SECTION 6

MEDICAL WASTE TREATMENT

SECTION 6 MEDICAL WASTE TREATMENT

6.1 MEDICAL WASTE MANAGEMENT

6.1.1 Collection Vehicle

(1) Specification Requirement

According to WHO, the dedicated collection vehicle used to transport medical waste should fulfil the following criteria.

- The body of the vehicle should be of a suitable size commensurate with the design of the vehicle.
- There should be a bulkhead between the driver's cabin and the vehicle body, which is designed to retain the load if the vehicle is involved in a collision.
- There should be a suitable system for securing the load during transport.
- Empty plastic bags, suitable protective clothing, cleansing equipment, tools and disinfectant, together with special kits for dealing with liquid spills should be carried in a separate compartment in the vehicle.
- The internal finish of the vehicle should allow it to be steam-cleaned and the internal angles should be rounded.
- The vehicle should be marked with the name and address of the waste carrier.
- The international hazard sign should be displayed on the vehicle or container as well as an emergency telephone number.

(2) Arrangement for Dedicated Collection Vehicle

The arrangement for the required collection vehicle is shown in Table 7.1.1.

Table 6.1.1 Arrangement of Collection Vehicle of Medical Waste

Medical Establishment		Number of establishment to be collected							Required Number of Vehicle per Day
Type	Number	Sat.	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	
Public Hospital	3	3*1	3	3	3	3	3	0	1
Private Hospital	21	21*1	21	21	21	21	21	0	
NGO Hospital	3	3*1	3	3	3	3	3	0	
Military Hospital	1	1*1	1	1	1	1	1	0	
Health Center	11	11*1	11	11	11	11	11	0	1
Clinics	600	200*2	200	200	200	200	200	0	1
Total	639	239	239	239	239	239	239	0	3

Notes: *1: Daily collection is conducted twice per week for public and private hospitals.
*2: Collection is conducted twice per week for health center and clinics.

(3) Determination of Size of Collection Vehicle

The size of the dedicated collection vehicle is calculated as follows.

The weight of the waste at 2010: 0.82 + 0.08 = 0.9 t/d

3 vehicles are arranged: 0.9 / 3 = 0.3 t/d

The volume converted from the weight per 1 unit: 0.3 / 0.125 = 2.4 m^3/unit/day

The required volume of the collection vehicle by the rate of operation:
2.4 x 7 / 6 = 2.8 m^3/unit/day

The van type vehicle with 2.0 t payload is applied.

The internal volume of the vehicle: L x W x H = 2.7 x 1.6 x 2.0 = 8.6 m^3

The effective loading capacity is calculated as follows by assuming the effective loading ratio as 0.75: 8.6 x 0.75 = 6.5 m^3 > 2.8 m^3

6.2 FINAL DISPOSAL

Table 6.1.2 shows the required volume at the final landfill. The treated medical waste by the existing incinerator is transported to the final landfill.

Table 6.1.2 Arrangement of Collection Vehicle of Medical Waste

Year	Weight (ton/day) (A)	Original Volume (m^3/day) (B)	Reduced Volume (m^3/day) (C)	Cover Soil (m^3/day) (D)	Total (m^3/day) (E)	Total (m^3/year)	Required Volume (m^3)
2002	0.60	4.79	4.79	1.68	6.47	2359.80	
2003	0.63	5.01	5.01	1.75	6.76	2467.80	
2004	0.65	5.24	5.24	1.83	7.07	2581.20	
2005	0.68	5.48	5.48	1.92	7.40	2700.00	
2006	0.71	5.69	2.84	1.00	3.84	1401.30	
2007	0.74	5.90	2.95	1.03	3.98	1452.60	12,962.7*1
2008	0.76	6.12	3.06	1.07	4.13	1506.60	
2009	0.79	6.33	3.17	1.11	4.28	1560.60	
2010	0.82	6.58	3.29	1.15	4.44	1620.00	
2011	0.82	6.58	3.29	1.15	4.44	1620.00	
2012	0.82	6.58	3.29	1.15	4.44	1620.00	
2013	0.82	6.58	3.29	1.15	4.44	1620.00	
2014	0.82	6.58	3.29	1.15	4.44	1620.00	
2015	0.82	6.58	3.29	1.15	4.44	1620.00	
2016	0.85	6.78	3.39	1.19	4.58	1670.72	
2017	0.87	6.99	3.50	1.22	4.72	1723.03	
2018	0.90	7.21	3.61	1.26	4.87	1776.98	
2019	0.93	7.44	3.72	1.30	5.02	1832.62	
2020	0.96	7.67	3.84	1.34	5.18	1890.00	21,680.55*2

Notes: *1: Required volume for the treated medical waste at existing rehabilitated landfill for the operation between 2002 to 2007.
*2: Required volume for the treated medical waste at new landfill from 2008 to 2020.
3: B=A/0.125
4: C=B for 2002 to 2005, C=0.5 x B for 2006 to 2020
5: D=0.35 x C
6: E=C + D

The filled embankment is assumed as the squared base with slope of 1:2, height h and the square length a.

Therefore, the volume, V is estimated as follows.

$V = (a+4h)^3/12 - a^3/12$

(1) At Existing Landfill

Embankment height is assumed as h = 5 m.

V > 12962.7

a +4h = 50 + 4 x 5 = 70 m

Therefore, 1 ha (> 70 x 70 = 4,900 m^2) is required at minimum for the special section for the treated medical waste at the final landfill.

(2) At New Landfill

50 years' operation is estimated for the new landfill.

Embankment height is assumed as h = 5 m.

V > 21680.55

a +4h = 60 + 4 x 5 = 80 m

Therefore, 1 ha (> 80 x 80 = 6,400 m^2) is required at minimum for the special section for the treated medical waste at the final landfill.

6.2.1 Cost Estimation

6.2.2 Capital Cost

(1) Collection Vehicle

Procurement of dedicated collection vehicles will be necessary for separate collection of medical waste.

Table 6.1.4 shows the summary of investment cost.

Table 6.1.4 Summary of Capital Cost

(Unit in 1,000 SP)

Item		Unit	Unit Price	Quantity	Amount
(1)Dedicated Collection vehicle		nos.	2,160	3	6,480
Sub Total					6,480
(2) Intermediate Treatment Facility					
	Autoclave	unit	8,000	1	8,000
	Compaction	unit	2,000	1	2,000
	Boiler	unit	2,000	1	2,000
	Freight	set	400	1	400
	Supervision, test, etc.	set	400	1	400
	Erection	m^2	15	200	3,000
Sub Total					15,800
Total					22,280

(2) Operation and Maintenance Cost

The cost for purchasing containers, collection/transport and operating the special area at final landfill site will be generated for operation and maintenance.

Table 6.1.5 shows the summary of annual operation and maintenance cost.

Table 6.1.5 Summary of Annual Operation and Maintenance Cost

(Unit in 1,000 SP)

Item		Unit	Unit Price	Quantity	Amount
Personnel Cost					
	Manager	person	163.3	1	163.3
	Engineer	person	128.0	1	128.0
	Driver	person	87.5	3	262.5
	Worker/Crew	person	73.2	10	732.0
Sub Total					1,285.8
Collection Vehicle					
	Fuel	liter	0.00625	3,800	23.8
Sub Total					23.8
Dedicated Container					
	Plastic Bag	nos.	0.001	222,856	222.86
	Cardboard Box	nos.	0.002	201,885	403.77
Sub Total					626.63
Intermediate Treatment					
	Fuel	lit.	0.0065	1300	8.45
	Water	ton	0.018	751.2	13.52
	Electricity	Kwh	0.007	20032	140.22
Sub Total					162.19
Total					2,098.42

SECTION 7

COMPOST PLANT AND COST ESTIMATION

SECTION 7 COMPOST PLANT AND COST ESTIMATION

7.1 SYSTEM OF THE COMPOST PLANT

(1) Design Basis

Composting system consists of the following procedures for better quality compost production referring to the pilot study conducted from June 2001 at the old compost plant in Al-Bassa.

(1) Receiving waste

(2) Removal of non-compostable material by hand sorting

(3) Shredding by pulverizing classifier

(4) Fermentation with mixing by turning machine

(5) Maturing with mixing by turning machine

(6) Refining of coarse compost by screen

(2) Planning Specification

Table 7.1.1 shows planning specification of Homs compost plant.

Table 7.1.1 Planning Specification of Homs Compost Plant.

No.	Item		Description
1	Waste Treatment Amount		100 ton/day
2	Actual Operating Time		12 hours (6 hours/shift x 2 shifts)
3	Equipment Capacity		8.3 t/h
4	Composting Method		
	1) Piling in fermentation yard		By wheel loader
	2) Turning in fermentation yard		By tuning machine
	3) Removing to maturing yard		By wheel loader
	4) Turning in maturing yard		By tuning machine
5	Screening		
	1) Treatment stage		Single stage
	2) Opening of sieve		10 mm
6	Composing period		
	1) Fermentation		2 weeks (with turning on every day)
	2) Fermentation		6 weeks (with turning once a week)
7	Building Works		
	1) Composting Building	Reception building	25 x 30 = 750 m^2
		Pretreatment building	12 x 30 = 360 m^2
	2) Cover roof of fermentation yard		None
	3) Cover roof of maturing yard		None
	4) Administration building		8 x 25 = 200 m^2
	5) Accessory building		Garage, Shower room, Guard house

(3) Waste composition

Design basis of waste composition for Homs compost plant have calculated according to the waste quality survey done by JICA study team in July and waste quality analysis in compost pilot study as shown in Table 7.1.2.

(4) Material balance

Detailed material balance calculation sheet is shown in Table 7.1.3

7.2 OPERATIONS AND MAINTENANCE PLAN

(1) Operation Organization

At initial stage the plant will be operated by one shift operation of 32 persons and the next stage will be operated by two-shift operation of 50 persons from 2006(Target year of new final disposal site operation start) as shown in Table 7.2.1.

Table 7.2.1 Number of Operational Personnel

(Person)

Item		Initial stage (2006)	Next stage (2010)	Remarks
Administration		6	6	
Operation	Reception area	4	4*	*See note.
	Hand sorting area	7	14	
	Shredding area	3	6	
	Fermentation area	2	4	
	Maturing area	3	6	
	Screening area	2	4	
	Others	3	4	
Maintenance		2	2	
Total		32	50	

*Note) Truck scale operator is not included in this number because they are counted as transfer station operator.

Detailed number of operational personnel is shown in shown in Table 7.2.2.

Table 7.2.2 Waste Composition in Homs City

		Survey	Source	Organic Food, Veg.	Paper	Plastic	Non-compostable Metal	Glass	Others	Sub-total	Total
Market	Base Data	Summer	DFR	94.3	1.7	2.9	0.0	0.1	1.0	5.7	100
		Pilot Study		72.4	6.0	11.6	1.2	0.9	7.9	27.6	100
	Design Basis	(Average)		83.4	3.9	7.3	0.6	0.5	4.5	16.7	100
Domestic	Base Data	High	DFR	67.7	14.0	10.7	1.0	1.5	5.1	32.3	100
		Middle	DFR	58.6	12.3	12.7	0.9	3.1	12.4	41.4	100
		Average		63.2	13.2	11.7	1.0	2.3	8.8	36.9	100
	Design Basis	Separation									
		Organic	78.0%	56.8 90%	6.6 50%	5.9 50%	0.5 50%	1.2 50%	7.0 80%	21.1	78
			100.0%	73.0	8.4	7.5	0.6	1.5	9.0	27.0	100
		Non-organic	22.0%	6.3 10%	6.6 50%	5.9 50%	0.5 50%	1.2 50%	1.8 20%	15.8	22
			100.0%	28.6	29.7	26.5	2.1	5.2	7.9	71.4	100
Compost Plant Design Basis											
	Market Waste		25t/d	20.8	1.0	1.8	0.2	0.1	1.1	4.2	25
	Domestic Waste		75t/d	54.7	6.3	5.6	0.5	1.1	6.7	20.3	75
	Total		100t/d	75.6	7.3	7.4	0.6	1.2	7.9	24.4	100

Table 7.2.3 Material Balance of Homs Compost Plant

			Total		Waste/Compost			Recycle	Reject	Drain	Gas	Vaper	Addition	Total
				S-total	Dry M	Water	Humidity							
			%	%	%	%	%	%		%	%		%	%
Market Wate	100.0		100.0	100.0	41.3	58.7	58.7							
↓														
Hand Sorting		→ 6.4		6.4	6.1	0.3	5.0	6.4						
↓	93.6		93.6	93.6	35.2	58.4	62.4							
↓		→ 1.0		1.0	0.0	1.0	100			1.0				
↓	92.6		92.6	92.6	35.2	57.4	62.0							
Shredding		→ 10.0		10.0	9.5	0.5	5.0		10.0					
↓	82.6		82.6	82.6	25.7	56.9	68.9							
↓		← -13.0		-13.0	-7.8	-5.2	40.0						-13.0	
↓	95.6		95.6	95.6	33.5	62.1	64.9							
Fermentation		→ 1.3		1.3	1.3	0.0	0.0				5.0			
											1.3			
↓	71.6		71.6	71.6	32.2	39.4	55.0					22.7		
Matuaring		→ 0.4		0.4	0.4	0.0	0.0				1.7			
											0.4			
↓	53.0		53.0	53.0	31.8	21.2	40.0					18.2		
↓		→ 13.0		13.0	7.8	5.2	40.0						13.0	
	40.0		40.0	40.0	24.0	16.0	40.0							
Screen		→ 15.0		15.0	9.0	6.0	40.0		15.0					
↓														
Fine Compost	25.0		25.0	25.0	15.0	10.0	40.0							
	25.0			25.0	15.0	10.0		6.4	25.0	1.0	1.7	40.9	0.0	125.0

Table 7.2.2 Number of Operating Personnel of Homs Compost Plant

Classification			Initial Stage:50t/d (1shift)								Next Stage:100t/d (2shift)							
			Staff	Morning Shift			Night Shift			Total	Staff	Morning Shift			Night Shift			Total
				Op.	Work	S.-total	Op.	Work	S.-total			Op.	Work	S.-total	Op.	Work	S.-total	
1. Plant Operation																		
	Truck Scale	Oprater								(Center)								(Center)
	Reception Hall	Wheel loader (1.2 m^3)		1		2	1		2	4		1		2	1		2	4
		Assistant worker			1			1					1			1		
	Hand sorting	Sorting			6	7				7			6	7		6	7	14
		Recovered material treatment			1								1			1		
	Shredding/Classifying	Operation chief		1		3				3		1		3	1		3	6
		Shredder/Classifier		1								1			1			
		Assistant worker			1								1			1		
	Fermentation	Wheel loader (1.2 m^3)		1		2				2		1		2	1		2	4
		Turning machine		1								1			1			
		Assistant Worker																
	Maturing	Wheel loader (33.1 m^3)		1		3				3		1		3	1		3	6
		Turning machine		1								1			1			
		Assistant Worker			1								1			1		
	Screening	Screen		1		2				2		1		2	1		2	4
		Wheel loader (1.2 m^3)		1								1			1			
		Assistant worker																
	Others	Dump track		1		2			1	3		1		2	1		2	4
		Guard			1			1					1			1		
		Sub-total		10	11	21	1	2	3	24	0	10	11	21	10	11	21	42
2.Maintenance																		
	Mechanical			1		2			0	2		1		2			0	2
	Electrical			1								1						
		Sub-total		2	0	2	0	0	0	2		2	0	2	0	0	0	2
3.Administration																		
	Manager		1							1	1							1
	Chief Engineer		1							1	1							1
	Engineer		1							1	1							1
	Account		1							1	1							1
	Secretary		1							1	1							1
	Others		1							1	1							1
		Sub-total	6							6	6							6
		Total	6	12	11	23	1	2	3	32	6	12	11	23	10	11	21	50

7.3 COST ESTIMATION

7.3.1 Construction cost

Construction cost of Homs compost plant is estimated as follows:

(1)	Equipment	272,000,000 SP
(2)	Civil and foundation	78,000,000 SP
	Sub-total	350,000,000 SP
(3)	Design	19,000,000 SP
	Total	369,000,000 SP

Cost breakdown is shown in Table 7.3.1.

7.3.2 Operation and maintenance cost

(1) Income

Incomes consist of sales of compost and recyclable material as followers:

		Year 2006	Year 2010
(1)	Compost	1,356,000 SP/year	2,713,000 SP/year
(2)	Recyclable material	2,325,000 SP/year	4,650,000 SP/year
	Total	3,681,000 SP/year	7,363,000 SP/year

(2) Expenses

Expenses consist of personnel cost, utility cost and maintenance cost as followers:

		Year 2006	Year 2010
(1)	Personnel cost	2,904,000 SP/year	4,336,000 SP/year
(2)	Utility cost	1,176,000 SP/year	2,353,000 SP/year
(3)	Maintenance cost	780,000 SP/year	1,560,000 SP/year
	Total	4,861,000 SP/year	8,249,000 SP/year

Breakdown of operation and maintenance cost is shown in Table 7.3.2.

