Chapter 3

Findings through Field Investigations

3 Findings through Field Investigations

3.1 Waste Amount and Composition Survey (WACS)

The Waste Amount and Composition Survey (WACS) provides an overview of the solid waste situation in the target area based on data from sample representative sectors: residential; commercial; market; institution; street; and park. The survey was carried out twice, in summer and in winter. The average was taken from the two results.

3.1.1 Method of the Survey

The team selected 79 sampling points from each representative sector for the survey . The sampling points are summarised in the following table.

Table 3-1: Generation Source and Number of Waste Sample

Generation Source		Area	Samples Per Area	Samples Per Day	Survey Days	Total Samples
Residential (by income)	High	4	5	20	7	140
	Middle	4	5	20	7	140
	Low	4	5	20	7	140
Commercial Area	Restaurants	1	5	5	7	35
	Other Shops	1	5	5	7	35
Markets		2	1	2	7	14
Institutions		1	5	5	7	35
Streets		1	1	1	7	7
Parks		1	1	1	7	7
Total				79		553

a. Method of Waste Amount Survey

The WACS in each season was conducted for eight days, but only the data from seven days were used for the analysis. Data from the first day was excluded assuming it may have some waste accumulated from the previous days. The first day was also used to familiarise all related parties on the sampling methods.

The plastic bags were distributed to sampling points before the survey, except markets that had its waste collected by a truck.

The plastic bags from the sampling points were bound with coloured string according to the generation sources. Then the waste was weighed at the collection point with a spring balance, and the weight recorded in the waste amount recording sheet. The truck carrying the market waste was weighed at the weighbridge of a private company before going to the disposal site for the waste composition analysis.

b. Method of Waste Composition Survey

After transporting all the sample waste the disposal site, the waste samples from each representative sector were gathered and mixed together. The volume of the mixture was reduced by the reducing method until the volume became 20-30 liters. Next the waste was loaded into a plastic bucket, which was tapped three times from a height of 30 cm. The volume was measured visually and the total weight was measured by a platform balance.

The Apparent Specific Gravity (ASG) was calculated using the following formula.

$$ASG = \frac{\text{Weight of Waste (kg)}}{\text{Volume of Waste (lit.)}}$$

Then, the physical composition of waste was sorted into the following 10 items:

- kitchen waste
- paper
- textile
- grass and wood
- plastic
- leather and rubber
- metal
- bottle and glass
- ceramic and stone
- miscellaneous (soil, etc.)

The results of the physical composition are presented as percentages.

3.1.2 Results of the Survey

a. Waste Amount

The study team observed the waste samples contained very little recyclable items. Because observation was confirmed by the sampling points of the WACS, the study team adopted the results of WACS as the discharge ratio. The results of the waste amount for household waste and other types of waste are shown in the following tables.

Table 3-2: Household Waste Discharge Ratio in the Target Area

unit : g/person/day

Discharge Source	Discharge Ratio					
	Adana			Mersin		
	Summer	Winter	Average	Summer	Winter	Average
High Income	509	512	511	461	499	480
Middle Income	444	484	464	473	480	477
Low Income	470	479	475	386	395	391

Table 3-3: Discharge Ratio of Other Types of Waste

Items	Unit	Discharge Ratio					
		Adana			Mersin		
		Summer	Winter	Average	Summer	Winter	Average
Commercial Waste (Restaurants)	g/table/day	1,110	930	1,020	1,451	1,345	1,398
Commercial Waste (Other Shops)	g/shop/day	1,033	1,326	1,180	840	1,283	1,062
Market Waste	g/stall/day	6,300	5,500	5,900	8,700	12,400	10,550
Institutional Waste	g/person/day	129	154	142	72	53	63
Street Sweeping Waste	g/km/day	72,063	69,302	70,683	40,457	27,238	33,848
Park Waste	g/m^2/day	3	4	4	1	1	1

The present composition of waste in the target area is also concluded as shown in the following tables. Kitchen waste constitutes, on average, 75.5 % of the household waste in Adana and 70.7 % in Mersin (weighted average by population in accordance with income level).

Table 3-4: Waste Composition in Adana GM (1998)

unit : %

Generation sources / Category of wastes		**Household**	Commercial		Market	Institution	Street	Park
			Restaurant	Other Shop				
Physical Composition	**Kitchen Waste**	**75.53**	**70.59**	**18.76**	**81.84**	**29.70**	**4.26**	**2.86**
	Paper	9.88	18.96	48.59	5.19	57.29	6.34	2.08
	Textile	1.77	0.50	2.35	0.81	0.63	0.94	0.14
	Grass & Wood	1.62	0.43	4.40	1.48	0.82	14.31	43.15
	Plastic	5.87	1.73	12.96	1.65	5.94	2.91	0.81
	Leather & Rubber	0.29	0.15	0.60	0.29	0.26	0.21	0.03
	Metal	0.53	1.41	6.92	0.04	1.83	2.78	0.67
	Bottle & Glass	3.33	2.23	3.90	0.53	2.08	1.23	0.39
	Ceramic & Stone	1.14	0.56	0.00	4.76	-	19.32	12.12
	Miscellaneous	0.04	3.44	1.52	3.41	1.45	47.70	37.75
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
ASG (kg/m^3)		**0.31**	**0.41**	**0.06**	**0.37**	**0.08**	**0.21**	**0.18**

Table 3-5: Waste Composition in Mersin GM (1998)

unit : %

Category of wastes	Generation sources	**Household**	Commercial		Market	Institution	Street	Park
			Restaurant	Other Shop				
Physical Composition	**Kitchen Waste**	**70.77**	**73.31**	**34.71**	**72.27**	**12.50**	**5.78**	**5.50**
	Paper	13.80	16.67	46.09	11.27	68.26	14.66	8.24
	Textile	3.43	0.47	0.94	1.29	1.70	2.40	2.36
	Grass & Wood	1.04	0.16	1.47	2.19	2.07	22.71	40.91
	Plastic	6.42	4.38	9.17	2.81	6.49	12.41	9.45
	Leather & Rubber	0.17	0.01	0.15	0.79	0.49	1.83	0.30
	Metal	0.72	0.79	1.80	1.01	5.12	7.61	5.50
	Bottle & Glass	2.55	3.63	3.01	2.79	3.08	8.74	8.36
	Ceramic & Stone	0.96	0.49	2.55	4.35	0.29	4.52	5.65
	Miscellaneous	0.14	0.09	0.11	1.23	-	19.34	13.73
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
ASG (kg/m^3)		**0.29**	**0.47**	**0.09**	**0.34**	**0.04**	**0.13**	**0.08**

After the physical composition analysis, wastes from middle income households and markets were subjected to chemical analysis in a laboratory. Moisture occupied more than 70% of kitchen waste in middle income households and markets of both Adana and Mersin.

Table 3-6: Results of Chemical Analysis for Middle Income Household and Market Waste in Adana

unit : %

Classification for Chemical Analysis		Middle Income Household						
		Three Contents				Ultimate Analysis		
		Combustible	Moisture	Ash	Total	Carbon	Nitrogen	C/N Ratio
MIDDLE INCOME HOUSEHOLD								
Combustible Waste	Kitchen waste	14.76	79.79	5.47	100	27.57	1.70	16.29
	Paper	39.03	56.52	4.46	100	36.86	1.06	35.24
	Textile	44.55	51.72	3.74	100			
	Grass and Wood	40.33	53.43	6.25	100	26.90	1.66	16.23
	Plastic	56.84	38.47	4.70	100			
	Rubber and Leather	37.25	18.08	44.67	100			
Non-combustible Waste	Metal		15.00					
	Bottle and Glass		6.23					
	Ceramic and Stone		29.57					
	Miscellaneous		N/A*					
MARKET								
Combustible Waste	Kitchen waste	12.02	77.30	10.69	100	28.86	1.76	16.46
	Paper	38.46	56.13	5.41	100	34.67	0.91	49.06
	Textile	34.00	63.87	2.14	100			
	Grass and Wood	34.62	59.37	6.01	100	27.66	1.48	19.13
	Plastic	61.06	32.34	6.61	100			
	Rubber and Leather	57.08	14.01	28.92	100			
Non-combustible Waste	Metal		N/A*					
	Bottle and Glass		15.18					
	Ceramic and Stone		5.81					
	Miscellaneous		36.36					

N/A* : The type of waste was not found on the day samples sent to laboratory

Table 3-7: Results of Chemical Analysis for Middle Income Household and Market Waste in Mersin

unit : %

Classification for Chemical Analysis		Middle Income Household						
		Three Contents				Ultimate Analysis		
		Combustible	Moisture	Ash	Total	Carbon	Nitrogen	C/N Ratio
MIDDLE INCOME HOUSEHOLD								
Combustible Waste	Kitchen waste	17.34	75.65	7.01	100	34.11	2.07	16.77
	Paper	37.84	58.01	4.15	100	33.38	0.89	38.27
	Textile	46.00	48.78	5.23	100			
	Grass and Wood	26.11	68.82	5.08	100	32.52	1.79	18.17
	Plastic	50.45	43.77	5.79	100			
	Rubber and Leather	37.71	46.34	15.94	100			
Non-combustible Waste	Metal		24.65					
	Bottle and Glass		17.53					
	Ceramic and Stone		31.15					
	Miscellaneous		37.50					
MARKET								
Combustible Waste	Kitchen waste	14.54	70.35	14.93	100	34.09	2.56	14.37
	Paper	33.57	62.89	3.55	100	33.63	0.76	53.07
	Textile	41.57	49.84	8.58	100			
	Grass and Wood	40.08	53.18	6.74	100	35.72	1.68	21.36
	Plastic	57.12	37.34	5.67	100			
	Rubber and Leather	63.44	14.05	22.52	100			
Non-combustible Waste	Metal		22.99					
	Bottle and Glass		7.85					
	Ceramic and Stone		15.35					
	Miscellaneous		62.75					

N/A* : The type of waste was not found on the day samples were sent to the laboratory

3.2 Public Opinion Survey (POS)

The POS was carried out on residential and non-residential sources. A total of 800 households were interviewed for the residential sources: 400 each from Adana and Mersin. Significant inferences from the survey results are as follows.

