					10,368			6,221	4,147

Table 7-4 Breakdown of Calle100 Landfill Expansion Area (Architecture and other work)

No.	Items	Specifications	Unit	Q'ty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	60% L / C (CUP)	40% F / C (US\$)
A-1: Office of Weights and Measures										
	Measures control office	3m x 5m	m2	15	146.43	2,196			1,318	878
	sub total					2,196		0	1,318	878
A-2: Administration Facility										
	1. Administration office	use existing facility	m2	400	146.43	58,572			35,143	23,429
	2. parking for visitor	use existing facility	m2	100	639.85	63,985			38,391	25,594
	3. tire washing facility	3m x 10m	unit	1	2,000.00	2,000			1,200	800
	Sub Total					124,557		0	74,734	49,823
A-3 Security Facility										
	1. Entrance Gate		unit	1	200.00	200			120	80
	2. Guard Office		m2	20	146.43	2,929			1,757	1,172
	3. lighting facility		unit	80	500.00	40,000			24,000	16,000
	4. Fence nearside of entrance Gate		m	500	2.58	1,290			774	516
	5. Wire Fence for boundary		m	3000	11.00	33,000			19,800	13,200
	Sub Total					77,419		0	46,451	30,968
A-4: Working facility and Parking Area										
	1. Operation Equipment Parking	use existing facility	m2	0	147.83	0			0	0
	2. Fuel Tank	use existing facility	1000 liter	0	2,073.50	0			0	0
	Sub Total					0.00			0	0
A-5 Supply Work										
	1. Water and Electric Supply installation w	use existing facility	Unit	0	20,000.00	0			0	0
	Sub Total					0			0	0
A-1- A-5 Total										
		Primary Construction Work				204,172			122,503	81,669

Table 8 Unit Cost of Special Period Dumping Site Closure Work

Final Cover Work for Special Period Landfill						Cost		
Item	Specification	Unit	Unit Price	Amount	CUP	US\$		
1.Preparation Work								
Grading work	Bulldozer 22 ton, L<200m	m3	2.17	2,000	4,340			
Sub total					4,340			
2.Gas vent installation work								
Excavation mechanical	Backhoe 1.0m ³ H<3m with loading	m3	0.54	11.3	6			
Portage of temporary Stock Soil	Dump truck 10m ³ under 1km	100m3	140.76	0.11	16			
Backfilling cobble portage	Dump truck 10m ³ The first 1km	100m3	120.36	0.11	14			
Backfilling cobble portage	Dump truck 10m ³ The rest 9km	100m3/km	27.50	1.0125	278			
Installing Vertical pipe perforated	PVC pipe ID=300mm	m	1.43	5.00	7			
PVC pipe perforated with drilling work		m	15.04	6.00	90	90		
Backfilling cobble	Backhoe 0.8m ³ Throw Down	m3	1.29	11.3	15			
Unit cost for Gas Vent Installation					420	90		
Unit cost per ha					setting by 30m distance, 9 unit/ha	9	3,780	812
3. Final covering work of Clay layer								
		t=30cm, L=10km						
Excavation sand stock pit with loading	Backhoe 1.0m ³ H<3m	m ³	0.54	3300	1,782			
Cover soil loading	Shovel Loader L<100m	m ³	0.65	3600	2,340			
Cover Soil portage	Dump truck 10m ³ The first 1km	100m3	120.36	39.6	4,766			
Cover Soil portage	Dump truck 10m ³ The rest 9km	100m ³ /km	27.50	356.4	98,010			
Leveling and compaction	Bulldozer 22 ton L <200m	m ³	2.65	3600	9,540			
Sub Total					116,438	-		
4. Final covering work of Top soil Layer								
		t=30cm, L=10km						
Excavation sand stock pit with loading	Backhoe 1.0m ³ H<3m	m3	0.54	3300	1,782			
Cover soil Lording	Shovel Loader L<100m	m3	0.65	3600	2,340			
Cover Soil portage	Dump truck 10m3, The first 1km	100m3	120.36	39.6	4,766			
Cover Soil portage	Dump truck 10m3, The rest 9km	100m3/km	27.50	356.4	98,010			
Leveling and compaction	Bulldozer 22 ton L <200m	m3	2.65	3600	9,540			
Sub Total					127,958	-		
5.Turfing work								
Turfing		100m2	2.58	100	258			
Sub total					258	-		
6.Strom Drainage System								
Rain Water Drainage	0.5m x 0.5m, With Riprap	m	6.61	200	1,322			
Sub total					1,322	-		
7.Boundary wire Fence work								
		m	14.79	400	5,916			
1). Primary Work Cost	from 1. to 7.				260,012	812		
2). Other Work Cost	(10% of 7.1)	set		1	26,001			
3). Direct Construction Cost	(1)+2)	set		1	286,013	812		
4).Managing Cost at Site	25% of net construction cost	set		1	71,503	203		
5) .Net Construction Cost					357,516	1,015		
6). Overhead fee	15% of 5)	set			53,627	152		
TOTAL					Unit COST per ha	411,143	1,167	
8.Entrance Gate Work								
		W=5m x H=3m						
		unit	500.00	1	500	-		
1). Primary Work Cost	only 8.				500	-		
2). Other Work Cost	(10% of 8.)	set		1	50			
3). Direct Construction Cost	(1)+2)	set		1	550			
4).Managing Cost at Site	25% of net construction cost	set		1	138	-		
5) .Net Construction Cost					688	-		
6). Overhead fee	15% of 5)	set			103	-		
TOTAL					Unit COST per ha	791		