Table 7.3.1 Cost Breakdown Table of Homs Compost Plant

1US$= 121 yen, ('01)
1US$= 49 SP, ('01)
1SP= 2.5 yen, ('01)

	Planning Condition		
1	Waste Generation Amount	t/d	100
2	Waste Receiving Amount	t/d	100
3	Operating hour	h	12
4	Equipment Capacity	t/h	8.3

		Unit	Spec.	Unit c.	Q'ty	SP	10^3 yen	Cost
A	Equipment							
1	Receptio Facility (Trck Scale)	t	-	-	-	-	-	-
2	Pre-treatment Facility							
	1) Conveyors	t/h						
	-Waste feeding conveyor	t/h	8.3	44,470	1 yen			44,470
	-Other conveyors							
	-Hand sorting conveyor	t/h	8.3	500	1	500	1,250	1,630
	-Compostable conveyor	t/h	7.5	270	1	270	675	880
	2) Bag breaker	t/h	-	-	-	-	-	-
	4) Shurreder with classifier	t/h	7.5	210,200	1 yen			210,200
	5) Others		7.5	32,100	1 yen			32,100
3	Fermentation Facility							
	1) Turning machine	m3/h	250	29,890	2 yen			59,780
	2) Fermented material conveyer	t/h						
4	Refining Facility (Screen)		3	54,580	1 yen			54,580
5	Miscellaneous Facility							
	1) Air compresor, others	t/h	7.5					
	2) Tanks	t/h	7.5	12,700	1 yen			12,700
	3) Pumps	t/h	7.5	1,180	1 yen			1,180
	4) Pipe, Duct, Support, Chute,etc.	t/h	7.5	14,360	1 yen			14,360
6	Electric Equipment	kw	234	34,390	1 yen			34,390
7	Auxiliary Equipment							
	1) Workshop Equipment			3,020	1 yen			3,020
	2) Emergency disel generator	kVA	312	2,730	1	2,730	6,825	8,870
8	Vehicle							
	1) Wheel loader (big)		2m3	5,000	4	20,000	50,000	65,000
	2) Wheel loader (small)		0.8m3					
	3) Dump Truck		8t	5,000	1	5,000	12,500	16,250
9	Spare Parts							
	1) for Equipment		5%	23,465	1 yen			23,460
	2) for Vehicles		10%	8,125	1 yen			8,130
	A-total							591,000
B	Installation Works							
	1) Mechanical Works	t	198t	15	198	2,973	7,432	9,660
	2) Electrical Works	kw	234kw	4	234	936	2,340	3,040
	3) Temporary Works			21,600	1 yen			21,600
	4) Supervisor			49,600	1 yen			49,600
	5) Removal of Obstracles							
	B-total							83,900
	Equipment Total (A+B)							674,900

1US$= 121 yen, ('01)
1US$= 49 SP, ('01)
1SP= 2.5 yen, ('01)

	Planning Condition		
1	Waste Generation Amount	t/d	100
2	Waste Receiving Amount	t/d	100
3	Operating hour	h	12
4	Equipment Capacity	t/h	8.3

		Unit	Spec.	Unit c.	Q'ty	SP	10^3 yen	Cost
C	Bulding							
	1) Compost Building							
	-Reception Building	m^2	30x25	8	750	5,625	14,063	18,280
	-Pretreatment Building	m^2	30x12x	17	720	11,880	29,700	38,610
	-Control office	m^2						
	2) Fermentation Yard CoverRoof	m^2						
	3) Maturing Yard Roof Cover	m^2						
	4) Administration Building	m^2	8x25	25	200	5,000	12,500	16,250
	5) Workshop/Garage	m^2	10x35	13	350	4,375	10,938	14,220
	6) Guard House	m^2	5x5	9	25	225	563	730
	C-total							88,090
D	Civil Works							
	1) Waste Hopper pit		5x8x3	487	1	487	1,218	1,580
	2) Foundation							
	-Conveyors	t	6	179	1	179	447	580
	-Shredder	t	68	312	1	312	780	1,010
	-Screen	t	16	134	1	134	335	440
	3) Partition Wall							
	-Recycle area	m	41	162	1	162	406	530
	-Shredding Area	m	18	97	1	97	244	320
	4) Pavement							
	-Pre sorting area/Stock yard	m	20x25	2	500	750	1,875	2,440
	-Shredding area	m	35x60	2	2,100	3,150	7,875	10,240
	-Fermentation area	m	75x110	1	8,250	6,600	16,500	21,450
	-Maturing area	m	110x11	1	12,100	9,680	24,200	31,460
	-Internal road	m	10x200	1	2,000	1,000	2,500	3,250
	5) Extelia			36,010	1yen			36,010
	6) Preliminary works							
	7) Comon Temporary Works							
	8) Transportation							
	9) Site Expence							
	10) General management Cost							
	D-total							109,310
	Civil and Building Total (C+D)							197,400
	Ground Total							872,300

Table 7.3.2 Operation and Maintenance Cost of Homs Compost Plant

		Initial Stage/1Shift Operation (2006)					Next Stage/2shift Operation (2010)				
Basic Condition	Treatment Capacity	50 t/d					100 t/d				
	Compost Production	13 t/d	25%				25 t/d	25%			
	Operating Time	12 h/y					12 h/y				
	Operating Days	310 d/y					310 d/y				
		Quantity		Unit Price	Sum		Quantity		Unit Price	Sum	
Income	Compost	13 t/d	3,875 t/y	350 SP/t	1,356 10^3SP/y	37%	25 t/d	7,750 t/y	350 SP/t	2,713 10^3SP/y	37%
	Recyclable Material										
	Paper	0.9 t/d	279 t/y	1,500 SP/t	419 10^3SP/y	11%	1.8 t/d	558 t/y	1,500 SP/t	837 10^3SP/y	11%
	Plastic	1.9	574	3,000	1,721	47%	3.7	1,147	3,000	3,441	47%
	Metal	0.2	47	1,000	47	1%	0.3	93	1,000	93	1%
	Glass	0.3	93	1,500	140	4%	0.6	186	1,500	279	4%
	Sub-total	3.2 6%	992		2,325	63%	6.4 6%	1,984		4,650	63%
	Total				3,681	100%				7,363	100%
Costs	Personnel										
	Manager		1 Person	163 10^3SP/y	163 10^3SP/y	3%		1 Person	163 10^3SP/y	163 10^3SP/y	2%
	Chief engineer		1	147	147	3%		1	147	147	2%
	Accountant class		1	128	128	3%		1	128	128	2%
	Secretary class		1	107	107	2%		1	107	107	1%
	Engineer class		2	128	256	5%		2	128	256	3%
	Operator class		14	87	1,224	25%		22	87	1,924	23%
	Worker class		12	73	878	18%		22	73	1,610	20%
	Sub-total		32		2,904	60%		50		4,336	53%
	Utility										
	Electricity	40 kw	148,800 kwh/y	7.0 SP/kwh	1,042 10^3SP/y	21%	80 kw	297,600 kwh/y	7.0 SP/kwh	2,083 10^3SP/y	25%
	Water	5 t/d	1,550 t/y	18.0 SP/t	28	1%	10 t/d	3,100 t/y	18.0 SP/t	56	1%
	Fuel	53 lit/d	16,430 lit/y	6.5 SP/lit	107	2%	106 lit/d	32,860 lit/y	6.5 SP/lit	214	3%
	Sub-total				1,176	24%				2,353	29%
	Maintenance work				780 10^3SP/y	16%				1,560 10^3SP/y	19%
	Total				4,861	100%				8,249	100%
Balance					-1,179					-886	

Construction Cost		10^3Yen	10^3US$	10^3SP
Equipment		674,900	5,600	272,000
Civil and Building		197,400	1,600	78,000
Sub-total		872,300	7,200	350,000
Design	7%	47,243	400	19,000
Total		919,543	7,600	369,000

Exchange Rate				
1US$=	121	yen	('01)	
1SP=	2.5	yen	('01)	
1US$=	49	SP	('01)	

SECTION 8

FACILITY PLANNING AND COST ESTIMATION

SECTION 8 FACILITY PLANNING AND COST ESTIMATION

8.1 METEOROLOGICAL DATA CONSIDERED IN FACILITY PLANNING

Meteorological data shown in the following tables are considered in the facility planning of this study.

Table 8.1.1 Average Monthly Precipitation in Homs

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly
1990	47.8	37.9	7.2	22.3	4.9	0.0	0.0	0.0	0.0	25.9	24.5	50.7	221.2
1991	60.9	47.6	107.3	26.8	23.3	0.0	0.0	0.0	0.0	13.3	43.6	32.3	355.1
1992	128.7	180.3	57.1	6.0	11.0	35.5	0.0	0.0	0.0	23.7	23.3	127.8	593.4
1993	30.1	64.0	59.0	14.0	82.9	0.6	0.0	0.0	0.4	0.0	66.4	101.7	419.1
1994	74.1	88.2	35.3	15.6	2.4	0.0	0.0	0.0	0.0	2.0	30.0	8.7	256.3
1995	96.0	36.4	58.5	18.0	0.0	0.0	0.0	0.0	0.0	10.9	77.2	25.5	322.5
1996	111.6	83.0	62.1	37.2	11.1	0.0	0.0	0.0	0.0	53.8	15.9	71.5	446.2
1997	137.3	46.3	84.8	28.8	0.7	0.0	0.0	0.0	49.1	17.9	21.3	67.0	453.2
1998	55.4	36.4	34.0	11.8	0.0	0.0	0.0	0.0	0.9	2.2	26.2	57.4	224.3
1999	94.6	42.2	30.7	10.3	0.0	0.0	0.0	0.0	16.4	26.0	14.0	12.4	246.6
Average	83.7	66.2	53.6	19.1	13.6	3.6	0.0	0.0	6.7	17.6	34.2	55.5	353.8

Table 8.1.2 Average Monthly Temperature in Homs

(Unit: Degree Celsius)

Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	Max.	17.2	18.7	25.0	34.4	35.0	36.0	42.0	41.6	38.0	34.5	28.0	18.4
	Min.	−2.0	−3.0	3.0	5.0	10.0	14.0	19.4	20.0	14.8	9.0	5.5	0.5
	Average	7.6	7.9	14.0	19.7	22.5	25.0	30.7	30.8	26.4	21.8	16.8	9.5
1999	Max.	17.3	19.3	23.0	33.0	38.6	34.0	37.0	33.4	36.6	n.a.	n.a.	n.a.
	Min.	−0.3	−0.7	1.5	6.0	9.8	16.0	19.4	21.3	13.2	n.a.	n.a.	n.a.
	Average	8.5	9.3	12.3	19.5	24.2	25.0	28.2	27.4	24.9	n.a.	n.a.	n.a.

8.2 AN EXAMPLE FOR OPERATION AND MAINTENANCE MANUAL OF SANITARY LANDFILL

Refer “8. Facility Planning and Cost estimation” of Part I and II in Supporting Report.

8.3 COST ESTIMATION

Major work items and costs of the master plan and the priority project are shown in the following tables.

(1) Improvement of Disposal Site and Landfill Operation in Homs

Table 8.3.1 Rehabilitation Cost of Zone A at Dir Baalbeh Disposal Site

(Unit: SYP/year)

Item	Unit	Quantity	Unit Price	Amount
Rental Fee of Heavy Equipment (2 units of Bulldozers)	day	730	9,800	7,154,000
Rental Fee of Heavy Equipment (Excavator)	day	365	7,840	2,861,600
Rental Fee of Heavy Equipment (Dump Truck)	day	365	5,880	2,146,200
Material for Operation Road (Gravel: t= 0.2m)	m^3	1,500	250	375,000
Material for Cover Soil (20%)	m	67,000	200	13,400,000
Gas Exhaust Facility (h=6.0m)	m	19	6,000	114,000
Sub-total				26,050,800
Contingency (10%)				2,605,000
Total				28,656,000

Note: The summed up cost includes cost of landfill operation.

Table 8.3.2 Construction of Dir Baalbeh Transfer Station

(Unit: SYP)

Item	Unit	Quantity	Unit Price	Amount
Re-loading Station				
Retaining Wall (h=4.5m)	m	78	22,000	1,716,000
Banking for Re-loading Station	m^3	15,000	265	3,975,000
Slope Adjusting	m^2	2,100	10	21,000
Concrete Pavement	m^2	2,600	1,100	2,860,000
Wall for Waste Storage (h=2m)	m	90	5,000	450,000
Control Building	m^2	14	75,000	1,050,000
Curbstone	m	1,350	265	357,750
On-site Road (Asphalt Pavement)	m^2	6,450	380	2,451,000
Fuel Station	unit	1	4,000,000	4,000,000
Sub-total				16,880,750
Contingency (10%)				1,688,000
Total				18,569,000

Table 8.3.3 Site Preparation of Cleansing Center at Dir Baalbeh

(Unit: SYP)

Item	Unit	Quantity	Unit Price	Amount
Excavation	m^3	30,000	55	1,650,000
Banking	m^3	30,000	65	1,950,000
Slope Adjusting	m^2	800	10	8,000
Netted Fence (h=2m)	m	920	1,500	1,380,000
Planting	m^2	13,000	5	65,000
Gate (w=16m)	unit	1	110,000	110,000
Gate (w=6m)	unit	1	40,000	40,000
Drain (Gutter: 350/350)	m	1,200	1,250	1,500,000
On-site Road (Asphalt Pavement)	m^2	7,200	380	2,736,000
Curbstone	m	1,600	265	424,000
Electric Wire within the Site	m	400	400	160,000
Telephone Line within the Site	m	400	50	20,000
Water Suplly Pipe within the Site (D=50mm)	m	400	120	48,000
Well Digging (D=350mm, 150m)	unit	1	120,000	120,000
Pump Installation	unit	1	250,000	250,000
Main Control Building	m^2	410	7,500	3,075,000
Guardhouse	m^2	14	7,500	105,000
Rest House for Workers	m^2	270	7,500	2,025,000
Truck-scale Building	m^2	18	7,500	135,000
Truck-scale Installation	unit	2	2,728,000	5,456,000
Electric Wire (External Works)	m	1,000	1,000	1,000,000
Telephone Line (External Works)	m	1,000	100	100,000
Sub-total				22,357,000
Contingency (10%)				2,236,000
Total				24,593,000

Table 8.3.4 Construction of Dir Baalbeh Transfer Station

(Unit: SYP)

Item	Unit	Quantity	Unit Price	Amount
Re-loading Station				
Retaining Wall (h=4.5m)	m	78	22,000	1,716,000
Banking for Re-loading Station	m^3	15,000	265	3,975,000
Slope Adjusting	m^2	2,100	10	21,000
Concrete Pavement	m^2	2,600	1,100	2,860,000
Wall for Waste Storage (h=2m)	m	90	5,000	450,000
Control Building	m^2	14	75,000	1,050,000
Curbstone	m	1,350	265	357,750
On-site Road (Asphalt Pavement)	m^2	6,450	380	2,451,000
Fuel Station	unit	1	4,000,000	4,000,000
Sub-total				16,880,750
Contingency (10%)				1,688,000
Total				18,569,000

SECTION 9

INSTITUTION AND ORGANIZATION

CHAPTER 9 INSTITUTION AND ORGANIZATION

9.1 FORMULATION OF THE MASTER PLAN (THE M/P)

The Solid Waste Management (the SWM) M/P for Homs City has been formulated by COWI (Danish consultant) in 2001 with the funds of the Mediterranean Environment Technical Assistance Program (<METAP>financed by the CEC, the EIB, the UNDP and the IBRD) as one of the METAP programs, i.e., the Study on Appropriate Solid Waste Management Practice (SASWMP) in February, 1996 for the SWM on a local level at a stretch of land.

9.2 REVIEW OF THE M/P RELATED TO THE MAJOR PILOT PLANT COMPONENTS

9.2.1 The M/P for Homs City

The M/P recommends a stepwise introduction of the compost plant. It is recommended as a pilot plant that a simple compost plant with capacity 25 ton/day shall be introduced for market waste and green waste at the first stage and a 15 ton/day- plant is recommended for organic waste from households at the next stage.

It is also recommended in the M/P that a comprehensive compost plant with capacity of 100 ton/day in 2 shifts shall be constructed subject to confirmation of "feasible" in a Feasibility Study (the F/S) as well as "demandable" of the compost products produced by the aforementioned compost plants.