- According to the cleansing section, every district municipality offers collection services to all residents. Nonetheless, 6.01% (3.26% in Adana, 8.75% in Mersin) of the residents replied they do not receive any services. Although almost all of the study area is covered by some type of collection service, in some areas the service is not efficiently carried out.

- Only less than 10% of the residents in both greater municipalities said they do not receive collection services, but they carry out inadequate self-disposal practices such as illegal dumping in vacant lots or rivers (49.99% in Adana, 31.03% in Mersin), or burning on the premises or vacant lots (16.67% in Adana, 20.69% in Mersin).

- The percentage of residents selling valuable/recyclable wastes to push carts ("Eskici") is 46.24% in Adana and 32.83% in Mersin. Approximately 40% of the residents in both greater municipalities recycle waste by selling them to push carts. Push carts play a major role in waste recycling.

- Around 90% of residents from the two GMs acknowledge the importance of carrying out recycling activities under the supervision and control of public institutions.
- Around 74% said they are willing to co-operate in waste segregation when and if requested, while 8.75% expressed unwillingness to do so.
- In the two GMs, about 94.87% of the residents said they pay refuse collection fees, indicating how extremely co-operative the residents are with the payment of the refuse collection fee.
- In Adana, the average amount paid for waste collection services is approximately **180 thousand TL/month.** In Mersin, it is approximately **800 thousand TL/month.** The residents of Mersin pay four times as much as the residents of Adana.
- It is possible to slightly increase the monthly refuse collection fee in Adana from the present 178,876 TL/month to 197,180 TL/month. In Mersin, the current amount paid averages around 800,000 TL/month, but the residents can only afford an average of about 300,000 TL/month. A lot of the residents in Mersin, therefore, consider the monthly refuse collection fee as expensive.
- Of the surveyed residents, 69.25% in Adana and 55.25% in Mersin said they sweep the area in front of their houses everyday or sometimes. Many of the residents in both greater municipalities voluntarily clean public facilities.

A total of 100 private enterprises were interviewed for the non-residential sources: 50 each from Adana and Mersin. The survey results revealed the following.

- Of the enterprises surveyed in Adana, 86.28% expressed satisfaction with the current collection services, while in Mersin, 40.81% showed satisfaction and 57.14% dissatisfaction.
- Based on the answers of the above, 95 % of all the enterprises in both greater municipalities receive collection services more than three times a week. However, when asked what needs to be improved, many enterprises who voiced dissatisfaction demand more frequent collection services.
- In both greater municipalities, about 90% of the enterprises said they pay refuse collection fees, indicating how extremely cooperative the enterprises are even with the payment of the refuse collection fee.
- In Adana, the average amount paid for waste collection services is approximately **440 thousand TL/month**. In Mersin, it is approximately **830 thousand TL/month.** Based on these figures, the enterprises in Mersin pay twice as much as the enterprises in Adana.
- In contrast with the answers of the above, it is possible to slightly increase the monthly refuse collection fee in Adana from the present 438,298 TL/month to 466,784 TL/month. In Mersin, the current amount paid averages 828,425 TL/month, but the enterprises can afford only an average of 626,560 TL/month. Accordingly, a lot of the enterprises in Mersin consider the monthly refuse collection fee as expensive.

3.3 Opinion Survey on Medical Institutions

A total of 41 main medical institutions in the target area were interviewed. Based on the results the team estimates the present infectious waste generation in Adana GM and in Mersin GM as shown in the table below. Unit generation rates of infectious waste from hospitalizing institution (Medical institution accepts inpatients.) are consistent with the values of other cities in the world.

Table 3-8: Waste Generation from Medical Institutions in Adana GM (1998)

Waste Type	Generation Source	Generation Rate	Quantity	Generation kg/day
Infectious	Hospitalising institution	0.82 kg/bed/day	4,032 beds	3,311
	Non-hospitalising	10.6kg/institution	120 institution	1,272
	sub-total			**4,583**
General	Hospitalising institution	1.67 kg/bed/day	4,032 beds	6,741
	Non-hospitalising	42.2kg/institution	120institution	5,064
	sub-total			**11,805**

Table 3-9: Waste Generation from Medical Institutions in Mersin GM (1998)

Waste type	Generation Source	Generation Rate	Quantity	Generation kg/day
Infectious	Hospitalising	0.59 kg/bed/day	1,292 beds	765
	Non-hospitalising	9.25kg/institution	50 institution	463
	subtotal			**1,228**
General	Hospitalising	2.62 kg/bed/day	1,292 beds	3,388
	Non-hospitalising	25.5kg/institution	50 institution	1,275
	subtotal			**4,663**

3.4 Time and Motion Survey

Collection and haulage expenses make up the bulk of the cleansing service expenses. The time and motion survey was carried out to collect the information necessary to calculate the service expenses in order to plan the improvement of the services and to formulate the M/P. The survey results revealed the following.

For Adana GM

- Generally the public is co-operative and most of the collection points are maintained. There was some littering around the collection points, but the collection workers promptly swept the waste. There is a shovel and a broom on all collection vehicles, so the collectors can sweep up any scattered litter.
- Drum cans are the most commonly used waste storage container, followed by fixed containers. Waste loading takes an average of about 15 seconds for drum cans. Wastes stored in the fixed containers take about 5 minutes to load by two collection workers using shovels and a broom. Shovels and brooms particularly come in handy when truck trailers are used for waste collection because the

height of the bed of the truck makes the unloading of waste in the drum cans quite difficult. The process takes an average of 3.5 minutes to finish.

- All containers in Yuregir and Seyhan are not wheeled, and therefore, it is very difficult to move; collectors must load the waste using shovels and brooms, which is not an easy task to achieve.
- Drums are relatively easy to load if there are two workers assigned to empty the contents into a compactor truck.
- With a proper collection route and appropriate containers and vehicle types, the collection efficiency will improve dramatically.

For Mersin GM

- In all municipalities, collection activity proceeded smoothly, but was unplanned and inefficient.
- Allocation of the containers must be done according to needs and amount of waste produced by the residents.
- In general, waste collection workers use their time efficiently. But collection of market waste takes a long time, because workers collect the waste by sweeping. Generally containers are new, but not maintained in a proper way.
- There was some littering around the collection points, but the collection workers promptly swept the waste. There is a shovel and a broom on all collection vehicles, so the collectors can sweep up any scattered litter.
- With a proper collection route, an appropriate number and capacity of containers and vehicle types, the collection efficiency will improve dramatically.

3.5 Compost Market Survey

3.5.1 Objectives of the Survey

While the Cukurova plain is naturally very fertile many farmers live in the mountain areas surrounding the plain. The soil in these areas is "harder" and requires soil conditioning. Furthermore, many farmers have started experiments with second and third crops at the same field; this expanding application attaches higher importance to the consumption of compost.

The composting plant in Mersin sells two types of compost:

- “Coarse compost”, which is compost that has been stored and to some degree treated in the plant for maybe 2 months; but has not obtained final screening.
- “Fine compost” which is material that has been stored and to some degree treated in the plant for maybe 2 months, and also obtained final screening. The capacity of the final screening plant is very limited. Therefore, the production of fine compost is limited.

This survey has the purpose of investigating the demand for compost amongst farmers living in the vicinity of Mersin Composting Plant.

3.5.2 Method of the Survey

a.1 Questions to Individual Farmers Using Compost

The individual farmers who purchase compost were located when they came to buy compost at the Mersin Composting Plant. A questionnaire, as presented in 2.5.1 Compost Market Survey of Annex 2, was prepared, and farmers were questioned during a period of one month at the weighbridge of the composting plant.

a.2 Questions to Group of Farmers Met in Villages

Farmers in groups were easily found in local pubs (kahave hane) in the villages. Almost all people met in these pubs were farmers, and very co-operative. After having questioned a few farmers one by one it was found that most farmers living in the same village had a common opinion regarding compost from Mersin Composting Plant. Therefore, it was more appropriate to put questions to the whole group of farmers gathered in a pub. Sometimes more than 30 farmers were listening, discussing, and giving their opinion.