Table 9-1 Break down of Calle 100 Existing Area Closure

Item	Specification	Unit	Qty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	Note
1.Preparation Work	Levering Work Bulldozer 22 ton	ha	64	4,340.00	277,760			
2.Gas vent installation work	Gas Ventilation Pipe Facility Work	ha	64	1,226.34	78,486	677	43,315	
3. Final covering work of Clay layer	t=30cm, L=10km	ha	64	17,833.00	1,141,312			
4. Final covering work of Top soil Layer	t=30cm, L=10km	ha	64	18,428.00	1,179,392			
5.Turfing work		ha	64	258.00	16,512			
6.Strom Drainage System								
	0.5m x 0.5m, Riprap with mortar	m	9,600	6.61	63,456			150 m/ha x 64ha =9600m
	1.0m x 1.0m, Riprap with mortar	m	3,200	20.66	66,112			50 m/ha x 64ha = 3200m
	1.0m x 2.0m, Riprap with mortar	m	640	37.19	23,802			10 m/ha x 64ha = 640m
7.Boundary wire Fence work		m	4,000	14.79	59,163			
8.Entrance Gate Work	Gate, Net fence 20m	unit	1	100,500	100,500			
TOTAL from 1. to 8.					2,823,030		43,315	
9. Primary work Cost	Total from 1 to 8				3,006,495		43,315	
10. Other Work Cost	10% cost of 9.	set		1	300,649	-	-	
11.Net Construction Cost	9. + 10.	set		1	3,307,144	-	-	
12.Managing Cost at Site	25% of 11.	set		1	826,786	-	-	
13.The Cost of Works					4,133,930	-	-	
14.Over head fee	15% of 13.	set			620,089	-	-	
TOTAL CONSTRUCTION COST					4,754,019	-	43,315	