9.2.2 Waste Source-Separation

The M/P recommends introduction of a waste separation at a source of waste generation which shall be essential for the compost plant, recycling, and so on to reduce a waste amount.

9.3 COMPOST PLANT IN THE STUDY

9.3.1 The Study

The Study recommends the three following alternatives.

(1) The 1st Alternative : a simple plant for market waste (25 ton/day)

(2) The 2nd Alternative : a pilot plant for market waste and separated-organic waste from households (40 ton/day)

(3) The 3rd Alternative : a big-sized pilot plant (50 – 100 ton/day)

For extending to the comprehensive compost plant, it is necessary to sep up the Pilot Plant for organic-domestic waste from households. It is reported tat the demand survey of compost products has resulted in about 44 ton/day which would vary depending on quality and price, though. Should the potential demand of compost products be 44 ton/day, the size of the compost plant facility would be about 129 ton/day on the base of segregated waste materials.

9.3.2 Scale of the Compost Plant to be Planned

(1) 50 ton/day-compost plant first (requiring 32 persons)
For the time being, a one shift-50 ton/day-compost plant shall be constructed under the aforementioned circumstances.

(2) 100 ton/day-(in 2 shifts)-compost plant to be planned (requiring 50 persons)
Until or in 2006, a two shifts-100 ton/day-compost plant shall be planned to construct at the time of demandable quantity of compost products to be confirmed enough for establishment of the 100 ton/day-compost plant..

9.4 ESTABLISHMENT OF A CLEANSING CENTER AT DIR BAALBEH FOR HOMS CITY (TOTAL : 93 PERSONS INCLUDING 26 DRIVERS)

The Cleansing Center shall be set up in 2003 at Dir Baalbeh which is located about 7km to the north and inside Homs City but very close to the City boundary, because it is expected the compost plant there in 2003 subject to achievement of the waste-source separation conducted by citizens of Homs City.

The Cleansing Center shall operate in parallel and close cooperation with the existing Cleansing Department (1,056 persons as of July, 2001 referred to Figure 9.4.1 & 9.4.2 while the METAP M/P describes 1,100 persons).

The Cleansing Center is composed of :

- Manager : 1 person,
- Financial/Administration Section : 2 persons
- Public Awareness Section : 2 persons
- Rehabilitation Disposal Site (Dir Baalbeh) Section : 17 persons,
- Compost Plant Section : 50 persons,
- Transfer Station Section : 6 persons, and
- Medical Waste Management Section : 15 persons
(Total : 93 persons)
Ownership : Homs City Council

9.4.1 Recruit of the Necessary Persons : 93 (including 26 drivers)

(1) Transfer of persons from the Cleansing Department (1,056persons in 2001)

- The Cleansing Department shall hold the right to shift well qualified persons first suitable for the respective new posts of the Cleansing Center by severe selection at the command and under the control of the Homs City Council (Mayor).
- The Cleansing Department will be streamlined in number of persons if endeavoring rationalize aptitude persons from an effective-and-efficient point of view. In this case, on-the-job training should severely be made for upgrading qualifications of the remaining persons.

(2) Looking for other manpower sources

- Qualified and aptitude persons for the new posts of the Cleansing Center shall be looked for at other manpower sources in the organization of Homs City if the said persons will not be fulfilled with persons from the Cleansing Department.
- In case that the above a) could not reach the needs for number of persons, then it would be inevitable to recruit other manpower sources outside the City organizational structure, particularly for the Compost Plant requiring persons in Agricultural Sector and the Medical Waste Treatment requiring a person in Medical and/or Sanitary Sector(s).

9.4.2 Financial/Administration Section : 2 persons

The Section shall be in charge of financial, administration and personnel matters of the Cleansing Center, specially budgetary matters in light of expenditures at each Section.

9.4.3 Public Awareness Section : 2 persons

The Section shall manage in enlightening citizens' public awareness on wastes through public campaigns in coordination with the Pubic Awareness Section of the Lattakia Cleansing Department.

9.4.4 Dir Baalbeh Disposal Site Section : 17 persons (including 8 drivers)

(1) Rehabilitation of the Existing Disposal Site

Rehabilitation of the existing disposal site, i.e., Dir Baalbeh, for parks and/or green areas shall be initiated in 2003 onward for two years, i.e., 2003 and 2004.

(2) Amelioration of the Landfill Operation

Amelioration of the landfill operation at Dir Baalbeh shall commence in 2003 with the following members.

(1) Rehabilitation supervisor : 1 person
(2) Engineer : 1 person
(3) Operation (12 persons)
  - Chief : 1 person
  - Driver : 8 persons
  - Worker : 3 persons
(4) Guard : 2 persons

The Section utilize for those purposes the under-mentioned heavy equipment to be procured through authorized channel starting with the Central Government.

9.4.5 Compost Plant : 50 persons

(1) Compost Plant

The Compost Plant shall be initiated with a 50 ton/day-plant in one shift at Dir Baalbeh at the former half part of 2002 for planning and at the later half part of 2002, in 2003 and 2004 for procurement and construction subject to attainment of the waste-source segregation.

The 50 ton/day-Compost Plant shall requires 73 engineers and workers as shown in Figure 9.4.3.

The capacity of the Compost Plant shall be increased from the 50 ton/day in one shift to a 100 ton/day in two shifts pursuant to a growing tendency for demand of compost products in 2006.

(2) Number of Persons

Number of the persons for the 100 ton/day Compost Plant : 50 persons

Detailed organization chart is referred to Figure 9.4.4.

(1)	Plant Manager (Agricultural Engineer) :	1 person
(2)	Financial/Administration Section :	1 person
(3)	Sales Promotion Section : (Agricultural Technician)	1 person
(4)	Quality Control Section : (Agricultural Technician)	1 person
(5)	Maintenance and Storage Section : (including 2 Engineers)	3 persons
(6)	Facility Operation and Manufacturing Section : (2 Shifts)	41 persons
(7)	Security and Guard Section : (Morning and Night)	2 persons

It is very important for the compost plant of the Cleansing Center how to regularly produce excellent quality of compost.

Quality of the compost products will clear as much as possible the (Standard No.2014) regulation of compost quality issued by Decree No.244 (August 31, 1998) of the Ministry of Industry and shall satisfy users (farmers) through cooperative channels, i.e.,

The Farmers' Union or directly, possibly by dint of the Directorate of Agriculture as well as the Farmers' Union and the Agricultural Engineers Association.

Agricultural technician shall entail promotion of compost products for the sales to propagate natural effectiveness of compost for cropland to the farmers without spoiling soil in a long term.

9.4.6 Transfer Station (the T/S) : 6 persons

The T/S to be installed at Dir Baalbeh will ensure to trans-ship and transport to trans-ship and transport the wastes for the amount of about 830 ton/day expected in 2006 to a new final disposal site, i.e., Maghlia which is located to the east about 26km from the center of the City, possibly, to initiate operation in 2006.

- Supervisor : 1 person
- Driver : 3 persons
- Worker : 2 persons

One heavy equipment will be provided the Cleansing Center with at least. Homs City is responsible for transport of wastes from the T/S to the Maghlia site (in any form, i.e., either direct transport management by the City or Contract-Out management to Private Sectors like the case of Damascus).

9.4.7 Medical Waste Management (the MWM) Section : 15 persons

An issue still remains which more appropriate it is to include the MWM in the Center under the control of the City Council or to place the MWM in a certain division or a department of Homs Governorate.

The MWM shall tentatively be organized in the structure of the Cleansing Center as shown in Figure 9.4.4.

(1) Number of MWT

Number of the MWT is expected to be as follows.

- Chief of the MW M (Medical and/or Sanitary Engineer) : 1 person
- Source-Separation Sub-Section : Worker : 3 persons
- Collection Sub-Section : Driver : 3 persons
  Crew : 3 persons
- Intermediate Treatment Sub-Section : Engineer : 1 person
  Worker : 2 persons
- Final Disposal Sub-Section : Worker : 2 persons

(2) Commencement years of procurement and operation

- Source-segregation : The separation shall be implemented by 2005.
- Dedicated collection vehicle : 2003 (procurement) and 2004 & 2005 (operation)
- Intermediate treatment facility : The former half year of 2004 (procurement)
  The later half year of 2004 (installation)
  2005 (operation)
- Final disposal site : Rehabilitation of the special area at Dir Baalbeh:
  by 2005
  At Maghlia : by 2010

(3) Temporary treatment

By commencement of operation, it is recommendable that a practical method should be applied as a temporary treatment way to medical wastes such as burial in a proper-sized receptacle made of thick concrete in which slacked lime, Ca(OH)2, at least is evenly scattered over the wastes before covering soil is provided them with.

9.4.8 New Final Disposal Site, Maghlia

Maghlia site located to the east about 26 km from the City center shall be ready for use in 2006 at the expense of Homs City.

Maghlia site shall require covering-soil by necessary heavy equipment which shall be prepared by the Homs City Council even on a rental basis to alleviate environmental contamination.

9.5 LEGAL ARRANGEMENT

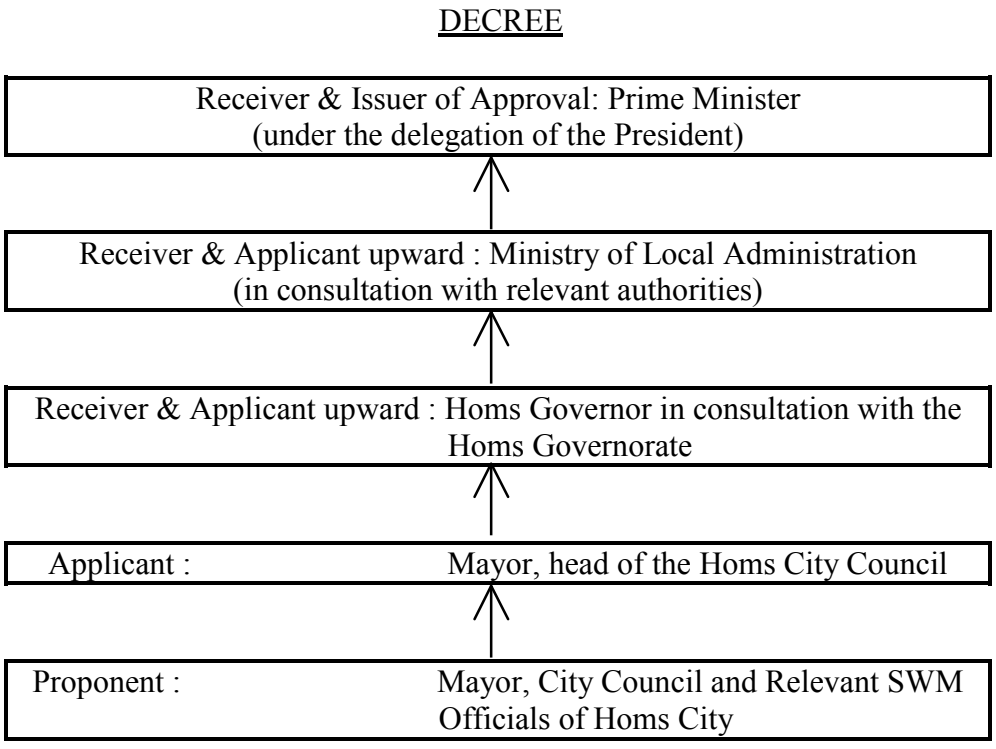
Legal procedures shall be arranged in the same or similar way as or to these for establishment of new institutions including operation and for procurement of equipment and facility.

9.5.1 Legal arrangement

(1) Decree for Establishment of the Cleansing Center and for Procurement of Necessary Equipment and Facility

The Central Government, particularly, the Ministry of Local Administration, is entitled to bestow on Homs City approval of the decree to be applied by Homs City Council (Mayor) through Homs Governorate (Homs Governor) for the establishment of the Cleansing Center in cooperation with the other Ministries concerned. The decree shall be promulgated in 2002 (during the period for basic designs).

(2) Flow chart of an application document



9.5.2 Observance of the Laws, Decrees, Resolutions, Orders, Regulations etc., now in force

- The Cleansing Center shall abide by all the laws, decrees, resolutions, orders, regulations and so on issued by the relevant authorities at any levels so far as related to, commencing with the Local Administration Law of October 10, 1974, the Environment Protection Law (even not promulgated yet), and so forth.
- Decree No. 244 of August 31, 1998 as to the Standard No.2014 for Municipal Solid Waste Composting (ICS 13.030.10 of 1998)
  The Decree was promulgated by the Ministry of Industry, inter alia, the Organic Materials Department of the Chemical Standards Directorate (10 personnel) in the Syrian Arab Organization for Standardization and Metrology (the SASMO) in the Ministry of Industry.

The Compost Plant should abide as much as possible by the regulations (alterations and additions to) of the Standard as far as quality of compost concerned to be produced at Dir Baalbeh in Homs City.

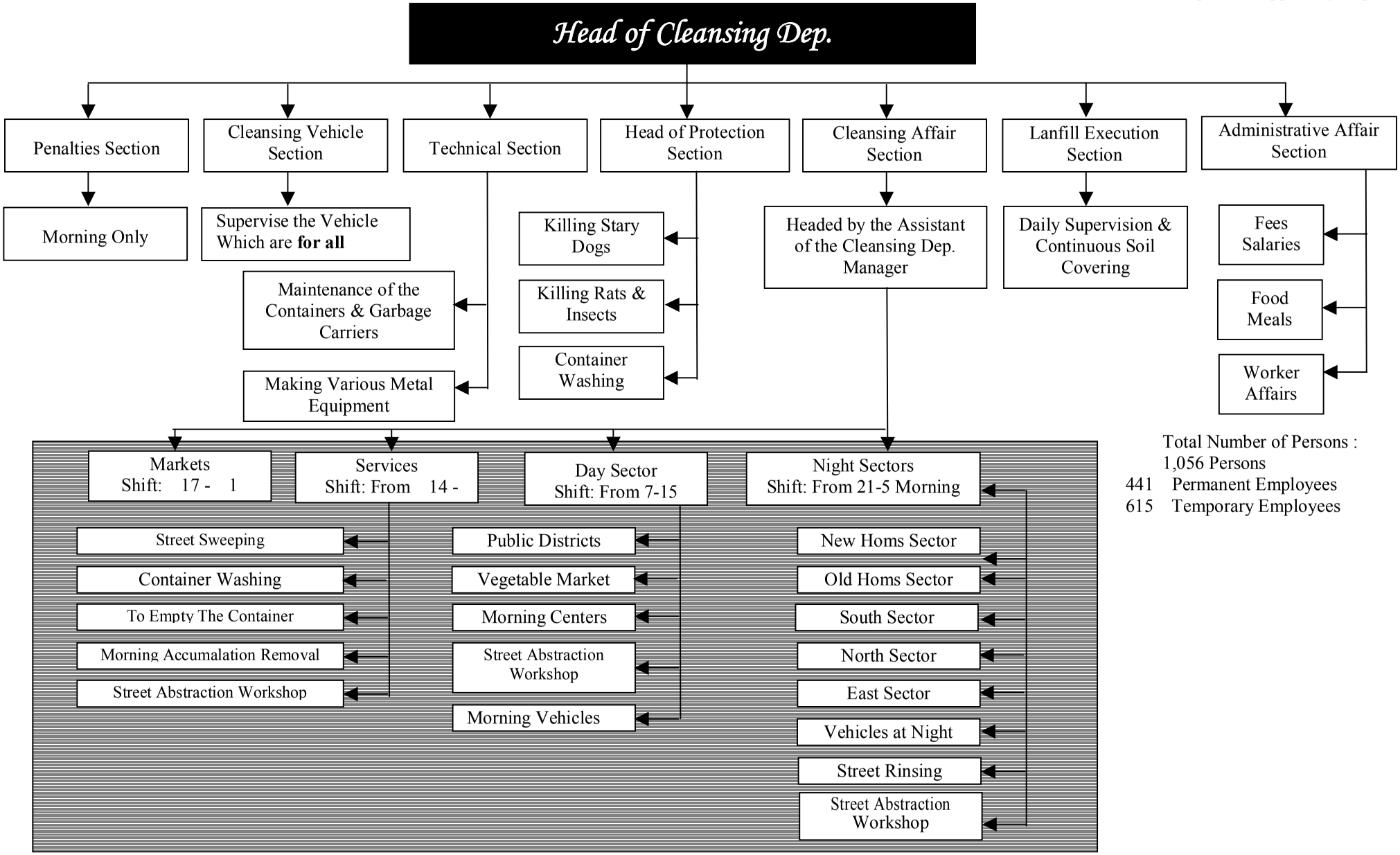


Figure 9.4.1 Head of Cleansing Dep.