3.5.3 Results of the Survey

The study team arrived at the following conclusions based on the results of the interviews:

1. The potential demand for compost seems to be very high. A more detailed market survey, however, should be carried out to determine:
   - The amount of compost that can be sold in the target areas.
   - A suitable compost price.
   - The seasonal variation in the demand of compost
2. The compost presently produced in the plant is of very poor quality. Coarse compost contains a lot of impurities that the farmers tend not to use the product again.
3. Farmers require compost produced from solid waste. However, they do not want their fields to be polluted by plastics, etc.
4. The farmers use compost for orchards, vineyards and vegetables.

3.6 Survey on Recycling System

3.6.1 Objectives of the Survey

The objectives of the Survey on Recycling System are as follows;

- To understand the present recycling system
- To understand the present waste amount recycled

- To understand the trends and potential demands for recycled materials
- To diagnose the present recycling system
- To obtain basic data to forecast the impact on recycling by the master plan and also to formulate the appropriate recycling plan.

3.6.2 Method of the Survey

In order to verify this flow diagram and also to grasp the waste amount of each flow, a questionnaire and/or interview survey were conducted with the following related parties.

- Consumers/generation source
- Scavengers in the cities
- Scavengers at the final disposal sites
- Middlemen
- Producers/final users

The questionnaire survey and interview survey have been carried out to determine the characteristics of the present recycling system and the total amount of waste recycled to the following number of interviewees.

Table 3-10: Number of Samples and Method of Survey

Greater Municipality / Related Party	Adana	Mersin	Method of Survey
1. Consumers/house owners	75	75	Questionnaire
2. Street waste pickers	30	30	Questionnaire
3. Scavengers at dumpsite	5	5	Interview
4. Middlemen	19	15	Questionnaire
5. Producers/final users	7	1	Questionnaire

3.6.3 Results of the Survey

a. Adana

a.1 Consumers/Generation Sources

The primary recycling activity starts at the generation source. While discharging waste, they also practice recycling activities by sorting out valuable/reusable waste for selling or reuse. Therefore, representatives of each of the WACS sampling points were asked by the study team using a questionnaire whether they recycle any waste items. If the reply was unclear, the study team proceeded to interview the sampling point for clarification.

From the questionnaire survey outcomes, the practice of reuse/recycling of items within the premises of the sources, or selling recyclable wastes to middlemen, is not active. However, among household samples for WACS, high income households and low income households engaged in recycling activities amount to about 33% and

30%, respectively. While only 13% of the middle income household samples practiced recycling.

Since the recycling amount differs much by income level, the study team took the recycled amount by income level into account. The amount of recycled materials by each income level is shown in the following table.

Table 3-11: Amount of Recycled Materials by Income Level in Adana

unit: g/day

Household Income	Recycled Items						Total Amount	Average Amount Per Person
	Paper	Cardboard	Metal	Plastic	Bottle & Glass	Others		
High	1,750	230	1,125	70	80	0	3,255	36
Middle	1,130	190	370	60	30	40	1,820	20
Low	990	0	350	100	60	620	2,120	17
Total	3,870	420	1,845	230	170	660	7,195	-

Finally, the total amount of recyclable materials sorted by generation source is calculated as shown below.

(36 x 0.09 x 1,196,620) + (20 x 0.47 x 1,196,620) + (17 x 0.44 x 1,196,620)/1,000,000 = 24 ton/day

a.2 Scavengers in the Cities

The questionnaire survey to street waste pickers was carried out for 15 persons from each district municipality, namely Seyhan and Yuregir by study assistants. The total amount of recyclable material sorted by street waste pickers is estimated to be 15 ton/day based on the questionnaire survey with street waste pickers and middlemen.

a.3 Scavengers at the Final Disposal Site

Approximately 60-70 scavengers work full time at the existing landfill site in Sofulu to sort out recyclable materials. The scavengers at the disposal site are well organised, working systematically and efficiently. From the interview survey of the head of the "big five scavengers", it is estimated that the total amount of recyclable materials sorted at the disposal site is approximately 9 ton/day.

Based on the results of the survey, the total amount of waste recycled in the target areas at present is estimated as shown below.

Table 3-12: Total Recycling Amount and Breakdown by Major Waste Items in Adana

unit : ton/day

Recycling Activity	Metal	Plastic	Bottle & Glass	Paper	Others*	Total
Recycling at Generation Sources:						
Household	5.30	0.90	0.50	15.30	2.90	24.90
Commercial (Restaurant)	0.00	0.00	0.00	0.00	0.00	0.00
Commercial (Other Shop)	0.00	0.00	0.00	0.10	0.00	0.10
Institution	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	5.30	0.90	0.50	15.40	2.90	25.00
Recycling by Street Waste Pickers	2.90	4.80	0.10	6.20	1.00	15.00
Recycling by Scavengers	3.00	2.00	2.60	1.00	0.40	9.00
Total Recycling Amount	11.20	7.70	3.20	22.60	4.30	49.00

Note : * Others includes food waste, garden waste, textile, battery, etc.

b. Mersin

b.1 Consumers/Generation Sources

As in Adana, the recycling activities of the generation sources in Mersin are unsatisfactory. From the results of the questionnaire survey to all WACS sampling points in Mersin, about 50% and 55% of high and middle income households, respectively, engage in recycling activities, while only 5% of low income households do.

From the results of the POS regarding recycling by generation source, 32.83% of the sampled households recycle their waste. However, more than 94% of these households replied that they sometimes sell recyclable materials (less than once a month on average). Because the recycling amount differs by income level, the study team considered the recycled amount by income level. The amount of recycled materials by income level is shown in the following table.

Table 3-13: Amount of Recycled Items by Income Level in Mersin

unit: g/day

Household Income Level	Recycled Items						Total Amount	Average Amount Per Person
	Paper	Cardboard	Metal	Plastic	Bottle & Glass	Others		
High	1,730	300	690	80	50	340	3,190	36
Middle	1,320	320	740	40	110	300	2,830	32
Low	650	0	450	190	0	270	1,560	13
Total	3,700	620	1,880	310	160	910	7,580	

Finally, the total amount of recyclable materials sorted by generation source is estimated as:

(36 x 0.09 x 634,850) + (32 x 0.47 x 634,850) + (13 x 0.44 x 634,850)/1,000,000 = 15 ton/day

b.2 Scavengers in the Cities (Street Waste Pickers)

The questionnaire survey on street waste pickers was carried out for 10 persons from each district municipality, namely Akdeniz, Yenisehir, and Toroslar by study

assistants. The outcome of the questionnaire survey stated that most street waste pickers mainly sort paper, plastic, PET and all types of metal. The total amount of recyclable material sorted by street waste pickers is estimated to be 10 ton/day based on the questionnaire survey with street waste pickers and middlemen.

b.3 Scavengers at the Final Disposal Site

Approximately 10 scavengers work full time at Mersin Composting Plant to collect recyclable materials while another 20 work at the present landfill which is located just at the back of the composting plant. They mainly sort bottles and glass, aluminium cans, tin cans, metals, and plastics. All sorted items collected by scavengers, both at the composting plant and the final disposal site, have been sold to a middleman who only has a concession with Mersin GM to purchase recyclable materials. Therefore, the estimation for recycled amount from composting plant and present landfill by scavenging activities is highly based on the middleman information. The total amount of items recovered by scavengers from the composting plant is approximately 0.35 ton/day, while 1.5 ton/day is collected from the disposal site.

Therefore, the total amount of waste recycled in Mersin is estimated as shown below.

Table 3-14: Total Recycling Amount and Breakdown by Major Waste Items In Mersin

unit : ton/day

Recycling Activity	Metal	Plastic	Bottle & Glass	Paper	Others*	Total
Recycling at Generation Sources:						
Household	3.90	0.60	0.40	8.20	1.80	15.00
Commercial (Restaurant)	0.00	0.00	0.00	0.00	0.10	0.00
Commercial (Other Shop)	0.00	0.00	0.00	0.00	0.00	0.00
Institution	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	3.90	0.60	0.40	8.20	1.90	15.00
Recycling by Street Waste Pickers	1.60	3.70	0.00	4.60	0.10	10.00
Recycling at Compost Plant	0.11	0.04	0.17	0.03	0.00	0.35
Recycling by Scavengers at Landfill	0.27	0.21	0.93	0.09	0.00	1.50
Total Recycling Amount	5.88	4.55	1.50	12.92	2.00	26.85

Note : * Others includes food waste, garden waste, textile, battery, etc.

In conclusion, recycling amount in the target area is tabulated in the following table.

Table 3-15: Recycling in the Target Areas (1998)

unit: ton/day

Study Items / Greater Municipality	Adana	Mersin
A. Recycling by the Private Sector		
1. Consumers/Generation Sources	24	15
2. Street Waste Pickers	15	10
3. Scavengers at the Dumpsite	9	1.5
Subtotal (A)	**48**	**26.5**
B. Recycling by the Public Sector		
4. Materials Recovered at the Compost Plant	0	0.35
5. Compost Production	0	20
Subtotal (B)	**0**	**20.35**
Total (A + B)	**48**	**46.85**
Estimated SW Generation	833	446
Recycling Ratio (%)	**5.8%**	**10.5%**

As can be seen from the above table, the recycling ratio of the private sector is around 6% for both Adana and Mersin. The operation of the compost plant has improved the recycling ratio in Mersin to over 10%.