Table 9-2 Unit Cost of Calle 100 Landfill Existing Area Closure Work

Calle 100 Existing Area Closure Work		Unit COST per 1 ha			Cost	
Item	Specification	unit	Unit Price	amount	CUP	US\$
1.Preparation Work						
Grading work	Bulldozer 22 ton , Under 200m	m3	2.17	2,000	4,340.00	
Sub total	(per 1ha)				4,340.00	
2.Gas vent installation work						
	installation of 30m pitch					
Excavation mechanical	Backhoe,0.8m3 H<3m with loadin	m3	0.54	12.5	6.75	
Portage of temporary Stock Soil	Dump truck 10m3 The1 km	100m3/km	140.76	0.125	17.60	
Backfilling cobble portage	Dump truck 10m3, The under 1km	100m3/km	120.36	0.125	15.05	
Place gas vent pipe	PVC perforated pipe Diameter=30	m	1.43	5.0	7.15	
Pvc perfaed pipe	Dia. 300mm	m	15.04	5.0	75.20	75.20
Backfilling cobble	Backhoe 0.8m3 Throw Down	m3	1.29	11.3	14.51	
Unit cost for Gas Vent Installation		unit	1		136.26	75.20
Unit cost per 1 ha		unit	9		1,226	676.80
3. Final Covering Work of Clay layer (t=30cm, L=10km)						
Excavation sand stock pit with load	Backhoe 1.0m3 H<3m	m3	0.54	3000	1,620.00	
Cover soil Loading	Shovel Ruder L<100m	m3	0.65	3600	2,340.00	
Cover Soil portage	Dump truck 10m3, The under 1km	100m3/km	120.36	36.0	4,333.00	
Levering and Compaction	Bulldozer 22ton L<200m	m3	2.65	3600	9,540.00	
Unit cost per 1 ha					17,833.00	-
4. Final covering work of top soil layer, t=30cm)						
Excavation sand stock pit with load	Backhoe 1.0m3 H<3m	m3	0.54	3300	1,782.00	
Cover soil Lording	Shovel Loader L<100m	m3	0.65	3600	2,340.00	
Cover Soil portage	Dump truck 10m3, The under 1km	100m3/km	120.36	39.6	4,766.00	
Levering and Compaction	Bulldozer22 ton L<200m	m3	2.65	3600	9,540.00	
Unit cost per 1 ha					18,428.00	-
5. Turfing work						
Turfing		100m2	2.58	100	258.00	
unit cost per ha					258.00	
6.Strom drainage system work						
Rain water drainage	0.5m x 0.5m, with riprap	m	6.61	-	-	
Rain water drainage	1.0m x 1.0m, with riprap	m	20.66	-	-	
Rain water drainage	2.0m x 1.0m, with riprap	m	37.19	-	-	
7.Boundary fence work						
Wire fence setting work		m	14.79	-	-	
8.Entrance Gate Work						
Gate	Gate and Net fence L=200m	unit	500.00	1	500.00	
Net Fence	W=5m x H=3m	m	500.00	200	100,000.00	
Sub Total	per 1 unit				100,500.00	-

Table 10-1 Cost Existing Guanabacoa Landfill Closure Work

Item	Specification	Unit	Qty	Unit Price (CUP)	Total Price (CUP)	Unit Price (US\$)	Total Price (US\$)	Date Source
1.Preparation Work		ha	20	4,340	86,800			
2.Gas Vent Installation Work	PVC 300mm perforated pipe	ha	20	1,723	34,450	677	13,536	
3. Final Covering Work of Clay Layer	Thickness=30cm	ha	20	38,030	760,605			
4. Final Covering Work of Top Soil Layer	Thickness=30cm	ha	20	38,030	760,605			
5.Turfing Work		ha	10	258	2,580			
6.Storm Drainage System Work								
	0.5m x 0.5m, riprap with mortar	m	3,200	6.61	21,152			150 m/ha x 28ha = 3200m
	1.0m x 1.0m, riprap with mortar	m	1,400	20.66	28,924			50 m/ha x 28ha = 1400m
	2.0m x1.0m, riprap with mortar	m	280	37.19	10,413			10 m/ha x 28ha = 280m
7.Boundary Wire Fence Work		m	2,000	14.79	29,582			
8.Entrance Gate Work		unit	1	100,500	100,500			
1. - 8. TOTAL					1,835,611		13,536	
9.Primary Work Cost	Total from 1 to 8				1,835,611		13,536	
10. Other Work Cost	10% cost of 9.	set		1	183,561		-	
11.Net Construction Cost	9+10	set		1	2,019,172		-	
12.Managing Cost at Site	25% cost of 11.	set		1	504,793		-	
13.The Cost of Works	11. +12.				2,523,965		-	
14.Over head fee	15% cost of 13.	set			378,595		-	
TOTAL CONSTRUCTION COST					2,902,560		13,536	