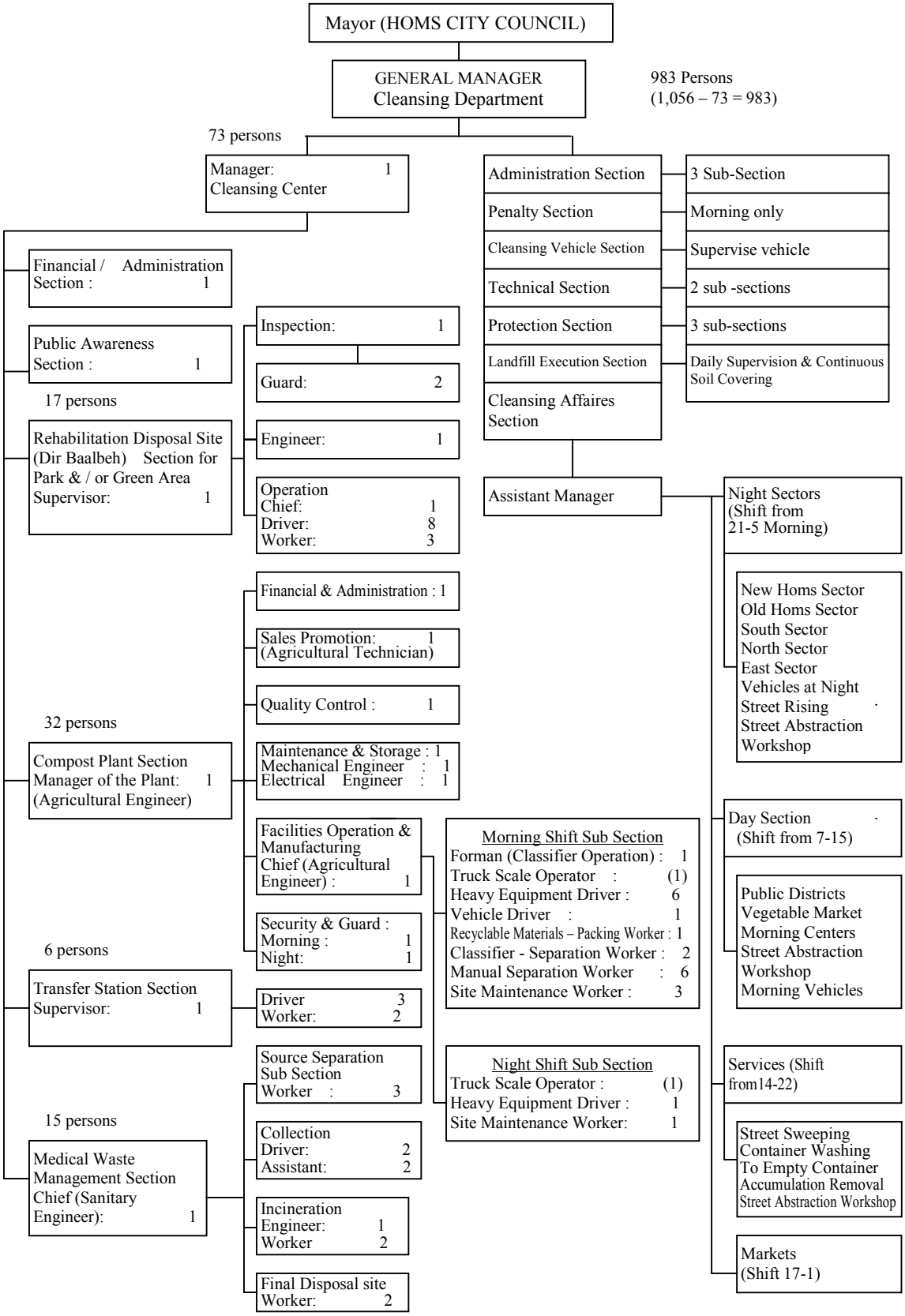
Figure 9.4.2 The Homs Cleansing Department (Number of Persons)

A list of the total number of members in cleansing division sector

(July, 2001)

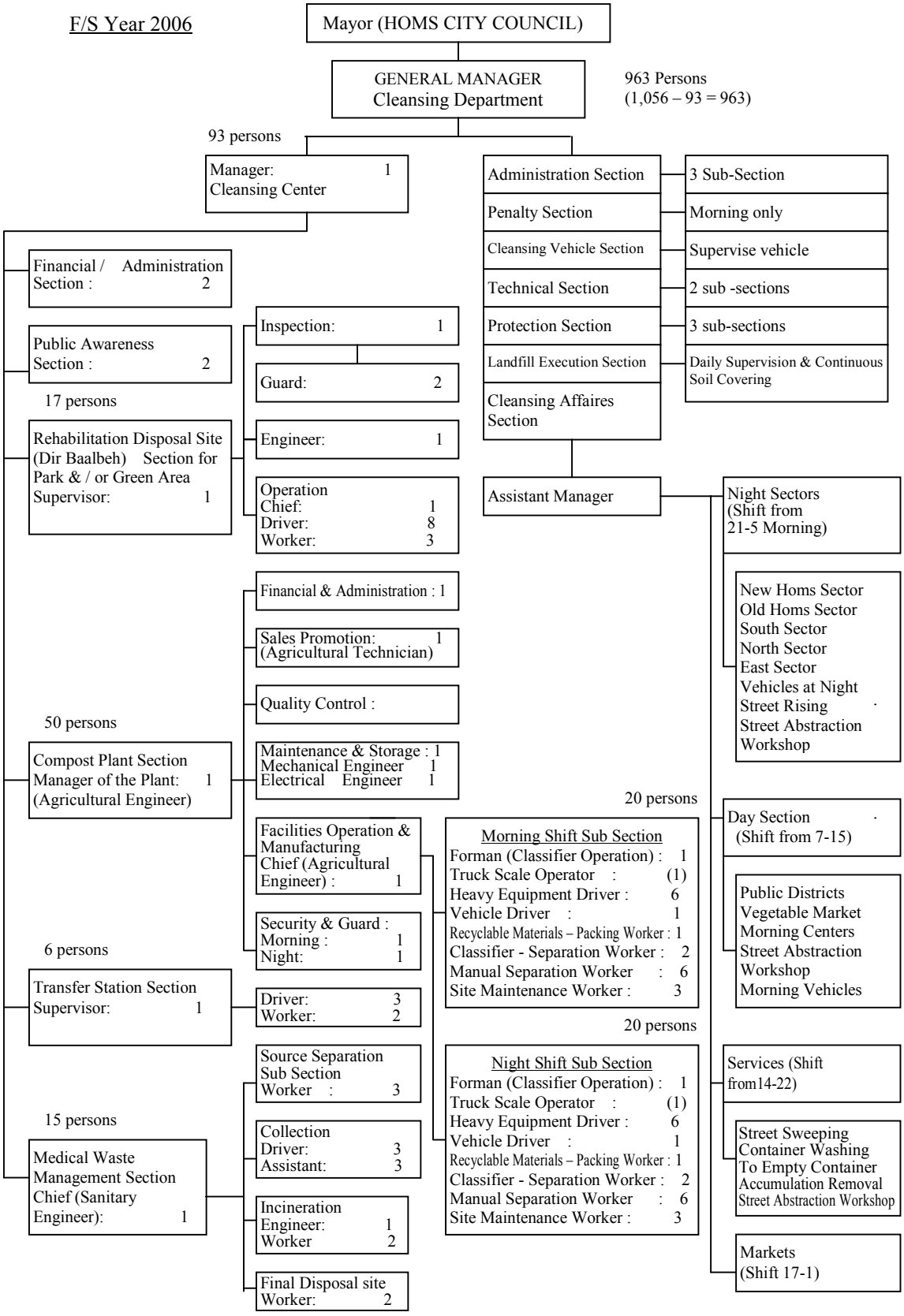
	Sector	Staff No.	Sector Administration	Supervisor	Guard and Tire Repair	Workers No.
1	Division administration	6	6	0	0	0
2	Penalties	14	1	11	0	0
3	Insecticides	28	2	5	0	20
4	Al-heal market morning shift	50	2	4	2	41
5	Public quarters	150	2	19	2	126
6	Plant and dirt removal	26	1	1	0	24
7	Services	61	1	3	5	50
8	Technical workshop	21	1	0	4	20
9	Markets morning shift	81	2	6	2	70
10	Markets night shift	44	2	6	3	33
11	Trucks morning shift	117	3	6	14	93
12	Trucks afternoon shift	33	1	2	2	29
13	Trucks night shift	62	1	1	2	58
14	New Homs City night shift	61	2	5	0	54
15	Old Homs City night shift	48	2	6	1	39
16	North sector night shift	77	1	7	1	67
17	South sector night shift	71	2	7	1	67
18	East sector night shift	87	2	7	2	76
19	Dump site	8	0	2	5	0
20	Night plant and dirt removal	11	1	0	0	10
	Sector	1,056	35	98	46	877

Note: 2/7 workers are out of service every day due to the work circumstances(week-end & holiday & absence)
Thus : 1056 2/7 = 302 workers out of service per day.
1056-302=754 workers at service per day.



Remarks:
(1) Truck scale for Dir Baalbeh is used for Compost Plant.
(2) Selected are the persons mainly from members of the existing Cleansing Department (1,056 persons) who are qualified and considered capable of fulfilling their duties at their positions respectively in the Cleansing Center .

Figure 9.4.2 Organization Chart (1)



Remarks:
(1) Truck scale for Dir Baalbeh is used for Compost Plant.
(2) Selected are the persons mainly from members of the existing Cleansing Department (1,056 persons) who are qualified and considered capable of fulfilling their duties at their positions respectively in the Cleansing Center .

Figure 9.4.3 Organization Chart (2)

SECTION 10

ECONOMIC AND FINANCIAL ANALYSIS ON MUNICIPAL BUDGET

SECTION 10 ECONOMIC AND FINANCIAL ANALYSIS ON MUNICIPAL BUDGET

10.1 GRDP IN HOMS

(1) Population

The total population of the Homs in September 1994 was 814,201 persons. The population in the city until year 2005 is estimated by the Statistics Department of Homs as shown in Table 10.1.1. The Population in Homs will be 1,130,732 in 2005. Population in 2010 will be 1,310,828 assuming annual increase 3% after year 2006.

Table 10.1.1 Future Population of Homs City

Year	Population (person)	Annual increase (%)	Year	Population (person)	Annual increase (%)
1994	814,201		2003	1,064,715	3.06
1995	834,934	2.55	2004	1,097,261	3.05
1996	860,885	3.11	2005	1,130,732	3.05
1997	887,586	3.10	2006	1,164,654*	
1998	915,058	3.09	2007	1,199,594*	
1999	943,322	3.09	2008	1,235,581*	
2000	972,397	3.08	2009	1,272,649*	
2001	1,002,306	3.07	2010	1,310,828*	
2002	1,033,072	3.07			

Note: Until 2005 is estimated by the Statistics Department of Homs
After 2006 is estimated using annual increase 3%

(2) GRDP

GDP of the Syria in 1998 was SP 790,440 million and GDP per person was SP 46,500. GRDP of Homs Governorate was SP 52,768 million (6.68% of GDP). Based on the population ratio, GRDP of Homs City would be SP 31,493 million in 1998. Assuming 2% of annual increase after 1998, GRDP will be SP 33,420 million in 2001 (SP 33,343 per capita), SP 36,175 million in 2005 and SP 42,289 million in 2010.

(3) Household Income

Household income in Homs is estimated referring the household income in Lattakia. According to the interview survey conducted in Lattakia city and the three (3) surrounding cities, the average family number is 5.3 persons. And the household income is SP 17,180/person and the expenses is SP 23,409/person in average. These are 43% and 58% of GRDP per person respectively and the income is much less than the expenses. However, it is assumed that the expenses will represent the actual income because it is usual to response less income at the interview survey. It is noted that 14.3% of household expense less than SP 4,000/month. It is noted that average household income and expenses excluding the household less than 4,000/month will be 21,449/capita and 25,959/capita respectively.

GRDP per capita in Homs will be SP 33,343 as mentioned above. The average household income is estimated assuming equal to 58% of GRDP per capita. Therefore, the household income will be SP 19,339/person (SP102,500/household).

10.2 BUDGET OF HOMS CITY

(1) Revenue and Expenditure

The budget of Homs City is shown in Table 10.2.1. The revenue and expenditure in 2001 will be SP 654.6 million that is only 2% of GRDP in Homs.

The budget of Homs City will be 708.6 in 2005 and 782.4 in 2010 assuming parallel increase with the GRDP.

Table 10.2.1 Budget of Homs City

Items	1996	1997	1998	1999	2000	2001
Revenue						
Taxes & Fees	411,131	422,075	296,696	319,705	326,600	328,689
Receipts from investment	50,278	71,102	112,029	67,611	178,300	217,300
Other Local fees and Taxes	304,191	141,392	63,807	47,195	47,665	58,660
Other income	0	0	50,000	0	50,000	50000
Total	765,600	634,569	522,532	434,511	522,970	654,649
Expenditure						
Salaries	127,205	139,434	157,242	155,060	169,145	182,795
Administrative expenses	148,385	167,267	147,285	130,324	132,550	122,700
Capital expenditures	451,929	426,068	406,198	108,187	275,000	325,000
Transfers	4,901	5,425	5,416	5,239	5,420	5,204
Debt service & commitments	33,180	68,825	66,823	90,396	20,450	18,950
Cultural center	0	0	0	0	0	0
Total	765,600	807,019	782,964	489,206	602,565	654,649

(2) Expenses of Cleansing Work

The revenue and expenditure of solid waste management in 2000 is shown in Table 10.2.2. Total revenue of cleansing fee was SP 80 million and the expenditure was SP 111.6 million. This amount is 18.5% of city expenditure.

Table 10.2.2 Revenue and Expenditure of Solid Waste Management in 2000

Items	Amount (SP 1,000)	Remark
1. Revenue of cleansing fee		
Commercial and industry	74,000	
Household	6,000	
Total	80,000	
2. Expenditure		
(1) Salaries and wages	72,378	
(2) Food and cloths	15,300	
(3) Fuel and lubricants	5,100	
(4) Insecticides	200	
(5) Maintenance		
- Vehicle and spare parts	17,000	
- Tolls and instruments	1,000	
- Handcarts	150	
- Container	500	
Total	111,628	

Note: Cleansing fee is used for solid waste management and street lighting etc.

(3) Fee Collection of Cleansing Charge

Cleansing charge is collected from household and business entity. The charge for household is set between SP 75 (slum area and suburban)-250/year (high income area) according to the area. 92.5% of revenue is from the commercial and industry. The revenue of cleansing charge covers 72% of cost. As the domestic waste amount share 60% of total solid waste, revenue from commercial and industry seems to cover the cost of their waste excluding depreciation cost.

10.3 FINANCIAL PLAN

(1) Cost of the Master Plan

According to the Master Plan prepared by METAP-EIB study, cost of master plan is estimated as shown in Table 10.3.1. Total investment cost is estimated to be SP 788.8 million and operation cost in 2010 will be SP198.6 million including the treatment of demolition waste and disposal of sewerage sludge.

Table 10.3.1 Cost of the Master Plan up to 2010.

Table 10.3.1 Priority Project Investment Plan in 1,000 SYP (2000 Prices excluding VAT)

Type of waste	2001	2002	2003	2004	2005	20006	2007	2008	2009	2010	Total
Investments											
Capacity building assistance	4,000	12,000	12,000								28,000
Collection equipment	371,000							22,000			393,000
Transfer facilities **	2,000	41,100									43,100
Composting plant **				1,000	20,500						21,500
Demolition waste treatment facility **	150	1,450									1,600
Healthcare waste treatment facility **	250	4,750									5,000
Landfill **	5,400	102,600		3,300	63,700			3,300	63,700		242,000
Sewage sludge disposal section **	500	9,500		400	7,400		400	7,400			25,600
HW landfill section **	500	10,500				500	8,800				20,300
Access road **	450	8,300									8,750
Total Investments	384,250	190,200	12,000	4,700	91,600	500	9,200	32,700	63,700	0	788,850
Operation Costs											
General cleansing services	122,000	125,855	129,832	133,935	138,355	142,920	147,637	152,509	157,541	163,055	1,413,641
Sep.collection of market waste						1,267	1,308	1,352	1,396	1,445	6,768
Sep.collect healthcare waste	426	439	453	467	480	494	508	522	537	550	4,875
Sep.collection HW			1,447	1,481	1,516	1,552	1,588	1,626	1,665	1,706	12,580
Central transfer station			4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	33,600
Transport, from transfer station			6,741	6,859	6,985	7,011	7,141	7,128	7,267	7,418	56,550
Transport, sewage sludge	1,175	1,188	6,240	6,305	6,370	6,435	6,500	6,565	6,630	66,950	54,103
Composting plant, market + park waste						2,817	2,827	2,838	2,849	2,861	14,192
Sale of compost						-2,533	-2,617	-2,703	-2,792	-2,890	-13,536
Demolition waste facility			1,692	1,706	1,721	1,736	1,751	1,766	1,781	1,796	13,948
Sale of products			-1,806	-1,825	-1,843	-1,861	-1,880	-1,899	-1,918	-1,937	-14,968
Healthcare waste treatment			520	520	520	520	520	520	520	520	4,160
Sanitary landfill			9,277	9,329	9,385	9,404	9,462	9,469	9,531	9,599	75,455
Swage sludge disposal section	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	10,000
HW landfill section		2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	16,800
Access road, maintenance			438	438	438	438	438	438	438	438	3,504
Total Operation Costs	124,601	128,482	162,133	166,515	171,227	177,498	182,484	187,430	192,745	198,557	1,691,671

Note: * Exclusive sewage sludge.
** Approximately 5% of the totla amount has been included for detial design etc. the year prior to construction.