3.7 Survey on Scavengers

3.7.1 Objectives of the Survey

The survey aimed to achieve the following:

- To understand the present role of scavengers in SWM.
- To understand the system and organisation concerning scavengers.
- To understand the present working condition and environment.
- To forecast social impacts of the master plan.
- To obtain recycling amount through scavenging activities.

3.7.2 Method of the Survey

The survey on scavengers is a part of Survey on Recycling System. The following survey methods were conducted:

- Interview of 30 street waste pickers in each greater municipality.
- Interview of 5 scavengers at the disposal site in each greater municipality.
- Interview of related parties.

3.7.3 Scavengers in the Cities (Street Waste Pickers)

a. Adana

A street waste picker is an individual who collects recyclable materials from private waste bin or communal containers. Most street waste pickers have only a push cart and a huge size sack to store collected wastes as their tools.

The main recycled items collected are paper, plastic, and metal. The most valuable recycling materials among these are copper and aluminium cans that fetch somewhere around 130,000 to 200,000 TL/kg. However, the most recycled material amount which street waste pickers easily collect is paper.

The amount of recycling material collected by street waste pickers varies from 60 to 200kg/person/day. The average collected amount is 100kg/person/day. Based on this figure and the questionnaire survey to middlemen, the study team estimated the number of street waste picker in Adana is somewhere about 150 persons. Therefore, the total recycled waste amount by street waste pickers is estimated at 15 ton/day (100kg x 150 persons).

b. Mersin

Street waste pickers are commonly seen in the city centre of the target area. Typically, street waste pickers use only a push cart and a big sack as their tools.

The main collected material by scavengers in the city are paper, plastic, metal, PET bottles, and aluminum cans, particularly aluminum cans which price is very promulgated to be recovered. As in Adana, the most recycled amount by street waste pickers is paper.

The amount of recycling material through scavenging activities in the city varies from 25-378 kg/person/day. However, the average collected amount of street waste pickers is estimated as 110kg/person/day.

Based on the outcome of the questionnaire survey on street waste pickers and middlemen, the study estimated the number of street waste pickers in Mersin as somewhere about 90 persons. Therefore, the study team assumed total recycled amount by street waste pickers in Mersin is 10 ton/day (110kg x 90 persons).

3.7.4 Scavengers at the Final Disposal Site

a. Adana

According to the municipality and the private contractor who operate the disposal site, they allow scavengers to do scavenging activities in the landfill. Furthermore, based on the data obtained from the manager of the disposal site and preliminary survey to scavengers, the study team acknowledged that all scavengers at the disposal site have established an informal organisation controlled by 5 scavengers called the “big five scavengers”.

Therefore, the study team carried out an interview survey on 5 scavengers at the dump site. Among these, two of them being surveyed are top of the “big five scavengers”. One of the top “big five scavengers” stated that they themselves control all scavenging works at dump site and share the profit among themselves.

Most of the scavengers do not live at the disposal site. Therefore, the “big five scavengers” provide transportation for the employed scavengers. This service maintains the number of scavengers working daily to be constant. Therefore, the number of scavengers is constantly somewhere around 60-70 persons/day and all of them are full time scavengers. The employed scavengers are being paid by recycled

amount basis. Basically, each employed scavenger gets about 2.5 million to 2 million TL/day (about US$ 8 to 10) based on their working effort.

The scavengers collected recyclable materials such as metal, glass, plastic, cardboard, aluminium can, and PET bottles. Materials recovered by scavengers and their prices are presented in the following table.

Table 3-16: Wastes Recycled by Scavengers at Sofulu Landfill and Price

Item	Ton/month (1997)	Price (TL/kg)	Total Income (Million TL/Year)
Metal	80	8,000	7,680
Aluminium Can	10	80,000	9,600
Glass	80	5,500	5,280
Plastic	40	32,500	15,600
PET	20	35,000	8,400
Cardboard	30	12,000	4,320
Bone	10	15,000	1,800
Total	270	-	52,680

From the table it is estimated that the recovered waste amount by scavengers at the disposal site totals 9 ton/day.

b. Mersin

Approximately 10 scavengers work daily full time at Mersin Composting Plant to pick recyclable materials while another 20 scavengers work at the present landfill that is located at the back of the plant. Recycling at both places are basically controlled by a middlemen who has sole right from Mersin Greater Municipality to purchase sorted materials from scavenging activities.

As in Adana, the interview survey was conducted on scavengers during the WACS period. Five scavengers were interviewed, one of whom is the chief of scavengers employed by a middleman to supervise scavenging works at the compost plant and the disposal site.

The scavengers at composting plant are full time scavengers. Recruitment of scavenger is depended on the middleman. No strange scavenger is allowed to scavenge at the composting plant or landfill without permission of him or his scavenger's chief.

Also, recycling works at composting plant are managed by the middleman. Each scavenger is assigned to his or her duty such as collecting, bringing, sorting or packaging recovered materials. A conveyor belt to the hammer mill is used for picking recyclable materials. Recovered wastes sorted out during the picking contributes to the main income for the scavengers and the middleman.

Scavengers are paid by total monthly revenue from selling reused wastes to middlemen divided by number of scavenger’s working day. Their income sharing system seem to be very clear. The average income of scavengers is somewhere around 3-4 million TL/day.

The following table presents recovered materials by scavengers at Mersin Composting Plant and price that scavengers obtained.

Table 3-17: Recycled Materials by Scavengers at Mersin Composting Plant

Material	TL/kg		Ton/Year		
	Middleman's Selling Price	Scavenger's Selling Price	1997	1996	1995
Steel	22,000	11,000	12	13	15
Aluminium Can	180,000	90,000	2	1.5	1
Can, Fe*	11,000	5,000	25	30	35
Plastic	30,000	15,000	10	8	7
PET	50,000	25,000	5	4	3.5
Bottle and Glass	6,500	3,000	60	65	70
Paper	11,000	5,000	10	12	12
Others	-	-	very little	very little	very little
Total	-	-	124	133.5	143.5

Note *: Also includes materials from the magnet.

From Table 3-17, it is calculated that amount of waste picking by scavengers at the composting plant is 0.35 ton/day.

Regarding recycling at the dump site, 20 scavengers work to collect reusable items. Most scavengers start work from early morning at 6:30-7:00 a.m. and finish around 4-7 p.m. All of them are full time scavengers and work about 8 hours/day. The scavengers guide the unloading at the site to obtain the best possibilities to sort the waste.

Because they were homeless people, scavengers and their families live at the disposal site. This contributes to increase in number of part time scavengers. Whenever their families have free time, scavenging works are often practised by members of scavengers' families. Therefore, scavenging work at the disposal site is sometimes engaged by women and children.

Table 3-18: Recycled Materials by Scavengers at Mersin Disposal Site

Material	TL/kg		Ton/Year		
	Middleman's Selling Price	Scavenger's Selling Price	1997	1996	1995
Steel	22,000	11,000	33	13	35
Aluminium Can	180,000	90,000	6	4.5	3
Can, Fe	11,000	5,000	60	60	65
Plastic	30,000	15,000	50	42	38
PET	50,000	25,000	25	19	16.5
Bottle and Glass	6,500	3,000	340	355	380
Paper	11,000	5,000	35	38	38
Others	-	-	very little	very little	very little
Total	-	-	549	531.5	575.5

As can be seen from Table 3-18, the total amount of waste recycled in 1997 was 549 ton. Therefore, the average collected amount by each scavenger is about 75kg/person/day. Finally the study team estimated total recycled amount at disposal site as 1.5 ton/day.

Chapter 4

Present SWM Conditions

4 Present SWM Conditions

4.1 Present SWM Conditions

4.1.1 Present Waste Stream

a. Household Waste

From the results of the waste amount and composition survey (WACS) in both reasons, the weighted average was calculated in accordance with population by income level in the target area as shown below.

Table 4-1: Population by Income Level & Household Waste Discharge Ratio

unit: g/person/day

Item	Population by Income Level	Discharge ratio	
		Adana	Mersin
High Income Household	9%	511	480
Middle Income Household	47%	464	477
Low Income Household	44%	475	391
Weight Average		473	439

Combining the results of the WACS both in the summer and the rainy season, the waste discharge ratio in the target area is concluded as shown in the following tables. The average discharge ratio of household waste is lower than other economically comparable countries: 473 g/person/day in Adana and 439 g/person/day in Mersin (weighted average by population in accordance with the income level). This is because of the absence of yards, as people mainly live in condominiums.

b. Commercial, Market, Institutional, Street Sweeping and Park Waste

The total waste generation amount of categories other than household waste were calculated by multiplying discharge ratio of each category by the number of units of that category. All results of these amounts were then summed to get the total waste discharge amounts as shown in the following table.