Table 10-2 Break Down for Existing Guanabacoa Landfill Closure Work

Closure Work		Guanabacoa Landfill			Cost	
Item	Specification	unit	Unit Price	amount	CUP	US\$
1.Preparation Work						
Grounding	Bulldozer 22 ton L<200m	m3	2.17	2,000	4,340	
	unit cost per ha				4,340	
2.Gas removing facility work						
Excavation mechanical	Backhoe,0.8 m3 H<3m with loading	m3	0.54	12.5	6.75	
Portage of temporary Stack Soil	Dump truck 10m3 The 1km	100m3	140.76	0.125	17.60	
Backfilling cobble portage	Dump truck 10m3, The first 1km	100m3	120.36	0.125	15.05	
Backfilling cobble portage	Dump truck 10m3, The rest 19km	100m3/km	27.50	2.250	61.88	
Place gas vent pipe	PVC perforated pipe Diameter=300	m	1.43	5.0	7.15	
Pac perforated pipe	Dia. 300mm	m	15.04	5.0	75.20	75.20
Backfilling cobble	Backhoe 0.8 m3 Throw Down	m3	1.29	11.3	14.51	
	unit cost per 1 unit	unit	1.00		191.39	75.20
	unit cost per ha	at 30m interval	9.00		1,722.51	676.80
3. Final Covering Work of Clay Layer , t=30cm						
Excavation sand stock pit with load	Backhoe 1.0m3 H<3m	m3	0.54	3300	1,782.00	
Cover soil Lording	Shovel Loader L<100m	m3	0.65	3600	2,340.00	
Cover Soil portage	Dump truck 10m3, The first 1km	100m3	120.36	39.6	4,766.26	
Cover Soil portage	Dump truck 10m3, The rest 19km	100m3/km	27.50	712.8	19,602.00	
Leveling and compaction	Bulldozer 15ton L<200m	m3	2.65	3600	9,540.00	
	Sub Total	unit cost per ha			38,030.26	-
4. Final Covering Work of Top soil layer (t=30cm, L=10km)						
Excavation sand stock pit with load	Backhoe 1.0m3 H<3m	m3	0.54	3300	1,782.00	
Cover soil Lording	Shovel Loader L<100m	m3	0.65	3600	2,340.00	
Cover Soil portage	Dump truck 10m3, The first 1km	100m3	120.36	39.6	4,766.26	
Cover Soil portage	Dump truck 10m3, The rest 19km	100m3/km	27.50	712.8	19,602.00	
Leveling and compaction	Bulldozer 15ton L<200m	m3	2.65	3600	9,540.00	
	Sub Total	unit cost per ha			38,030	-
5.Turfing work						
Turfing		100m2	2.58	100	258.00	
	Sub total	unit cost per ha			258.00	-
6.Strom drainage system work						
Rain water drainage	0.5m x 0.5m, with Riprap	m	6.61		-	
Rain water drainage	1.0m x 1.0m, with Riprap	m	20.66		-	
Rain water drainage	3.0m x 1.0m, brick cover with mortar	m	37.19		-	-
7.Boundary Fence work						
Wire fence		m	14.79	0	-	
8.Entrance Gate Work						
Gate	Gate and Net fence L=200m	unit	500.00	1	500.00	
Net Fence	W=5m x H=3m	m	500.00	200	100,000	
	Unit Cost	(per 1 unit)			100,500	-