(2) Renewal

Cost for the renewal of equipment is considered according to the following life time of equipment.

a. Vehicle and heavy equipment 10 years
b. Plant equipment 15 years
c. Civil works and buildings 30 years

10.4 ECONOMIC ANALYSIS OF THE PROJECT

10.4.1 Benefit of Waste Removal and Willingness to Pay

Major benefit of solid waste management will be the removal of waste from urban area to maintain living environment and public hygiene. However, it is difficult to make quantitative analysis on these benefits. Therefore, the willingness to pay for solid waste management is used as the benefit of solid waste removal from urban area.

Willingness to pay is surveyed at Lattakia city and the three surrounding cities.

The result is shown in Table 10.4.1.

Table 10.4.1 Willingness to Pay (Unit: SP/Month/Household)

	Lattakia	Jableh	Al Haffeh	Qurdaha	Total*
No. of sample	124	44	14	21	203
Average	132	82	73	98	118
High income	156	86			142
Middle income	131	82	73	98	117
Low income	120	81			112

Note: Weighted average considering population of each city

Willingness to pay in Lattakia is SP 132/month/household in average and SP 118/month/household in the four cities in average according to the interview survey. This amount is 1.1% - 1.3% of average household expenses (SP 23,409/person). Also the amount is 0.7% of GRDP per capita (SP 40,400/capita)

(SP 132/month x 12 month/5.3 person) / SP 23,409 = 1.3%
(SP 118/month x 12 month/5.3 person) / SP 23,409 = 1.1%
(SP 132/month x 12 month/5.3 person) / SP 40,400 = 0.7%
(SP 118/month x 12 month/5.3 person) / SP 40,400 = 0.7%

10.4.2 Benefit of Compost

(1) General

Usage of compost is effective to reduce usage of chemical fertilizer, to increase agriculture product, to produce better quality production and to reduce usage of irrigation water.

(2) Reduction of Chemical Fertilizer

One ton of compost contents 9.9 kg of N, 11.1 kg of P_2O_5 and 11.1 kg of K_2O according to the result of analysis in Damascus Compost Plant. There nutrient is equivalent to chemical fertilizer as shown in Table 10.4.2.

Table 10.4.2 Nutrient Content and Equivalent Fertilizer per Ton of Compost

Nutrient	Contents	Equivalent fertilizer	Equivalent amount
N	9.9 kg/ton	Urea	21.5 kg
P_2O_5	11.1 kg/ton	Super-phosphate	24.0 kg
K_2O	11.0 kg/ton	K_2SO_4	3-33 kg

Based on the local price of the chemical fertilizer, the valuation of the compost is estimated to be SP 400- 764 /ton. Therefore, SY 580/ton, the middle figure, is used as the average of benefit on one ton of compost concerning reduction of chemical fertilizer.

Table 10.4.3 Economical Valuation of Compost on Reduction of Chemical Fertilizer

	Price	Equivalent amount	Valuation per ton
Urea	SP 7.7 /kg	21.5 kg/ton	SP 165 /ton
Super-phosphate	SP 8.3 /kg	24 kg/ton	SP 199 /ton
K_2SO_4	SP 12.1 /kg	3-33 kg/ton	SP 36-399 /ton
Total	-	-	SP 400 – 764 /ton

(3) Increase of Agriculture Product

There are very few reports of controlled experiments on the use of compost, and of there few provide for controls against no treatment and treatment with and equivalent quantity of chemical fertilizer. Of these the most comprehensive is a report of long term experiments at Bahteem, which reports that after continuous application of organic fertilizer for 43 years, average crop yield increased by 112% when compared to the control group with no treatment, and by 49% compared to a control group treated with chemical fertilizer only.

Reports from Japan indicate a generally lower response from the application of organic fertilizers, as might be expected given the very different soil and climatic conditions. This results also show similar effects from the regular application of 2 tons per hectare before planting of ezch crop, and the one-off application of 16 tons per hectare.

To identify the possible scale of benefits, it is assumed that a single application of 20 ton/hectare on poor soils will increase crop yields by 20% as a result of the improved soil condition, or 1% per ton/hectare. The gross value of this additional yield will be the economic benefit derived from the compost.

Economic benefits of compost on increase of product is depend on the crops as shown in Table 10.4.4 and it vary from SP 70/ton in case of barley to SP 3,200 in case of tomato/ton.

Table 10.4.4 Benefits of Compost by Crops

Crop	Yield (ton/ha)	Farm-gate price (SP/ton)	Production (SP/ha)	Benefit (SP/ton)
Tomato	32.78	10,000	327,800	3,278
Potato	19.05	5,000	95,255	953
Cucumbers	19.92	15,000	298,800	2,988
Cotton	3.56	30,750	109,470	1,095
Wheat	1.83	11,300	20,679	207
Barley	1.26	7,000	7,182	72
Lentil	0.58	17,000	9,860	99

It is expected that compost will be used mainly for vegetable and fruits because it will be used only the benefit will be larger than the cost. According to the cultivated area of vegetables in Lattakia and Homs Governorate, benefit of compost could estimated as shown in Table 10.4.5. Therefore, SY 1,500/ton is used for economic analysis considering benefit in Homs Governorate.

Table 10.4.5 Average Benefits of Compost

Crops	Lattakia Governorate			Homs Governorate		
	Area (%)	Benefit	Amount	Area (%)	Benefit	Amount
Tomato	76.5	3,278	2,508	16.9	3,278	554
Potato	12.1	953	115	49.7	953	474
Cucumbers	11.4	2,988	341	3.0	2,988	90
Cotton	0	1,095	0	30.4	1,095	333
Total			2,964			1,450

(4) Saving of Irrigation Water

There are few reported results on the effect of compost on water requirements. The most relevant is from a trail in the United Arab Emirates where the application of 18.8 ton/ha of compost on sandy soils resulted in the reduction in water use of between 18% and 63%, depending on the crop type. There reductions in water use would allow an increase in the area irrigated by the same water of between 22% and 270%. The sandy soil of the near desert regions might be expected to show some of the largest benefits from the addition of compost.

The gross value of production from increased area will of course depend on the crop and many other considerations. Simply to illustrate possible effect, it would be base estimates of potential benefits on medium value industrial crops such as cotton that average value of production will be SP100,000 /ha. The producer surplus from this gross production level is assumed to be 15%.

Above result and assumption will be converted as follows:

a.	Compost	18.8 ton/ha
b.	Increased area	22% - 270% (1.2% - 14.4% per ton)
c.	Production per hectare	SP 100,000
d.	Gross production of increased area	SP 22,000 – SP 270,000 (SP 1,200 – 14,400 /ton)

e. Producer surplus 15%

f. Benefit of compost SP 3,300 – SP 40,500 (SP180 – 2,160/ton)

Based on above estimation, SY 500 is used for economic analysis.

10.4.3 Reusable Material

In the process of composting, reusable material will be recovered at the hand sorting process. Based on composition of solid waste, quantity of reusable material to be recovered is estimated and sales income is estimated based on the market price of reusable material as shown in Table 10.4.6.

Table 10.4.6 Sales Income of Reusable Material (Treated Amount 100 Ton/Day)

Material	Quantity		Unit price	Amount
	Ton/day	Ton/year	SP /ton	SP/year
Paper	1.8	558	1,500	837,000
Plastic	3.7	1,147	3,000	3,441,000
Metal	0.3	93	1,000	93,000
Grass	0.6	186	1,500	279,000
Total	6.4	1,984		7,363,000

10.4.4 Reduction of Disposal Amount

(1) General

Reduction of disposal amount is one of major benefit of composting and it will effect on reduction of pollution load, improvement of surrounding environment and reduction of disposal cost.

(2) Reduction of disposal cost

Reduction of disposal cost could be estimated as follows:

a. Reduction of construction cost.

Construction cost of Maghlia disposal site from year 2001 to 2010 is estimated SP 242 million in total according to the master plan in Homs. Annual disposal amount in year 2006 will be 301,550 ton/year. Therefore, construction cost per ton of waste will be SP 80.3/ton

SP 242,000,000 / 301,550 ton / 10 years = SP 80.3 /ton

b. Reduction of operation cost

Operation cost of landfill in Dir Baalbeh is estimated to be 15.1 million in 2006 and disposal amount will be 301,550 ton/year. Therefore, operation cost per ton of waste will be SP 50.1/ton

c. Reduction of transportation cost

Operation cost of transfer station and transportation is estimated to be SP 11.3 million in 2006. Therefore, operation cost per ton will be SP 37/ton.

d. Disposal cost reduction

As described above, cost of disposal will be SP167.4 per/ton in Homs including transportation cost. The compost plant is planned to treat 100 ton/day of waste and reject will be 25 ton/day that shall be disposed of. Therefore, disposal amount will be reduced 75 ton/day.

Accordingly, cost reduction of disposal will be SP 3.9 million /year.

SP 167.4 /ton x 75 ton/day x 310 day/year = SP 3,892,050 /year

PART IV

PILOT STUDY IN LATTAKIA

SECTION 1

PRODUCTION OF BETTER QUALITY OF COMPOST

SECTION 1 PRODUCTION OF BETTER QUALITY OF COMPOST

1.1 TREATED WASTE AMOUNT

During the pilot study, total approximately 114 ton of waste have been treated as follows:

(1) Market waste

Waste source : Aphamia Souq
Test period : 16th June to 30th August 2001
Total treatment amount : 103ton

(2) Domestic waste

Waste source : 200 Households in Al Soleiba
Test period : 5th July to 5th August 2001
Total treatment amount : 11ton

Refer to Photograph 1.1.1 and dairy treated waste amounts are shown in Figure 1.1.1 and 1.1.2.

Detailed test records are shown in Table 1.1.1amd 1.1.2.

Waste Compost

Photograph 1.1.1 Compost Production

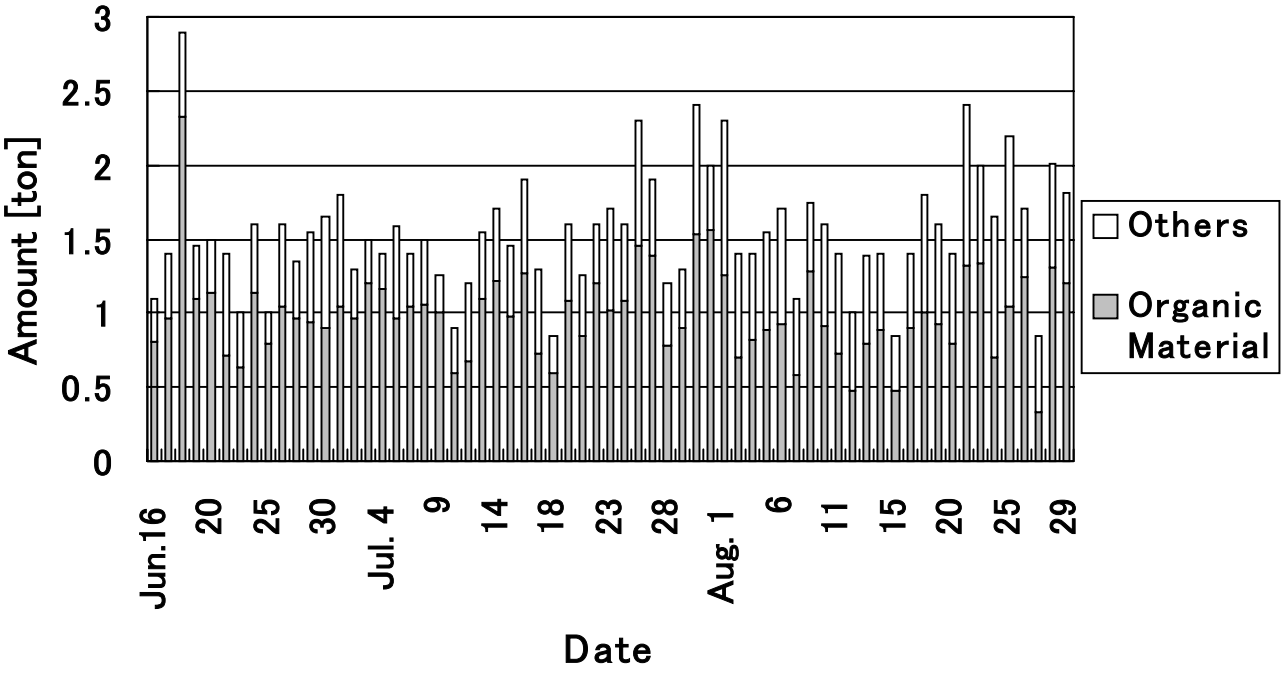


Figure 1.1.1 Treated Market Waste Amount

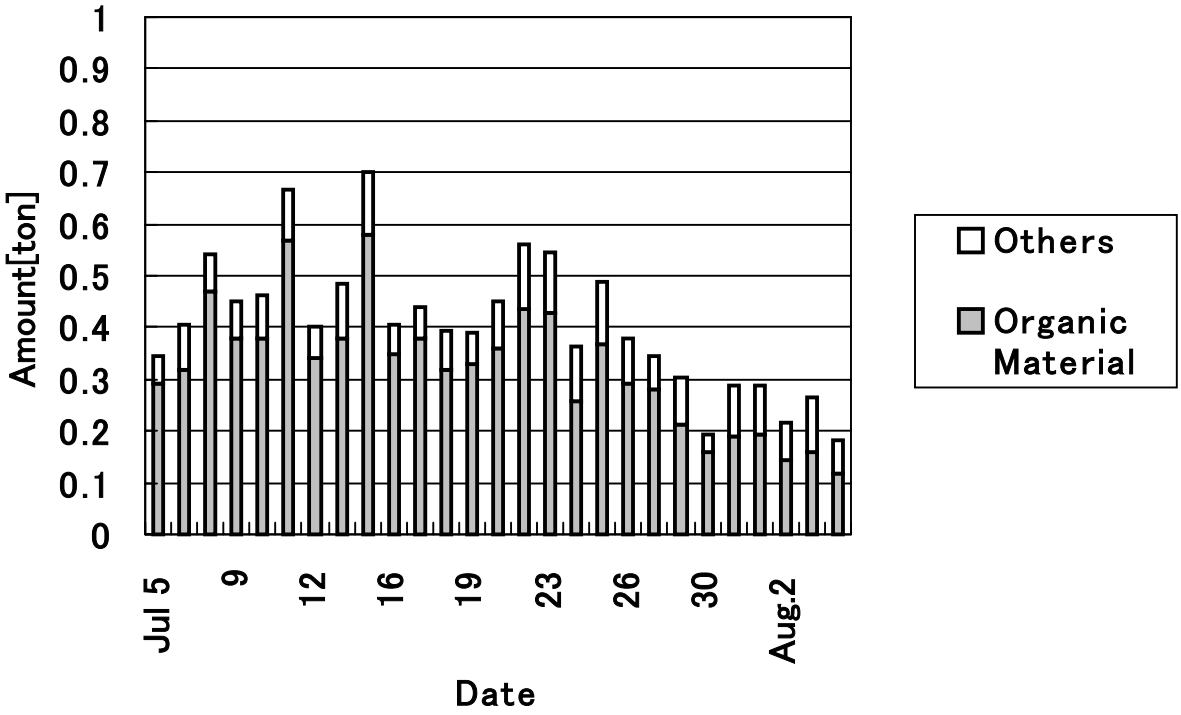


Figure 1.1.2 Treated Domestic Waste Amount

Table 1.1.1 Test Record of Compost Pilot Study (Market waste) (1)