Table 4-2: Waste Discharge Amount in Adana GM (1999)

Generation Source	Unit	No. of Unit	Discharge Ratio	Daily Discharge Amount (ton/day)
Household Waste	g/person/day	1,196,620	473	566
Commercial Waste (Restaurant)	g/table/day	77,790	1,020	79
Commercial Waste (Other Shop)	g/shop/day	70,000	1,180	83
Market Waste	g/stall/day	2,407	5,900	14
Institutional Waste	g/person/day	53,813	142	8
Street Sweeping Waste	g/km/day	718	70,683	51
Park Waste	g/sq.m./day	600,000	4	2
Total Daily Waste Generation				**803**

Table 4-3: Waste Discharge Amount in Mersin GM (1998)

Generation Source	Unit	No. of Unit	Discharge Ratio	Daily Discharge Amount (ton/day)
Household Waste	g/person/day	634,850	439	279
Commercial Waste (Restaurant)	g/table/day	39,895	1,398	56
Commercial Waste (Other Shop)	g/shop/day	50,000	1,062	53
Market Waste	g/stall/day	1,248	10,550	13
Institutional Waste	g/person/day	38,048	63	2
Street Sweeping Waste	g/km/day	624	33,848	21
Park Waste	g/sq.m./day	730,000	1	1
Total Daily Waste Generation				**425**

Then, the other part of the waste stream was estimated from the results of the WACS, the POS, and the weighbridge data. The results of the estimation are tabulated in the table below.

Table 4-4: Waste Stream Component in the Target Area

unit: ton/day

Waste Stream Component	Adana GM (1999)	Mersin GM (1998)
Waste Generation Amount	834	446
Recycling by Discharge Source	25	15
Discharge Amount	803	425
Self-Disposed Amount	6	6
Recycling by Street Waste Pickers	15	10
Waste Collection Amount	780	407
Illegally Dumped Waste Amount	8	8
Injected Waste to Compost Plant	-	40
Compost	-	20
Recycling by Scavengers at Compost Plant	-	0.4
Rejected Waste from Compost Plant	-	10
Recycling by Scavengers at Dumpsite	9	2
Other Wastes	25	17
Final Disposal Amount	796	392

The following figure presents the waste stream in the greater municipality of Adana.

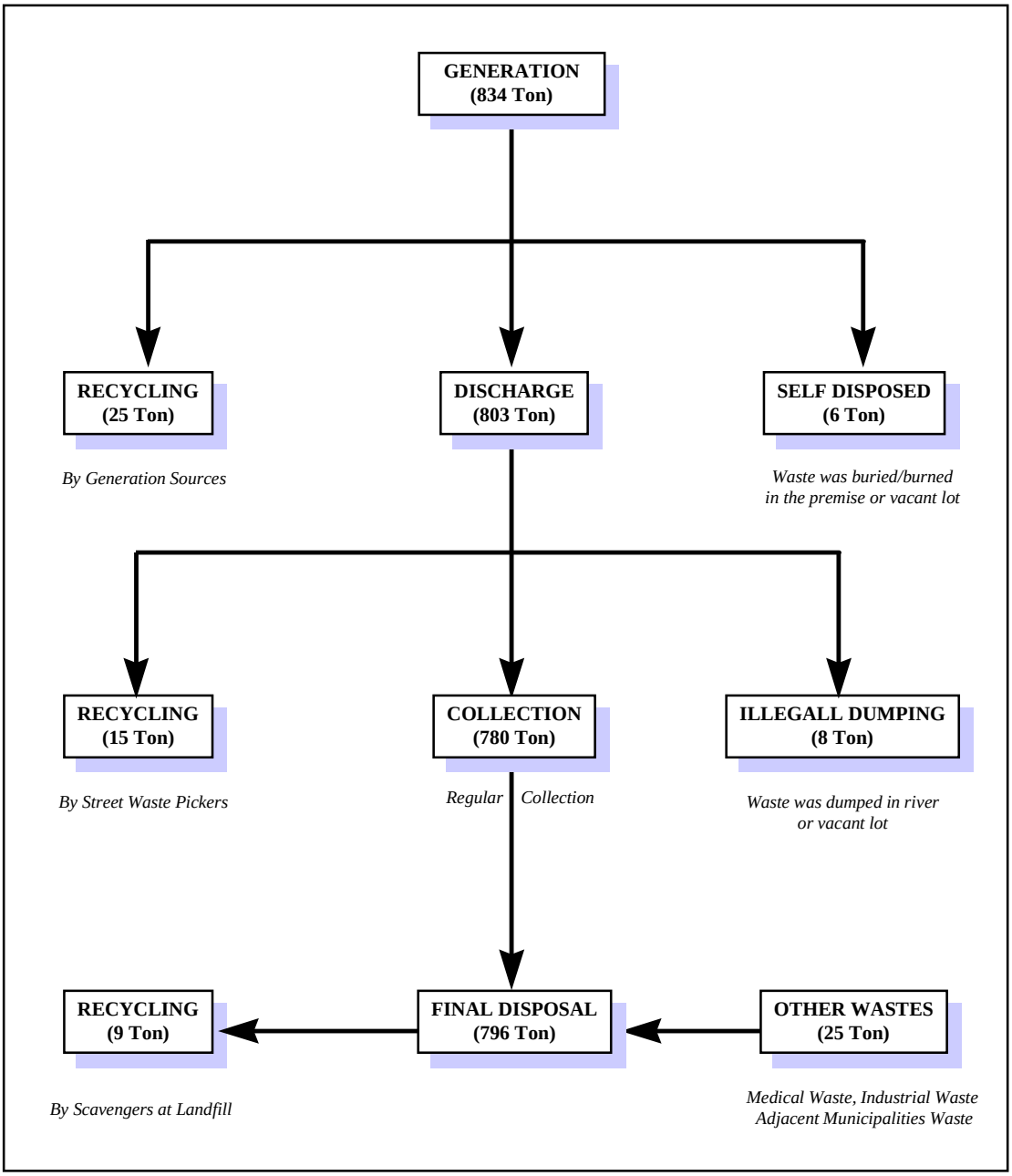

Figure 4-1: Present Waste Stream in Adana GM (1999)

The following figure shows the present waste stream in the Greater Municipality of Mersin.

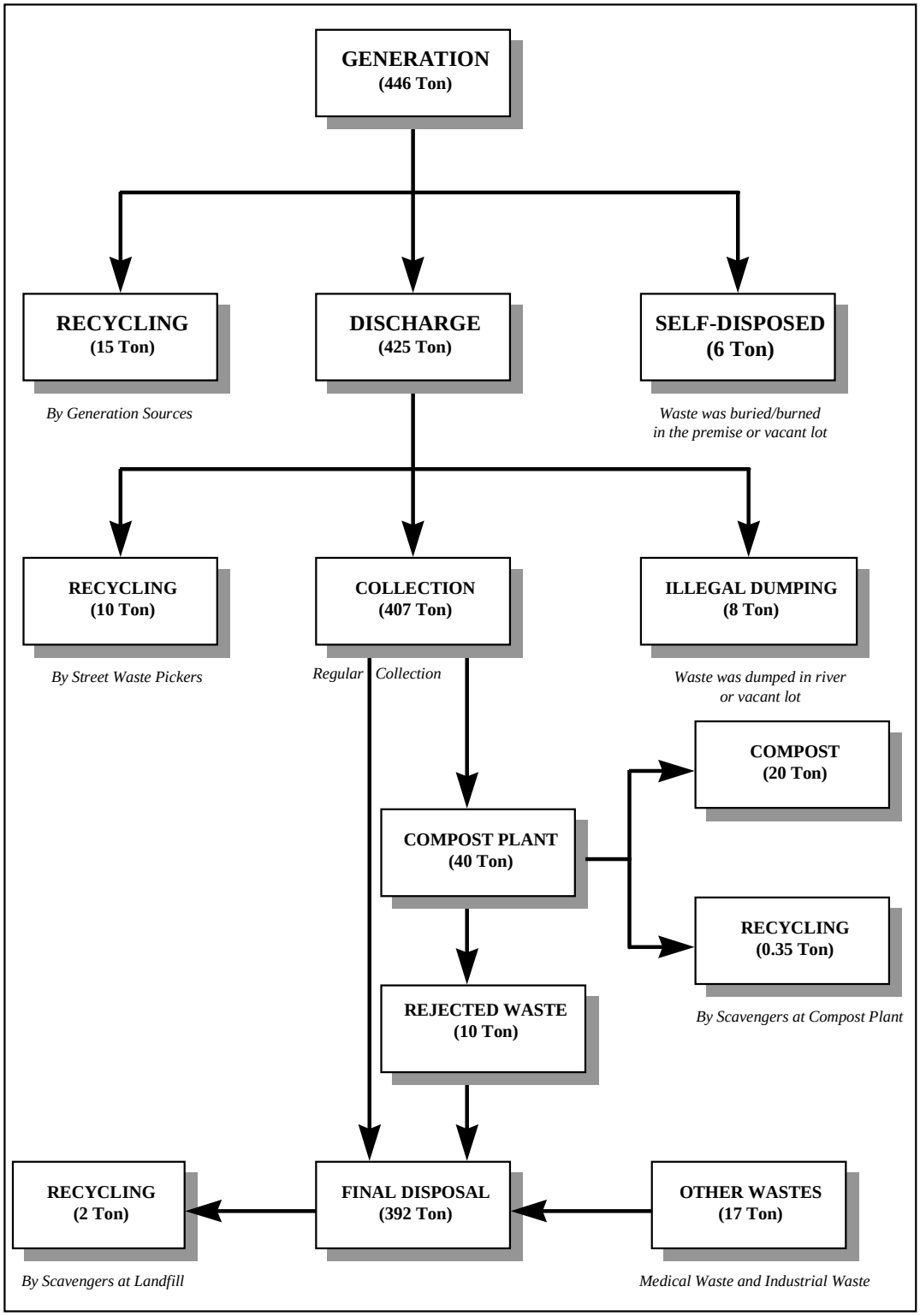

Figure 4-2: Present Waste Stream in Mersin GM (1998)

4.1.2 Present SWM Conditions

The following table summarises the present SWM conditions in the target areas.

Table 4-5: Present SWM Conditions in the Target Areas

Items		Adana Greater Municipality		Mersin Greater Municipality	
Technical System	1. MSW Waste Stream (t/day) (as of 1999 for Adana, 1998 for Mersin)				
		Generation	834	Generation	446
		Discharge	803	Discharge	425
		Collection	780	Collection	407
		Final Disposal	796	Final Disposal	392
		Recycling	49	Recycling	47
		Others	25	**Others**	17
	2. Collection and Haulage				
	Service area (ha)	Seyhan DM	11,550	Yenisehir DM	2,700
		Yuregir DM	3,500	Akdeniz DM	2,995
				Toroslar DM	2,526
		Total	**15,500**	**Total**	**8,221**
	Population (as of 1999 for Adana, 1998 for Mersin)	Seyhan DM	859,170	Yenisehir DM	145,310
		Yuregir DM	337,450	Akdeniz DM	255,516
				Toroslar DM	234,024
		Total	**1,196,620**	**Total**	**634,850**
	Service population (as of 1998)	Seyhan DM	>870,000	Yenisehir DM	>140,000
		Yuregir DM	>330,000	Akdeniz DM	>240,000
				Toroslar DM	>220,000
		Total	**>1,200,000**	**Total**	**>600,000**
	No. of households serviced (as of 1998)	Seyhan DM	251,450	Yenisehir DM	35,000
		Yuregir DM	90,000	Akdeniz DM	48,088
				Toroslar DM	62,179
		Total	**341,450**	**Total**	145,267
	No. of households not serviced (as of 1998)	Seyhan DM	0	Yenisehir DM	0
		Yuregir DM	0	Akdeniz DM	0
				Toroslar DM	0
		Total	**0**	**Total**	**0**
	Collection rate (%)		100 (96.24 % by POS)		100 (91.25 % by POS)
	Collection system	Communal container collection High and middle income, commercial and market areas		Communal container collection High and middle income, commercial and market areas	
		Curbside collection High and middle income areas		Curbside collection High and middle income areas	
		Door to door collection Middle and low income areas		Door to door collection Low income area	
	Collection frequency	Seyhan DM: 6 days per week (except Sundays and national holidays)		Yenisehir DM 7 days per week wit additional collection when necessary	
		Yuregir DM 6 days per week with night collection (except Sundays and national holidays)		Akdeniz DM 7 days per week	
				Toroslar DM 7 days per week	
	Collection vehicle and equipment	**Adana Greater Municipality**		**Mersin Greater Municipality**	
			None	Truck for medical waste	1
				Truck	1
		Seyhan DM (owned by Seyhan DM)		Yenisehir DM (owned by Yenisehir DM)	
		Compaction vehicle ($12m^3$)	24	Compaction vehicle ($16m^3$)	4
		Compaction vehicle ($6m^3$)	20	Compaction vehicle ($14m^3$)	1
		Tractor trailer ($6m^3$)	4	Compaction vehicle ($12m^3$)	8
		Trucks for medical waste	2		

Items		Adana Greater Municipality		Mersin Greater Municipality	
				Akdeniz DM	
		(leased from private sector)		(owned by Akdeniz DM)	
		Compaction vehicle ($8m^3$)	10	Compaction vehicle ($16m^3$)	8
		Compaction vehicle ($6m^3$)	3	Compaction vehicle ($12m^3$)	8
		Yuregir DM		Toroslar DM	
		(owned by Yuregir DM)		(owned by Toroslar DM)	
		Compaction vehicle ($16m^3$)	3	Compaction vehicle ($16m^3$)	4
		Compaction vehicle ($12m^3$)	11	Compaction vehicle ($12m^3$)	8
		Lorry (10 ton)	1		
		(leased from private sector)			
		Tractor trailer ($6m^3$)	50		
		Compaction vehicle ($16m^3$)	3	**Compaction vehicle ($16m^3$)**	16
		Compaction vehicle ($12m^3$)	35	**Compaction vehicle ($14m^3$)**	1
		Compaction vehicle ($8m^3$)	10	**Compaction vehicle ($12m^3$)**	24
		Compaction vehicle ($6m^3$)	23	**Truck for medical waste**	1
		Tractor trailer ($6m^3$)	50	**Truck**	1
		Lorry (10 ton)	1		
		Truck for medical waste	2		
		Total	**124**	**Total**	**43**
	Executing organisation	**General waste** Seyhan and Yuregir DMs		**General waste** Yenisehir, Akdeniz, and Toroslar DMs	
		Medical waste Seyhan and Yuregir DMs		**Medical waste** Mersin Greater Municipality	
	No. of workers for waste collection	Seyhan DM employed by Seyhan DM	470	Yenisehir DM employed by private contractor	42
		Yuregir DM employed by Yuregir DM	202	Akdeniz DM employed by private contractor	52
				Toroslar DM employed by private contractor	13
		Total	**672**	**Total**	**107**
	Unit cost for collection (US$/ton)*	**Adana GM**	**None**	**Mersin GM**	None
		Seyhan DM	22.2	Yenisehir DM	13.1
		Yuregir DM	31.3	Akdeniz DM	13.9
				Toroslar DM	5.0
	3. Cleansing of streets and parks				
	Method of sweeping	Machinery and manual labour		Machinery and manual labour	
	Length of road	**Adana GM**	N/A	**Mersin GM**	N/A
		Seyhan DM	1,200km	Yenisehir DM	300km
		Yuregir DM	83km (avenues only)	Akdeniz DM	N/A
				Toroslar DM	N/A
	Length of road swept in 1998	**Adana GM**	241 km	**Mersin GM**	93 km
		Seyhan DM	398 km	Yenisehir DM	100 km
		Yuregir DM	79 km	Akdeniz DM	172 km
				Toroslar DM	160 km
	Executing organisation	**Adana GM** 2 private companies Seyhan DM A private contractor.		**Mersin GM** For main streets and parks over 3ha, Mersin GM conducts the cleansing. For secondary streets/alleys and parks under 3ha, Mersin contracts the cleansing services out to a private company.	

Items		Adana Greater Municipality		Mersin Greater Municipality	
		Yuregir DM The municipality takes care of the street sweeping activities.		Yenisehir DM A private contractor. Akdeniz DM A private contractor. Toroslar DM Street sweeping services are contracted out to a private contractor. The municipality takes care of the cleansing and maintenance of green areas.	
	No. of workers for street sweeping	**Adana GM** workers of private contractor Seyhan DM workers of private contractor Yuregir DM municipal workers **Total**	 350 250 30 **630**	**Mersin GM** municipal workers workers of private contractor Yenisehir DM workers of private contractor Akdeniz DM workers of private contractor Toroslar DM workers of private contractor **Total**	 37 86 144 172 12 **564**
	Unit cost for street sweeping (US$/ton)*	**Adana GM** for Seyhan DM for Yuregir DM Seyhan DM Yuregir DM	387.1 N/A N/A 77.6 142.6	**Mersin GM** Yenisehir DM (as contracted) Akdeniz DM Toroslar DM	997.4 204.0 266.8 99.3
	Main equipment	**Adana GM** (municipal equipment) Vacuum street sweepers Street washers (equipment of private contractor) Trucks Truck with sweeper Tractor trailer Street washer Seyhan DM Yuregir DM **Total**	 8 2 2 6 13 3 0 0 **31**	**Mersin GM** Sweepers Washer Yenisehir DM Akdeniz DM Sweeper Toroslar DM **Total**	 2 1 0 1 0 **4**
	4. Intermediate Treatment				
		None in particular		Compost facility with a capacity of 128 t/day under 8 hours of operation x 10 x 8 x 2)	
	5. Recycling				
		A survey on the recycling system, including informal recycling activities, was carried out by the study team. The results are detailed in section A.2.5 of the Annex.		A survey on the recycling system, including informal recycling activities, was carried out by the study team. The results are detailed in section A.2.5 of the Annex.	
	6. Final Disposal				
	Disposal method	Open dumping		Open dumping with irregular soil covering. Leachate drainage system from an area with impermeable liner is not well maintained.	
	Area and land use around disposal site area	Agricultural use; soil borrow pit	23.5ha	Forests and meadows; residential area	60ha