Days	Waste Treatment Date		W. No.	Waste Amount										Product Amount														Compost Screening Date		Remarks
				Received		Non-org.	Organic				Compost Material			Residue									Fine Compost				Total			
											Add.	Total		1st Screen			2nd Screen			Total										
				Daily	Accu.	Daily	Daily	Accu.	R-O1	R-O2	Daily	Daily	Accu.	Daily	Accu.	R-1	Daily	Accu.	R-2	Daily	Accu.	R-R	Daily	Accu.	R-C1	R-C2	Accu.	R-P			
				ton	ton	ton	ton	ton	%	%	ton	ton	ton	ton	ton	%	ton	ton	%	ton	ton	%	ton	ton	%	%	ton	%			
0	16-Jun	Sat	1	1.10	1.10	0.29	0.81	0.81	74.0		0.00	0.81	0.81	0.31	0.31		0.14	0.14		0.46	0.46		0.25	0.25	35.2		0.71		21-Jul	Sat	
1	17-Jun	Sun	2	1.40	2.50	0.43	0.97	1.78	69.0		0.00	0.97	1.78	0.34	0.65		0.10	0.25		0.44	0.90		0.21	0.46	33.9		1.36		22-Jul	Sun	
2	18-Jun	Mon	3	2.90	5.40	0.57	2.33	4.11	80.4	76.2	0.00	2.33	4.11	0.35	1.00	46.3	0.19	0.44	20.2	0.54	1.44	66.5	0.26	0.72	33.5	17.6	2.17	52.7	23-Jul	Mon	
3	19-Jun	Tue	4	1.45	6.85	0.35	1.10	5.21	75.9		0.00	1.10	5.21	0.33	1.34		0.12	0.55		0.45	1.89		0.21	0.93	33.0		2.82		24-Jul	Tue	
4	20-Jun	Wed	5	1.50	8.35	0.37	1.13	6.34	75.4		0.00	1.13	6.34	0.22	1.55		0.10	0.66		0.32	2.21		0.13	1.06	32.4		3.26		25-Jul	Wed	
5	21-Jun	Thu	6	1.40	9.75	0.69	0.71	7.06	51.0	72.4	0.00	0.71	7.06	0.11	1.67	47.4	0.05	0.70	20.0	0.16	2.37	67.4	0.09	1.14	32.6	16.2	3.51	49.8	26-Jul	Thu	
6	22-Jun	Fri			9.75			7.06					7.06		1.67			0.70			2.37			1.14			3.51		27-Jul	Fri	
7	23-Jun	Sat	7	1.00	10.75	0.36	0.64	7.70	63.8		0.00	0.64	7.70	0.13	1.79		0.05	0.75		0.18	2.55		0.06	1.20	32.0		3.75		28-Jul	Sat	
8	24-Jun	Sun	8	1.60	12.35	0.47	1.13	8.83	70.7		0.00	1.13	8.83	0.15	1.94		0.05	0.80		0.20	2.75		0.07	1.27	31.6		4.02		29-Jul	Sun	
9	25-Jun	Mon	9	1.00	13.35	0.21	0.79	9.61	78.6	72.0	0.00	0.79	9.61	0.11	2.05	48.2	0.06	0.86	20.1	0.17	2.91	68.3	0.08	1.35	31.7	14.1	4.26	44.4	30-Jul	Mon	
10	26-Jun	Tue	10	1.60	14.95	0.55	1.05	10.66	65.6		0.00	1.05	10.66	0.18	2.24		0.11	0.97		0.29	3.20		0.08	1.43	30.9		4.63		31-Jul	Tue	
11	27-Jun	Wed	11	1.35	16.30	0.39	0.96	11.62	70.8		0.00	0.96	11.62	0.16	2.39		0.02	0.99		0.18	3.38		0.03	1.46	30.2		4.84		1-Aug	Wed	
12	28-Jun	Thu	12	1.55	17.85	0.61	0.94	12.56	60.8	70.4	0.00	0.94	12.56	0.17	2.56	50.0	0.05	1.04	20.3	0.22	3.60	70.3	0.06	1.52	29.7	12.1	5.12	40.8	2-Aug	Thu	
13	29-Jun	Fri			17.85			12.56					12.56		2.56			1.04			3.60			1.52			5.12		3-Aug	Fri	
14	30-Jun	Sat	13	1.65	19.50	0.75	0.90	13.46	54.3		0.00	0.90	13.46	0.24	2.81		0.09	1.13		0.33	3.93		0.07	1.59	28.8		5.53		4-Aug	Sat	
15	1-Jul	Sun	14	1.80	21.30	0.76	1.04	14.50	57.7		0.00	1.04	14.50	0.17	2.98		0.06	1.19		0.23	4.17		0.06	1.66	28.4		5.82		5-Aug	Sun	
16	2-Jul	Mon	15	1.30	22.60	0.33	0.97	15.47	74.6	68.4	0.00	0.97	15.47	0.19	3.17	51.5	0.07	1.26	20.4	0.26	4.43	71.9	0.08	1.74	28.1	11.2	6.16	39.9	6-Aug	Mon	
17	3-Jul	Tue	16	1.50	24.10	0.30	1.20	16.67	80.3		0.00	1.20	16.67	0.22	3.39		0.11	1.37		0.33	4.76		0.11	1.85	28.0		6.61		7-Aug	Tue	
18	4-Jul	Wed	17	1.40	25.50	0.24	1.16	17.83	82.6		0.00	1.16	17.83	0.13	3.52		0.05	1.42		0.18	4.94		0.06	1.91	27.9		6.86		8-Aug	Wed	
19	5-Jul	Thu	18	1.60	27.10	0.62	0.98	18.81	61.3	69.4	0.00	0.98	18.81	0.15	3.68	51.5	0.06	1.48	20.7	0.21	5.16	72.2	0.07	1.99	27.8	10.6	7.14	38.0	9-Aug	Thu	
20	6-Jul	Fri			27.10			18.81					18.81		3.68			1.48			5.16			1.99			7.14		10-Aug	Fri	
21	7-Jul	Sat	19	1.40	28.50	0.35	1.05	19.86	75.0		0.00	1.05	19.86	0.27	3.94		0.09	1.58		0.36	5.52		0.10	2.08	27.4		7.60		11-Aug	Sat	
22	8-Jul	Sun	20	1.50	30.00	0.44	1.06	20.92	70.7		0.00	1.06	20.92	0.17	4.11		0.06	1.63		0.23	5.75		0.10	2.18	27.5		7.93		12-Aug	Sun	
23	9-Jul	Mon	21	1.25	31.25	0.24	1.01	21.93	80.8	70.2	0.00	1.01	21.93	0.11	4.22	51.6	0.06	1.69	20.7	0.17	5.91	72.2	0.09	2.27	27.8	10.4	8.18	37.3	13-Aug	Mon	
24	10-Jul	Tue	22	0.90	32.15	0.30	0.60	22.53	66.7		0.00	0.60	22.53	0.18	4.41		0.08	1.77		0.26	6.17		0.09	2.36	27.7		8.54		14-Aug	Tue	
25	11-Jul	Wed	23	1.20	33.35	0.53	0.67	23.20	55.8		0.00	0.67	23.20	0.22	4.63		0.11	1.88		0.34	6.51		0.14	2.50	27.7		9.01		15-Aug	Wed	
26	12-Jul	Thu	24	1.55	34.90	0.45	1.10	24.30	71.0	69.6	0.00	1.10	24.30	0.11	4.74	51.1	0.07	1.95	21.0	0.18	6.69	72.1	0.08	2.58	27.9	10.6	9.27	38.1	16-Aug	Thu	
27	13-Jul	Fri			34.90			24.30					24.30		4.74			1.95			6.69			2.58			9.27		17-Aug	Fri	
28	14-Jul	Sat	25	1.70	36.60	0.49	1.21	25.51	71.2		0.00	1.21	25.51	0.06	4.80		0.05	2.00		0.12	6.80		0.08	2.66	28.1		9.46		18-Aug	Sat	
29	15-Jul	Sun	26	1.45	38.05	0.47	0.98	26.49	67.6		0.00	0.98	26.49	0.11	4.91		0.04	2.05		0.15	6.95		0.12	2.77	28.5		9.73		19-Aug	Sun	
30	16-Jul	Mon	27	1.90	39.95	0.63	1.27	27.76	66.8	69.5	0.00	1.27	27.76	0.14	5.05	50.4	0.06	2.11	21.0	0.20	7.16	71.4	0.10	2.87	28.6	10.3	10.03	36.1	20-Aug	Mon	
31	17-Jul	Tue	28	1.30	41.25	0.57	0.73	28.49	56.2		0.00	0.73	28.49	0.07	5.12		0.08	2.18		0.14	7.30		0.09	2.96	28.9		10.26		21-Aug	Tue	
32	18-Jul	Wed	29	0.85	42.10	0.26	0.59	29.08	69.4		0.00	0.59	29.08	0.06	5.18		0.13	2.31		0.19	7.49		0.26	3.23	30.1		10.72		22-Aug	Wed	
33	19-Jul	Thu	30	1.60	43.70	0.52	1.08	30.16	67.5	69.0	0.00	1.08	30.16	0.10	5.28	47.8	0.11	2.42	21.9	0.21	7.70	69.7	0.12	3.35	30.3	11.1	11.05	36.6	23-Aug	Thu	
34	20-Jul	Fri			43.70			30.16					30.16		5.28			2.42			7.70			3.35			11.05		24-Aug	Fri	
35	21-Jul	Sat	31	1.25	44.95	0.41	0.84	31.00	67.2		0.00	0.84	31.00	0.08	5.36		0.07	2.49		0.14	7.85		0.11	3.46	30.6		11.31		25-Aug	Sat	
36	22-Jul	Sun	32	1.60	46.55	0.40	1.20	32.20	75.0		0.00	1.20	32.20	0.10	5.45		0.10	2.59		0.20	8.04		0.10	3.56	30.7		11.60		26-Aug	Sun	
37	23-Jul	Mon	33	1.70	48.25	0.68	1.02	33.22	60.0	68.8	0.00	1.02	33.22	0.18	5.63	47.2	0.08	2.67	22.4	0.26	8.30	69.6	0.08	3.64	30.4	10.9	11.94	35.9	27-Aug	Mon	

Table 1.1.1 Test Record of Compost Pilot Study (Market waste) (2)

Days	Waste Treatment Date		W. No.	Waste Amount										Product Amount														Compost Screening Date		Remarks
				Received		Non-org.	Organic				Compost Material			Residue								Fine Compost				Total				
											Add.	Total		1st Screen			2nd Screen			Total										
				Daily	Accu.	Daily	Daily	Accu.	R-O1	R-O2	Daily	Daily	Accu.	Daily	Accu.	R-1	Daily	Accu.	R-2	Daily	Accu.	R-R	Daily	Accu.	R-C1	R-C2	Accu.	R-P			
				ton	ton	ton	ton	ton	%	%	ton	ton	ton	ton	ton	%	ton	ton	%	ton	ton	%	ton	ton	%	%	ton	%			
38	24-Jul	Tue	34	1.60	49.85	0.51	1.09	34.31	68.1		0.00	1.09	34.31	0.07	5.70		0.07	2.74		0.14	8.44		0.09	3.73	30.6		12.17		28-Aug	Tue	
39	25-Jul	Wed	35	2.30	52.15	0.85	1.45	35.76	63.0		0.00	1.45	35.76	0.10	5.80		0.07	2.8128		0.17	8.61		0.08	3.81	30.7		12.42		29-Aug	Wed	
40	26-Jul	Thu	36	1.90	54.05	0.51	1.39	37.15	73.16	68.7	0.00	1.39	37.15	0.16	5.96	46.8	0.08	2.89	22.7	0.24	8.85	69.6	0.07	3.87	30.4	10.4	12.72	34.2	30-Aug	Thu	
41	27-Jul	Fri			54.05			37.15					37.15																31-Aug	Fri	
42	28-Jul	Sat	37	1.20	55.25	0.42	0.78	37.93	65.2		0.00	0.78	37.93																		
43	29-Jul	Sun	38	1.30	56.55	0.40	0.90	38.83	69.46		0.00	0.90	38.83																		
44	30-Jul	Mon	39	2.40	58.95	0.87	1.53	40.36	63.6	68.5	0.00	1.53	40.36																		
45	31-Jul	Tue	40	2.00	60.95	0.44	1.56	41.92	78.0		0.00	1.56	41.92																		
46	1-Aug	Wed	41	2.30	63.25	1.05	1.25	43.17	54.35		0.00	1.25	43.17																		
47	2-Aug	Thu	42	1.40	64.65	0.70	0.70	43.87	50.0	67.9	0.00	0.70	43.87																		
48	3-Aug	Fri			64.65			43.87					43.87																		
49	4-Aug	Sat	43	1.40	66.05	0.58	0.82	44.69	58.7		0.00	0.82	44.69																		
50	5-Aug	Sun	44	1.55	67.60	0.67	0.88	45.57	56.58		0.00	0.88	45.57																		
51	6-Aug	Mon	45	1.70	69.30	0.77	0.93	46.50	54.9	67.1	0.07	1.00	46.57																		
52	7-Aug	Tue	46	1.10	70.40	0.52	0.58	47.08	53.1		0.11	0.70	47.27																		
53	8-Aug	Wed	47	1.75	72.15	0.47	1.28	48.36	73.0		0.05	1.33	48.59																		
54	9-Aug	Thu	48	1.60	73.75	0.69	0.91	49.28	57.1	66.8	0.06	0.98	49.57																		
55	10-Aug	Fri			73.75			49.28					49.57																		
56	11-Aug	Sat	49	1.40	75.15	0.67	0.73	50.01	52.3		0.09	0.83	50.39																		
57	12-Aug	Sun	50	1.00	76.15	0.54	0.47	50.47	46.5		0.06	0.52	50.92																		
58	13-Aug	Mon	51	1.39	77.54	0.60	0.79	51.26	56.7	66.1	0.06	0.85	51.76																		
59	14-Aug	Tue	52	1.40	78.94	0.51	0.89	52.15	63.3		0.08	0.96	52.73																		
60	15-Aug	Wed	53	0.85	79.79	0.38	0.47	52.61	55.1		0.11	0.58	53.31																		
61	16-Aug	Thu	54	1.40	81.19	0.50	0.90	53.51	64.3	65.9	0.07	0.97	54.27																		
62	17-Aug	Fri			81.19			53.51					54.27																		
63	18-Aug	Sat	55	1.80	82.99	0.80	1.00	54.51	55.4		0.05	1.05	55.32																		
64	19-Aug	Sun	56	1.60	84.59	0.67	0.93	55.44	58.3		0.04	0.98	56.30																		
65	20-Aug	Mon	57	1.40	85.99	0.60	0.80	56.24	57.0	65.4	0.06	0.86	57.16																		
66	21-Aug	Tue	58	2.40	88.39	1.08	1.33	57.57	55.2		0.08	1.40	58.56																		
67	22-Aug	Wed	59	2.00	90.39	0.67	1.33	58.90	66.6		0.13	1.46	60.02																		
68	23-Aug	Thu	60	1.65	92.04	0.95	0.70	59.60	42.2	64.8	0.11	0.81	60.83																		
69	24-Aug	Fri			92.04			59.60					60.83																		
70	25-Aug	Sat	61	2.20	94.24	1.16	1.04	60.64	47.2		0.07	1.11	61.93																		
71	26-Aug	Sun	62	1.70	95.94	0.45	1.25	61.88	73.4		0.10	1.35	63.28																		
72	27-Aug	Mon	63	0.85	96.79	0.52	0.33	62.21	38.7	64.3	0.08	0.41	63.70																		
73	28-Aug	Tue	64	2.00	98.79	0.70	1.31	63.52	65.3		0.07	1.38	65.07																		
74	29-Aug	Wed	65	1.80	100.59	0.61	1.20	64.71	66.4		0.07	1.26	66.34																		
75	30-Aug	Thu	66	2.40	102.99	1.45	0.95	65.66	39.6	63.8	0.08	1.03	67.36																		
76	31-Aug	Fri																													

Table 1.1.2 Test Record of Compost Pilot Study (Domestic waste)