Items	Adana Greater Municipality	Mersin Greater Municipality
Haulage distance	**Adana GM** 10km	**Mersin GM** 8.5km
Executing organisation	Private contractor	
No. of workers	7 operators	3 operators
Unit cost for disposal (US$/ton)*	0.80	1.05
Main equipment	Bulldozers 2	Weighbridge 1
	Drilling rig 1	Bulldozer 1
	Tractors with trailers 3	Drilling rig 1
	Wheel loader 1	
7. Equipment Maintenance		
Maintenance facility	One each in Seyhan and Yuregir DMs	One in Mersin GM (shared with other municipal departments) One in Toroslar DM (at compost plant landfill)
Executing organisation	Seyhan and Yuregir DMs	Mersin GM and Private Contractor for Toroslar DM
No. of workers	Seyhan DM 19	**Mersin GM** ?
	Yuregir DM 12	Toroslar DM 5
8. Operational & Organisational System		
Competent authorities & jurisdiction	**Adana GM** Cleansing of trunk roads, squares and parks, and final disposal site Seyhan and Yuregir DMs Collection and haulage of municipal as well as medical waste.	**Mersin GM** Cleansing of trunk roads, squares and parks, composting plant, and final disposal site Yenisehir, Akdeniz, and Toroslar DMs Collection and haulage of municipal as well as medical waste.
No. of staff	**Adana GM** Cleansing Dept. of the Directorate for Urban Development and Environmental Protection - Director 1 - Deputy Director 1 - Secretary 1 - Control official 2 - Driver 1 **Total** **6** Seyhan DM Cleansing Department - Director 1 - Deputy Director 3 -Chief Driver 3 - Control Official 2 - Office Staff 10 **Total** **19** Yuregir DM (Cleansing Department) - Director 1 - Deputy 2 - Office staff 26 - Controller 7 - Logistic service employee 30 **Total** **66**	**Mersin GM** Directorate for Environmental Health - Engineers 5 - Support staff 5 **Total** **15** Yenisehir DM - Director 1 - Subordinate employee 14 **Total** **15** Akdeniz DM - Director 1 - Controlling employee 2 - Driver 2 - Labourer 4 **Total** **9** Toroslar DM - Director 1 - Deputy 1 - Chief 3 - Driver 5 - Employees 7 **Total** **17**

Items		Adana Greater Municipality	Mersin Greater Municipality
	Operational system	Adana GM commissions a private company to sweep trunk roads, squares and parks in Seyhan and Yuregir DMs. The rest if directly operated by the municipality	Yenisehir DM commissions a private company to undertake waste management The rest is directly operated by the municipality.
	9. Financial Matters		
	Total municipal budget	**Adana GM** US$ 97,377,427 Seyhan DM US$ 19,373,945 Yuregir DM US$ 7,472,807 **Total** **US$ 124,224,179**	**Mersin GM** US$ 30,193,794 Yenisehir DM US$ 4,190,198 Akdeniz DM US$ 7,164,844 Toroslar DM US$ 5,485,977 **Total** **US$ 47,034,813**
	Budget for SWM in 1998	**Adana GM** US$ 3,062,000 (budget in 1998) Seyhan DM US$ 6,086,136 (budget in 1998) Yuregir DM US$ 3,327,991 (budget in 1998) **Total** **US$ 12,476,127**	**Mersin GM** US$ 1,333,233 Yenisehir DM US$ 626,318 Akdeniz DM US$ 1,748,063 Toroslar DM US$ 625,056 **Total** **US$ 4,332,670**
	Service beneficiary administration	No list of beneficiaries	No list of beneficiaries
	Fee collection method	Cleansing tax is collected twice a year	Cleansing tax is collected twice a year
	Cleansing tax collection rate	Seyhan DM: 80% Yuregir DM: 85%	Yenisehir DM: 80% Akdeniz DM: >90% Toroslar DM: 70%
	Fee collection list	Fee levels set according to the category and condition of dwellings/buildings	Fee levels set according to the category and condition of dwellings/buildings
	Annual income (revenue)	US$ 1,208,000	US$ 1,275,000
	10. Contract-out system		
	Contracted items	**Adana GM** Cleansing of streets and parks. Operation of landfill Seyhan DM Cleansing of streets and parks. Yuregir DM None.	**Mersin GM** Cleansing of streets and parks Yenisehir DM Refuse collection and cleansing of streets and parks. Akdeniz DM Refuse collection and cleansing of streets and parks. Toroslar DM Refuse collection and street sweeping.

Items	Adana Greater Municipality	Mersin Greater Municipality
11. Legislation		
	Laws, regulations, and standards related to waste disposal operations have gradually been arranged, although they are far from perfect. The operational aspect is an issue of concern. Collection of household waste is regulated under Law 3030. Hazardous/infectious waste is regulated under Law 2872.	Laws, regulations, and standards related to waste disposal operations have gradually been arranged, although they are far from perfect. The operational aspect is an issue of concern. Collection of household waste is regulated under Law 3030. Law 3030 is already in force. Hazardous/infectious waste is regulated under Law 2872.
12. Public Co-operation		
	A separate collection system has not been introduced and the public has very little desire to do so for waste minimisation and recycling. Though littering is observed, illegal dumping is hardly observed due to high public awareness regarding the importance of refuse collection and public area cleansing.	A separate collection system has not been introduced and the public has very little desire to do so for waste minimisation and recycling. Though littering is observed, illegal dumping is hardly observed due to high public awareness regarding the importance of refuse collection and public area cleansing.
13. Medical Waste Management		
	The Medical Waste Control Regulation has been put into force placing the responsibility for infectious/hazardous medical wastes on waste producers. The regulation contains guidelines on the following issues regarding infectious/hazardous medical wastes. • Rules for waste producers • Waste incineration, licensing, and control of incineration plants • Follow up of waste management conditions The infectious/hazardous medical wastes are disposed of at the disposal site in Sofulu together with general waste. No waste is incinerated. Law 2872 obliges the separation of waste into three categories. Present status of separation based on interview survey on 28 institutions as follows: • Two hospitals mix all types of waste at the point of discharge and one mixes infectious and hazardous waste at this stage. • Twenty-five of 28 hospitals maintain the storage system used in the department at the central collection point.	The Medical Waste Control Regulation has been put into force placing the responsibility for infectious/hazardous medical wastes on waste producers. The regulation contains guidelines on the following issues regarding infectious/hazardous medical wastes. • Rules for waste producers • Waste incineration, licensing and control of incineration plants • Follow up of waste management conditions The infectious/hazardous medical wastes are disposed of at the disposal site in Cimsa together with general waste. No waste is incinerated. Law 2872 obliges the separation of waste into three categories. Present status of separation based on interview survey on 13 institutions as follows: • All of the 13 hospitals separate general, infectious and hazardous wastes at the point of discharge. • All hospitals maintain the separate discharge system from generation to the central collection point.

Items	Adana Greater Municipality	Mersin Greater Municipality
14. Industrial Waste Management		
	The operation of hazardous waste treatment facilities and the disposal of such waste are the responsibilities of the greater municipalities in Turkey. Adana GM, however, has few data on industrial SW and hazardous waste. Under regulations related to hazardous waste management, regulation and control systems have been gradually arranged, although they are far from perfect. The operational aspect is an issue of concern. A large amount of industrial SW is disposed of at the present dump site at Sofulu.	The operation of hazardous waste treatment facilities and the disposal of such waste are the responsibilities of the greater municipalities in Turkey. Mersin GM, however, has few data on industrial SW and hazardous waste. Under regulations related to hazardous waste management, regulation and control systems have been gradually arranged, although they are far from perfect. The operational aspect is an issue of concern. A large amount of industrial SW is disposed of at the present compost plant disposal site.

Note: * average of the unit cost in 1997 and 1998.

4.2 Assessment of Present SWM Conditions

The present SWM in the target areas is assessed, the results of which are shown in the table below.

Table 4-6: Assessment of Present SWM Conditions in the Target Area

Item		Adana GM	Mersin GM
Technical System	1. Municipal SW Discharge	• In contrast with other economically comparable countries, the household waste discharge ratio is small at 473 g/person/day (on weighted average of population in income level), as the people mainly live in condominiums. • Kitchen waste constitutes, on average, 64.41 % of the MSW.	• In contrast with other economically comparable countries, the household waste discharge ratio is small at 439 g/person/day (on weighted average of population in income level), as the people mainly live in condominiums. • Kitchen waste constitutes, on average, 63.01 % of the MSW.
	2. Collection and Haulage	• Municipal SWM aims to handle the waste and maintain the living environment; the collection service to achieve this objective is fully established. Almost all urban residents receive collection services. • There is no government related separate collection which is essential for waste minimisation and resource-recovery. However, a voluntary source separate collection system through the "Eskici" and a donation system of recyclable waste are in place, which work well. • There is no transfer system, and waste collected is directly hauled to the disposal site. The Yuregir DM uses tractors trailers intensively for collection and haulage, and therefore the system is not cost effective. • The collection and haulage expenses make up the bulk of the SWM expenses (over 78 % estimated by the team), therefore the improvement of collection and haulage system is extremely important.	• Municipal SWM aims to handle the waste and maintain the living environment; the collection service to achieve this objective is fully established. Almost all urban residents receive collection services. • There is no government related separate collection which is essential for waste minimisation and resource-recovery. However, a voluntary source separate collection system through the "Eskici" and a donation system of recyclable waste are in place, which work well. • There is no transfer system, and waste collected is directly hauled to the disposal site. Problems may arise in the haulage services, as the disposal site's location is far from the city. • The unit cost of collection and haulage, estimated by the team, is low (43 %). This is presumed to be due to the exclusion of the depreciation cost of the municipal collection vehicles lent to the private company and the inclusion of collection and haulage expenses in the public area cleansing expenses.
	3. Cleansing of Streets & Parks	• The present cleansing services contribute to make the city clean. • Although a mechanical cleansing system is being adopted gradually, the cleansing system is mainly labour intensive. It, however, contributes to provide jobs to the unemployed labour force.	• The present cleansing services contribute to make up the city clean. • A labour intensive cleansing system is employed at present. It, however, contributes to provide jobs to the unemployed labour force.