Days	Date		W.No.	Waste Amount														Compost Material			Product Amount																COmpost Screening Date	
				Total		White Bag (Non-org)		Black Bag (Organic)													Residue									Fine Compost				Total					
								Total				Non-o	Organic					Add.	Total		1st Screen			2nd Screen			Total											
				Daily	Accu.	Daily	Accu.	Daily	Accu.	R-B1	R-B2	Daily	Daily	Accu.	R-O1	R-O2		Daily	Daily	Accu.	Daily	Accu.	R-1	Daily	Accu.	R-2	Daily	Accu.	R-R	Daily	Accu.	R-C1	R-C2	Accu.	R-P				
				ton	ton	ton	ton	ton	ton	%	%	ton	ton	ton	%	%		ton	ton	ton	ton	ton	%	ton	ton	%	ton	ton	%	ton	ton	%	%	ton	%				
0	5-Jul	Thu	1	0.54	0.541	0.200	0.200	0.34	0.34	63.0	63.0	0.056	0.285	0.29	83.6	83.6		0.0	0.29	0.29																			
1	6-Jul	Fri			0.541		0.200		0.34		63.0			0.29		83.6				0.29																			
2	7-Jul	Sat	2	0.64	1.181	0.230	0.430	0.41	0.75	64.1	63.6	0.086	0.324	0.61	79.0	81.1		0.0	0.32	0.61																			
3	8-Jul	Sun	3	0.60	1.781	0.061	0.491	0.54	1.29	89.8	72.4	0.073	0.466	1.08	86.5	83.3		0.0	0.47	1.08																			
4	9-Jul	Mon	4	0.50	2.281	0.048	0.539	0.45	1.74	90.4	76.4	0.070	0.382	1.46	84.5	83.6		0.0	0.38	1.46																			
5	10-Jul	Tue	5	0.50	2.78	0.037	0.576	0.46	2.21	92.6	79.3	0.082	0.381	1.84	82.3	83.4		0.0	0.38	1.84																			
6	11-Jul	Wed	6	0.70	3.48	0.030	0.606	0.67	2.88	95.7	82.6	0.096	0.574	2.41	85.7	83.9		0.0	0.57	2.41																			
7	12-Jul	Thu	7	0.55	4.03	0.147	0.753	0.40	3.28	73.3	81.3	0.063	0.340	2.75	84.4	84.0		0.0	0.34	2.75	0.12	0.12	22.7	0.18	0.18	33.6	0.30	0.30	56.4	0.23	0.23	43.6	8.5	0.54	19.5	13-Aug	Mon
8	13-Jul	Fri			4.03		0.753		3.28		81.3			2.75		84.0				2.75																			
9	14-Jul	Sat	8	0.90	4.93	0.414	1.167	0.49	3.76	54.0	76.3	0.104	0.382	3.13	78.6	83.3		0.0	0.38	3.13																			
10	15-Jul	Sun	9	0.84	5.77	0.143	1.310	0.70	4.46	83.0	77.3	0.120	0.580	3.71	82.9	83.2		0.0	0.58	3.71																			
11	16-Jul	Mon	10	0.49	6.26	0.082	1.392	0.41	4.87	83.2	77.8	0.057	0.350	4.06	86.0	83.4		0.0	0.35	4.06																			
12	17-Jul	Tue	11	0.60	6.86	0.159	1.551	0.44	5.31	73.5	77.4	0.060	0.380	4.44	86.4	83.7		0.0	0.38	4.44																			
13	18-Jul	Wed	12	0.50	7.36	0.101	1.652	0.39	5.71	79.6	77.5	0.074	0.320	4.76	81.2	83.5		0.0	0.32	4.76																			
14	19-Jul	Thu	13	0.51	7.87	0.119	1.771	0.39	6.10	76.6	77.5	0.060	0.330	5.09	84.6	83.6		0.0	0.33	5.09																			
15	20-Jul	Fri			7.87		1.771		6.10		77.5			5.09		83.6				5.09																			
16	21-Jul	Sat	14	0.60	8.46	0.147	1.918	0.45	6.55	75.4	77.3	0.091	0.359	5.45	79.8	83.3		0.0	0.36	5.45	0.06	0.18	22.9	0.09	0.27	33.9	0.15	0.46	56.9	0.11	0.35	43.1	6.3	0.80	14.7	20-Aug	Mon
17	22-Jul	Sun	15	0.72	9.19	0.164	2.082	0.56	7.11	77.3	77.3	0.124	0.436	5.89	77.9	82.9		0.25	0.68	6.14																			
18	23-Jul	Mon	16	0.66	9.84	0.109	2.191	0.55	7.65	83.4	77.7	0.119	0.428	6.32	78.2	82.6		0.19	0.62	6.75																			
19	24-Jul	Tue	17	0.45	10.29	0.087	2.278	0.36	8.01	80.6	77.9	0.103	0.259	6.58	71.5	82.1		0.12	0.38	7.13																			
20	25-Jul	Wed	18	0.62	10.91	0.127	2.405	0.49	8.50	79.4	78.0	0.124	0.366	6.94	74.7	81.6		0.10	0.47	7.60																			
21	26-Jul	Thu	19	0.47	11.38	0.092	2.50	0.38	8.88	80.5	78.1	0.089	0.291	7.23	76.6	81.4		0.16	0.45	8.05																			
22	27-Jul	Fri			11.38		2.497		8.88		78.1			7.23		81.4				8.05																			
23	28-Jul	Sat	20	0.40	11.78	0.059	2.556	0.34	9.23	85.4	78.3	0.065	0.279	7.51	81.1	81.4		0.05	0.33	8.38	0.13	0.31	21.3	0.22	0.49	33.8	0.35	0.81	55.0	0.31	0.66	45.0	7.8	1.46	17.5	27-Aug	Mon
24	29-Jul	Sun	21	0.39	12.17	0.083	2.639	0.30	9.53	78.6	78.3	0.093	0.211	7.72	69.4	81.0		0.05	0.26	8.64																			
25	30-Jul	Mon	22	0.24	12.41	0.048	2.687	0.19	9.73	80.1	78.4	0.035	0.158	7.88	81.9	81.0		0.06	0.21	8.85																			
26	31-Jul	Tue	23	0.37	12.78	0.087	2.774	0.28	10.01	76.5	78.3	0.096	0.188	8.07	66.2	80.6		0.11	0.29	9.15																			
26	1-Aug	Wed	24	0.39	13.18	0.105	2.879	0.29	10.30	73.2	78.1	0.09	0.195	8.26	67.9	80.3		0.02	0.22	9.37																			
27	2-Aug	Thu	25	0.29	13.46	0.074	2.95	0.22	10.51	74.4	78.1	0.072	0.143	8.41	66.5	80.0		0.05	0.20	9.56																			
28	3-Aug	Fri			13.46		2.953		10.51		78.1			8.41		80.0				9.56																			
29	4-Aug	Sat	26	0.38	13.85	0.119	3.072	0.26	10.77	68.9	77.8	0.105	0.159	8.57	60.2	79.5		0.09	0.25	9.81																			
30	5-Aug	Sun	27	0.24	14.09	0.061	3.133	0.18	10.96	75.2	77.8	0.065	0.118	8.68	64.6	79.2		0.06	0.18	9.99	0.13	0.44	18.8	0.39	0.88	37.7	0.52	1.32	56.5	0.36	1.02	43.5	10.2	2.34	23.5	3-Sep	Mon

1.2 WASTE COMPOSITION

(1) Market waste

Market waste of the study included approximately 72 % organic matter as shown Table 1.2.1.

Table 1.2.1 Market Waste Composition

(% in wet basis)

Organic	Paper	Plastic	Metal	Glass	Others	Total
72.4	6.0	11.6	1.2	0.9	7.9	100.0

(Survey period: 16 to 22 June 2001)

(2) Separated domestic waste

1) Source separation ratio

By source separation of domestic waste, 78% of domestic waste was discharged as organic waste and 22 % of domestic waste was discharged as non-organic waste.

2) Separated domestic waste composition

Separated organic domestic waste has contained approximately 84 % of organic material as shown in Table 1.2.2.

On the other hand, separated non-organic waste has also contained 22 % of organic material

Table 1.2.2 Domestic Waste Composition

(% in wet basis)

Waste	Organic	Paper	Plastic	Metal	Glass	Others	Total
Organic	83.5	3.8	10.3	0.2	0.6	1.6	100.0
Non-organic	22.0	23.7	30.5	3.9	8.3	11.6	100.0

(Survey period: 5 to 16 July 2001)

Detailed data of waste composition are shown in Table 1.2.3 and 1.2.4.

Trends of waste composition ratio are shown in Figure 1.2.1, 1.2.2, and 1.2.3.

Table 1.2.3 Detailed data of market waste composition

Date	Organic		Non Organic												Total
			Plastic		Paper		Glass		Metal		Others		Total		
	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)
2001/6/16	814.0	74.0	133.7	12.2	42.3	3.8	13.7	1.2	9.5	0.9	86.8	7.9	286.0	26.0	1,100.0
2001/6/17	965.3	69.0	211.5	15.1	79.5	5.7	27.3	2.0	28.7	2.1	87.7	6.3	434.7	31.1	1,400.0
2001/6/18	2,7332.9	80.4	290.5	10.0	128.0	4.4	12.5	0.4	33.0	1.1	103.1	3.6	567.1	19.6	2,900.0
2001/6/19	1,101.0	75.9	165.0	11.4	120.0	8.3	12.5	0.9	8.0	0.6	43.5	3.0	349.0	24.1	1,450.0
2001/6/20	1,131.2	75.4	106.0	7.1	90.0	6.0	7.0	0.5	12.0	0.8	153.8	10.3	368.8	24.6	1,500.0
2001/6/21	714.5	51.0	228.0	16.3	123.0	8.8	15.0	1.1	25.0	1.8	294.5	21.0	685.5	49.0	1,400.0
SUM	7,058.9	72.4	1,134.7	11.6	582.8	6.0	88.0	0.9	116.2	1.2	769.4	7.9	2691.1	27.6	9,750.0

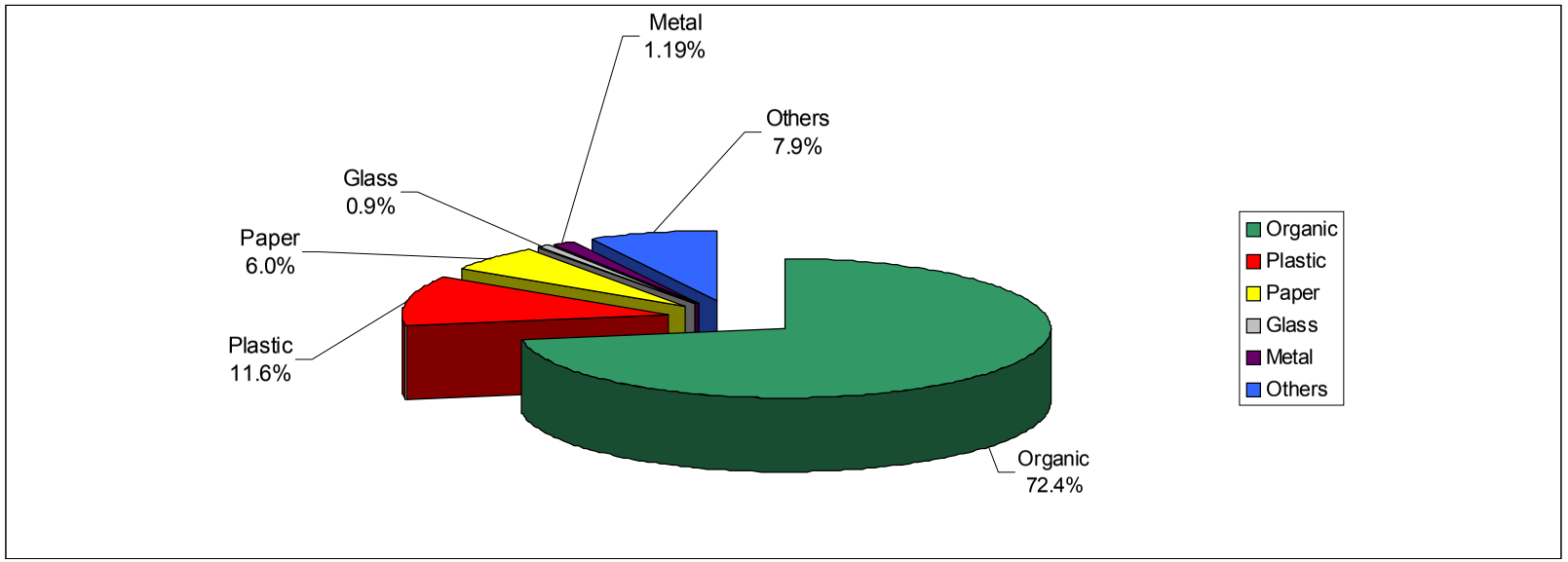


Table 1.2.4 Detailed data of separated domestic waste composition

Date	Organic		Non-organic												Total
			Plastic		Paper		Glass		Metal		Others		Sub-total		
	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)	Ratio (%)	Weight (kg)
2001/7/5	0.285	83.8	0.038	11.2	0.006	1.8	0.002	0.6	0.001	0.3	0.008	2.4	0.055	16.2	0.340
2001/7/6															
2001/7/7	0.324	78.6	0.050	12.1	0.015	3.6	0.002	0.5	0.001	0.2	0.02	4.9	0.088	21.4	0.412
2001/7/8	0.466	86.1	0.045	8.3	0.015	2.8	0.005	0.9	0.001	0.2	0.009	1.7	0.075	13.9	0.541
2001/7/9	0.382	84.1	0.048	10.6	0.016	3.5	0.002	0.4	0.000	0.0	0.006	1.3	0.072	15.9	0.454
2001/7/10	0.381	82.1	0.055	11.9	0.018	3.9	0.004	0.9	0.001	0.2	0.005	1.1	0.083	17.9	0.464
2001/7/11	0.574	85.7	0.058	8.7	0.027	4.0	0.001	0.1	0.001	0.1	0.009	1.3	0.096	14.3	0.670
2001/7/12	0.340	84.4	0.036	8.9	0.019	4.7	0.002	0.5	0.001	0.2	0.005	1.2	0.063	15.6	0.403
2001/7/13															
2001/7/14	0.382	78.3	0.071	14.5	0.021	4.3	0.003	0.6	0.001	0.2	0.01	2.0	0.106	21.7	0.488
2001/7/15	0.580	84.1	0.062	9.0	0.033	4.8	0.005	0.7	0.001	0.1	0.009	1.3	0.110	15.9	0.690
2001/7/16	0.350	86.0	0.038	9.3	0.015	3.7	0.001	0.2	0.001	0.2	0.002	0.5	0.057	14.0	0.407
SUM	4.064	83.5	0.501	10.3	0.185	3.8	0.027	0.6	0.009	0.2	0.083	1.7	0.805	16.5	4.869