Item		Adana GM	Mersin GM
	4. Intermediate Treatment	• None in particular	• The compost plant which operated since 1985 is now obsolete and has various operational problems. • The compost market survey carried out by the study team concluded a potentially high demand for compost, but the plant lacks the capability to produce compost of high quality. The plant only treated 40 ton/day in 1998 as opposed to the nominal capacity of 128 ton/day.
	5. Recycling	• Although the recycling activities of public institutions are considerably limited, a recycling system formed by the private sector, which consists of a lot of informal individuals, is established and very active. • In particular, the informal collection of recyclable materials by "Eskici", at generation sources, and street waste pickers, at discharge points, is very active. It is assumed that almost 5.9 % of the total waste is recycled. • In the Sofulu dump site, 15 - 40 scavengers are allowed to operate without paying any money to Adana GM nor to the private contractor. However, both Adana GM and the contractor accept the activities of scavengers in the site; disposal operations are usually hampered, such as widely scattered working faces, etc.	• A recycling system formed by the private sector, which consists of a lot of informal individuals, is established and very active. In particular, the informal collection of recyclable materials by "Eskici" at generation sources and street waste pickers at discharge points is very active. It is assumed that almost 6.1 % of the total waste is recycled while the recycling rate of the composting plant, which is considered as public sector recycling, is only 4.6 %. • In the landfill at the composting plant, a private company, who has obtained a concession for picking up recyclables from the compost plant and the landfill, employs scavengers and pay a certain amount to Mersin GM. Because Mersin GM accepts the activities of scavengers in the site, disposal operations are usually hampered, such as delay of covering soil, widely scattered working faces, etc.
	6. Final Disposal	• The present Sofulu disposal site is a typical open dump site that seriously affects the surrounding environment in an adverse way. In particular, the smoke from fires that break out in the site not only affects the surrounding area, but also the entire Adana GM. Fire prevention/extinguishing measures should be urgently adopted. • Since the incoming vehicles are not properly monitored, there are no records as to the type of waste disposed and the section where it is disposed of. • Medical (infectious) wastes are not segregated, and are disposed of along with general wastes. Some of the medical wastes, such as intravenous plastic tubes and syringes, are recycled by scavengers.	• The most serious problem has been caused by the rapid urbanisation that has extended from the city periphery to within a few hundreds of meters of the disposal site. As a result, the Mersin GM frequently receives complaints from the residents. • Further, the disposal site is also nearing its capacity. The construction of a new disposal site and the closure of the present disposal site is therefore a matter of urgency. • Environmental preservation measures adopted in 1992 are not maintained at the compost plant disposal site where waste covering is rarely carried out. Consequently, outbreaks of fire and leachate leakage adversely affect the surrounding environment, e.g., stream contamination.
	7. Equipment Maintenance	• There is an operation and maintenance (O&M) system for equipment used in waste collection and haulage, and for the cleansing of streets and parks. • There is neither an O&M system, nor daily inspection services for the heavy machinery used in the disposal site where working conditions are considerably poor. Consequently, the machinery constantly break down.	• There is an operation and maintenance system for equipment used in waste collection and haulage, and for the cleansing of streets and parks. • The O&M of the heavy machinery at the disposal site, where working conditions are considerably poor, are not efficiently carried out, which is one of the reasons for frequent machinery breakdown.
Institutional System	**8. Operational & Organisational System**	• The organisations responsible for SWM in both Adana GM and two DMs (District Municipalities) are not well established. • In particular, the Adana GM responsible for final disposal and hazardous waste management could not manage them due to the weak organisation.	• The organisations responsible for SWM in both Mersin GM and three DMs (District Municipalities) are not well established. • In particular Mersin GM, responsible for composting plant, final disposal, and hazardous waste management, could not manage them properly due to the weak organisation.

Item		Adana GM	Mersin GM
	9. Financial Matters	• There is a great tendency for municipalities to receive a larger share of their income from the Central Government as the local authorities can not make decisions on local taxes, except for the sign and advertisement fees. • Revenue for SWM is insufficient. • The Cleansing Tax and its collection rate are insufficient, the proportion of the tax compared with SWM costs is extremely low. The legal basis of the Cleansing Tax is weak, with payment of this tax being essentially voluntary, and annual increases being fixed at only half the rate of inflation.	• There is a great tendency for municipalities to receive a greater share of their income from the Central Government as the local authorities can not take decision on local taxes except for the sign and advertisement fees. • Revenue for SWM is insufficient. • The Cleansing Tax and its collection rate are insufficient, the proportion of the tax compared with SWM costs is extremely low. The legal basis of the Cleansing Tax is weak, with payment of this tax being essentially voluntary, and annual increases being fixed at only half the rate of inflation.
	10. Contract-out system	• In contrast with the Mersin GM, there is a strict anti-privatisation sentiment and a conservative approach in the public service management within the cleansing departments of the two district municipalities. • Legislation regarding tendering and the contracting out of private companies is not exactly devised to allow the participation of the private sector in solid waste management services.	• Privatisation is highly appreciated by the cleansing departments, which results in satisfactory services under existing terms and conditions. • Legislation regarding tendering and the contracting out of private companies is not exactly devised to allow the participation of the private sector in solid waste management services.
	11. Legislation	• Although laws, regulations, and standards related to SWM are gradually being established, the problem lies in the way they are enforced. • Although slightly extreme, the conditions in the disposal site will be used as an example. Sofulu is an open dump site where separately collected medical wastes are disposed of together with general wastes.	• Although laws, regulations, and standards related to SWM are gradually being established, the problem lies in the way they are enforced. • Although slightly extreme, the conditions in the disposal site will be used as an example. The compost plant disposal site contaminates the environment as fires break out and leachate flows into drains.
	12. Public Co-operation	• As wastes are discharged and collected using mainly communal containers without any form of segregation, the residents are hardly aware of the SWM problems. • Separate collection is indispensable to waste volume reduction and resource-recovery. However, its introduction is predicted to be considerably difficult.	• As wastes are discharged and collected using mainly communal containers without any form of segregation, the residents are hardly aware of the SWM problems. • Separate collection is indispensable to waste volume reduction, resource-recovery, and in particular, the improvement of the quality of compost produced. However, its introduction is predicted to be considerably difficult.

Item		Adana GM	Mersin GM
	13. Medical Waste Management	• Twenty eight main medical institutions were surveyed to identify medical waste management in Adana GM. The survey results indicate medical waste management system of Adana GM is insufficient, although the system was clearly explained by law and almost all of the institutions were aware of that. • People were sufficiently informed about the system and risks of infectious/hazardous wastes; most of the institutions had taken precautions at the point of generation, but at the central collection point some of these were not taken. • Some of institutions reported the insufficient separation of infectious and hazardous wastes. Many institutions did not report hazardous waste, indicating a lack of awareness on the definitions, the characteristics, and the identity of hazardous waste. • All institutions reported the insufficiency of Adana GM about the disposal of infectious/hazardous wastes after they are separately collected from their institutions. They are disposed of at the landfill together with general wastes; the disposal site is in an awful condition and there are no precautions to protect both human and environment health. • The institutions expressed that they were ready to cover the necessary expenses, and to help protecting the environment and the human in general. However, the municipal authorities claimed, based on past experiences, that despite such expressions, whenever their assistance were required for this purpose, the institutions had not behaved the way they express.	• Thirteen main medical institutions were surveyed to identify medical waste management in Mersin GM The survey results indicate medical waste management system of Mersin GM is not sufficient, although the system was clearly explained by law and almost all of the institutions were aware of that. • People were sufficiently informed about the system and risks of infectious/hazardous wastes, and the institution had taken precautions and many applied these to their collecting systems. • All institution reported sufficient separation of infectious and hazardous wastes. Many institutions did not report hazardous waste, indicating a lack of awareness on the definitions, the characteristics, and the identity of hazardous waste. • All institution reported the insufficiency of Mersin GM about the disposal of infectious/hazardous wastes after they are separately collected from their institutions. • The institutions are ready to cover the necessary expenses, and are willing to help to protect the environment, and the human in general.
	14. Industrial Waste Management	• Although regulatory and monitoring systems are gradually established in accordance with the legislation related to the handling of hazardous industrial waste, the problem lies in the way they will be enforced. Many of the industrial wastes are disposed of at the disposal site along with other urban solid wastes.	• Although regulatory and monitoring systems are gradually established in accordance with the legislation related to the handling of hazardous industrial waste, the problem lies in the way they will be enforced. Many of the industrial wastes are disposed of at the disposal site along with other urban solid wastes.