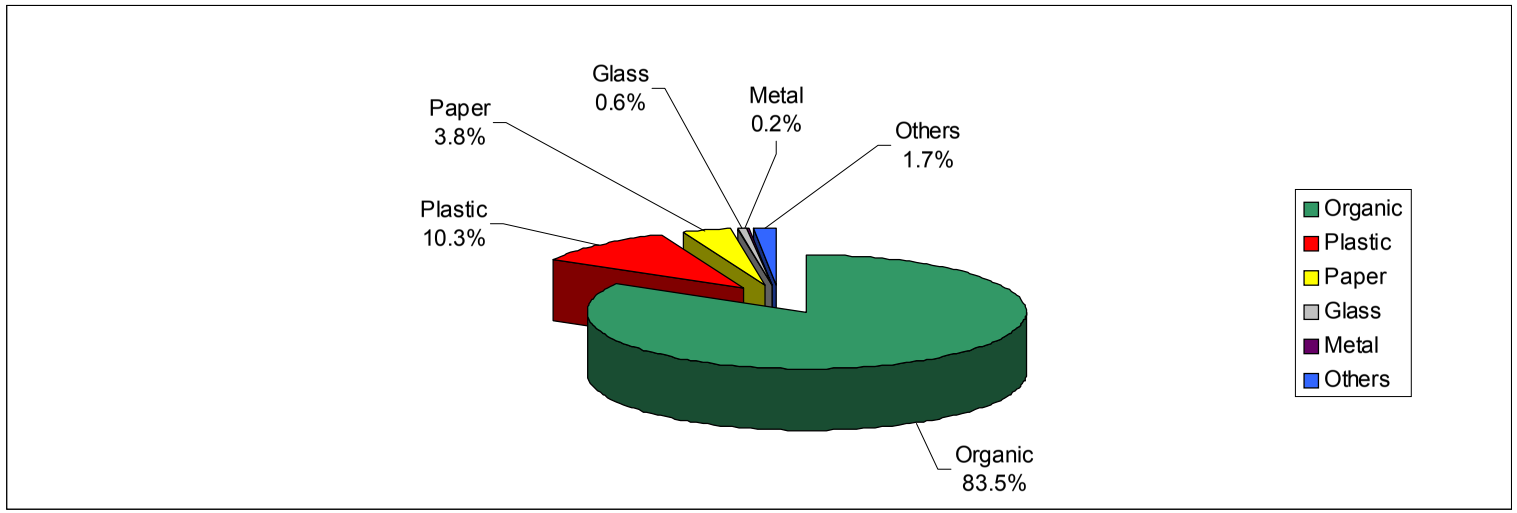


Figure 1.2.1, 1.2.2, and 1.2.3 Trends of Organic Waste

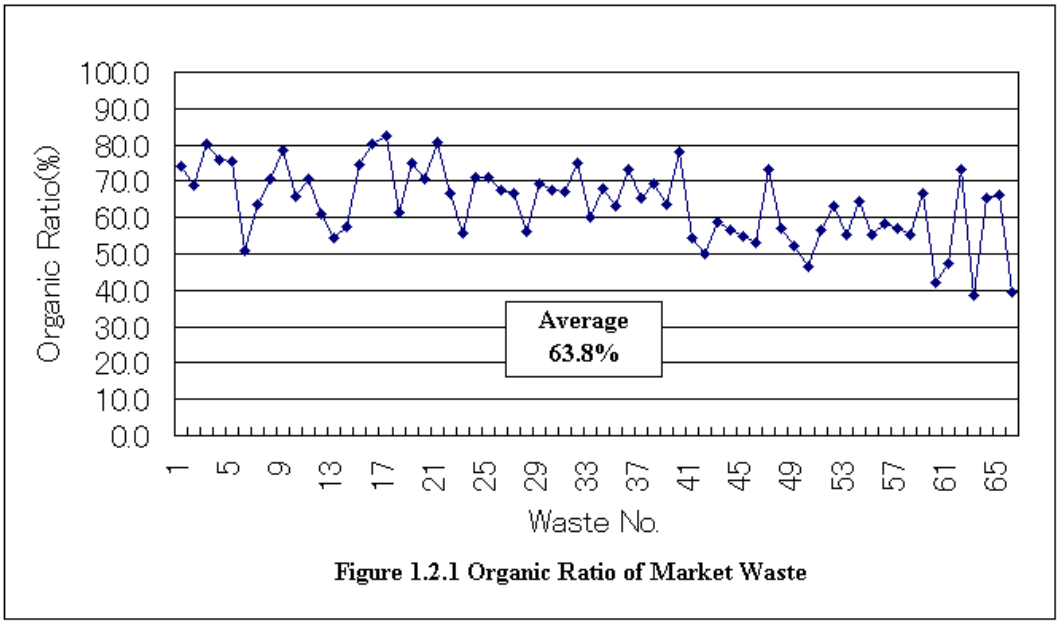


Figure 1.2.1 Organic Ratio of Market Waste

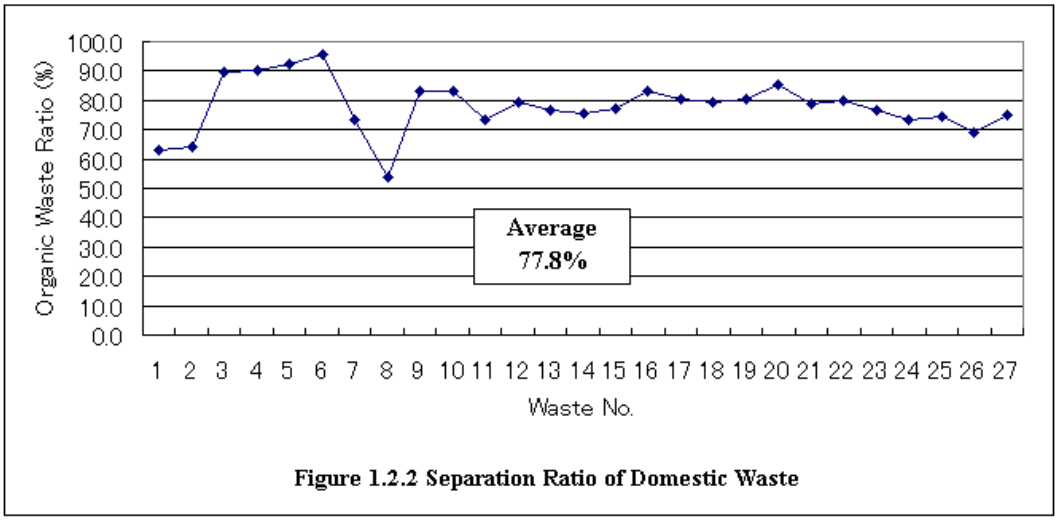


Figure 1.2.2 Separation Ratio of Domestic Waste

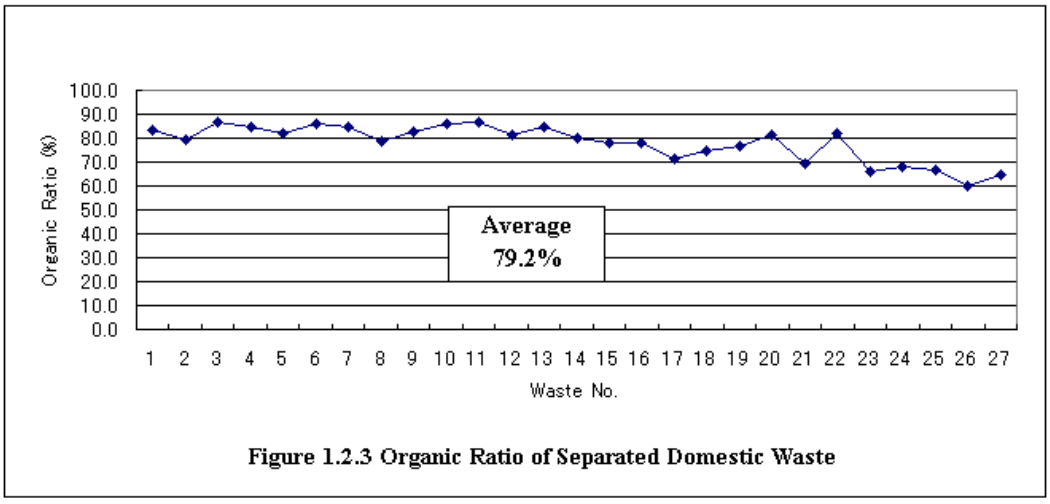


Figure 1.2.3 Organic Ratio of Separated Domestic Waste

1.3 COMPOST PRODUCTION RATIO

In the study approximately 23 to 35 % of organic material changed to coarse compost.

Coarse compost has been screened by 2-stage screen for eliminating foreign mater.

First screen is existing vibrating screen with16 mm holes and the second one is hand operated screen with10 mm wire mesh, therefore fine compost was approximately 30 to 40 % of coarse compost.

Consequently compost production ratio became as shown in Table 1.3.1.

Table 1.3.1 Compost Production Ratio

(% in wet basis)

Waste	Organic Mater	Coarse Compost	1st Screen Reject	2nd Screen Reject	Fine Compost
Market Waste	100	34.2	16.0	7.8	10.4
Domestic Waste	100	23.5	4.4	8.9	10.2

Detailed data of compost production ratio are shown in Table 1.1.2 and 1.1.3 aforementioned.

Trends of waste compost production ratio are shown in Figure 1.3.1, 1.3.2, and 1.3.3

1.4 COMPOST QUALITY

Compost quality produced in pilot study is summarized as shown in Table 1.4.1.

Table 1.4.1 Compost quality of pilot study

Item			Standard in Syria No. 2014-1998 (Ministry of Industry)	Pilot Study in Lattakia (Jun-Aug 2001)	Damascus Compost Plant Standard in Catalogue
Particle size (under 12 mm)		%	>95	99.1-99.4	-
Organic Material		%	>35	40.1-43.2	45-50
C/N Ratio		-	<25	22.3-26.8	Appox. 30
Chemical component	C	%	-	19.8-20.9	40-45
	N	%	-	0.78-0.89	1.5>
pH		-	5-8	7.20-8.32	6.5-7.8
Moisture		%	<35	28.6-28.9	25-30
Metal and glass		%	<1	0.08-0.26	-

Detailed data of compost quality are shown in Table 1.4.2.

Compost quality standard in Syria is attached as Appendix 13.

Figure 1.3.1, 1.3.2, and 1.3.3 Trends of Waste Compost Production Ratio

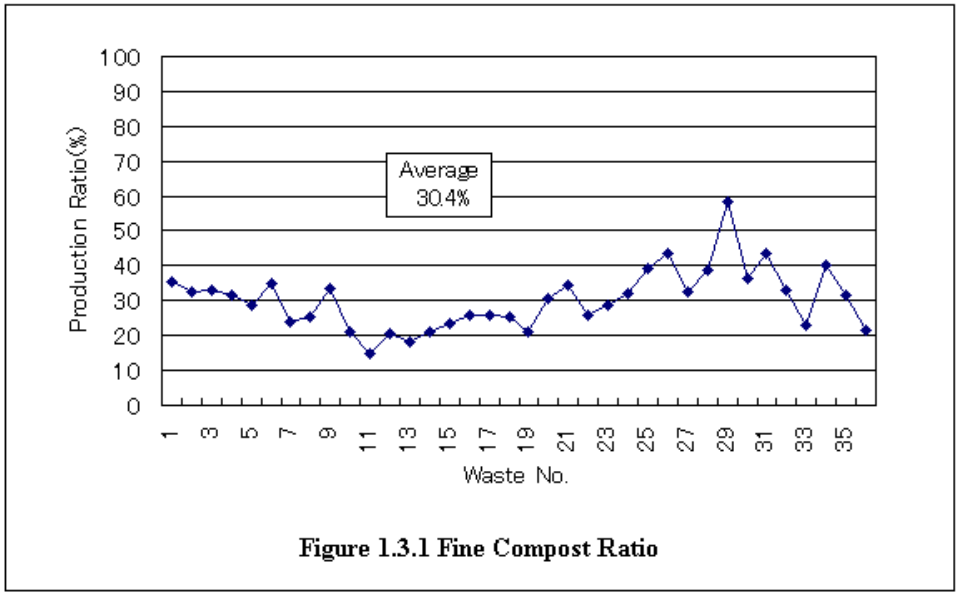


Figure 1.3.1 Fine Compost Ratio

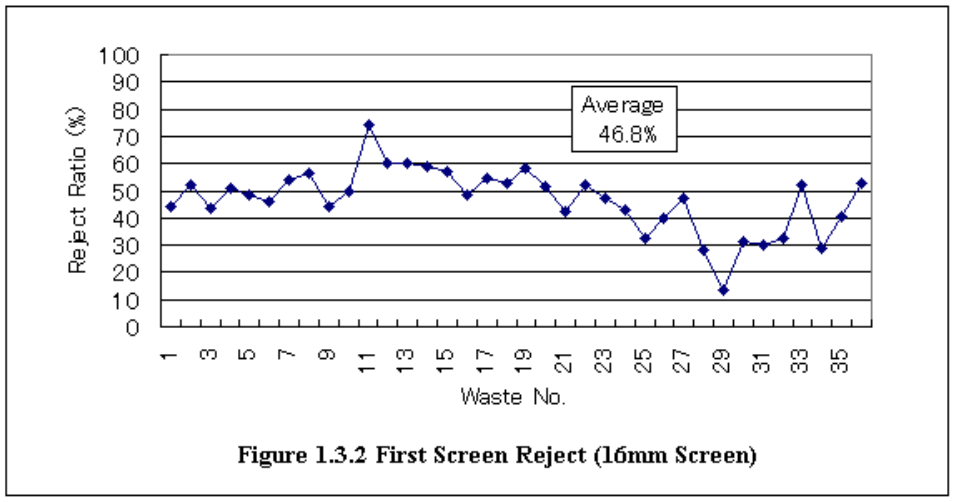


Figure 1.3.2 First Screen Reject (16mm Screen)

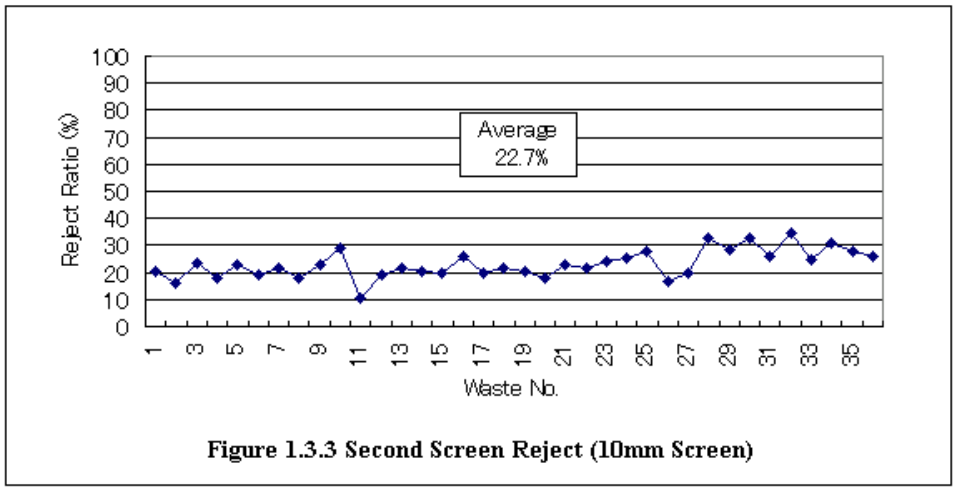


Figure 1.3.3 Second Screen Reject (10mm Screen)

Table 1.4.2 Detailed Data of Compost Quality (1)

Item			Standard in Syria		Lattakia							
			Ministry of Industry No. 2014-1998		Existing	Market Waste Compost						
					Mar. 2001	Coarse Compost		Fine Compost				Super Fine Compost
					CQT	Dr. Abd Al-Elah	L.U. Lab.	CQT	Dr. Al-Elah	L.U. Lab (1)	L.U. Lab (2)	L.U. Lab.
Particle size (under 12mm)		%	>95		-	-		99.1-99.4	-	-	-	-
Organic Material		%	>35		24.3-39.0	-	-	40.1-43.2	-	-	-	-
C/N Ratio			<25		16.1-39.3	-	-	22.3-26.8	-	-	-	-
Chemical component	C	%	-		-	-	-	19.8-20.9	-	-	-	-
	N	%	-		-	-	-	0.78-0.89	-	-	-	-
	H	%	-		5.36-5.74	-	-	7.56-7.92	-	-	-	-
	Cl	%	-		-	4.33	0.2261	3.45-3.49	3.28-3.91	0.348(liqid)	0.2122	0.1495
pH			5-8		-	8.18	7.18	8.31-8.32	8.10-8.50	7.31	7.2	7.35
Electric Conductivity (1:10)		mS/cm	<1(Actual 10-20)		-	21.0	10.19	7.0-7.5	17.0-22.0	11.38	9.5	7.09
Moisture		%	<35		10.4-13.6	-	-	28.6-28.9	-	-	-	-
Metal and glass		%	<1		<1-4	-	-	0.08-0.26	-	-	-	-
Heavy metal			Deg.(1)	Deg.(2)								
	As	ppm	<15	<25	1.612-3.58	-	-	-	18.5-20.05	-	-	-
	Cd	ppm	<3	<5	0.39-7.34	-	-	0.144-0.461	<0.2	-	-	-
	Cr	ppm	<100	<150	41.1-72.7	-	-	54.3-69.6	63.4-79.6	-	-	-
	Cu	ppm	<150	<250	137.3-1577	401	54.23	362-494	239-681	489-577	146.07	197.34
	Pb	ppm	<120	<150	83.3-522	-	-	97.1-115.3	12.26-31.4	-	-	-
	Hg	ppm	<1.5	<3	1.903-5.35	0.390	0.394	2.96-5.22	0.347-0.693	0.482-0.616	0.38	0.538
	Ni	ppm	<50	<70	47.0-80.4	-	51.18	44.9-55.7	98.5-142.4	-	56.83	80.4
	Zn	ppm	<350	<500	391-603	-	-	341-434	245-452	-	-	-

Table 1.4.2 Detailed Data of Compost Quality (2)

Item			Lattakia									Damascus	
			Market Waste			Domestic Waste Compost					Soil	Catalogue	Measurement
			Mix	Grass	Water Melon	Coarse Compost		Fine Compost		Super Fine Compost	Al-Bassa		Mar. 2001
			L.U. Lab.	L.U. Lab.	L.U. Lab.	CQT	L.U. .Lab	CQT	L.U. Lab.	L.U. Lab.	L.U. Lab.		CQT
Particle size (under 12mm)	%		.	-	-	-	-	100.0	-	-	-	-	-
Organic Material	%		-	-	-	-	-	51.7-54.4	-	-	-	45-50	39.5-48.7
C/N Ratio			-	-	-	-	-	24.4-25.6	-	-	-	Appox. 30	52-78.6
Chemical component	C	%	-	-	-	-	-	22.5-25.7	-	-	-	40-45	-
	N	%	-	-	-	-	-	0.92-0.99	-	-	-	1.5>	-
	H	%	0.1391	0.1948	0.1774	-	-	6.42-6.80	-	-	-	-	8.63-9.44
	Cl	%	-	-	-	1.45	0.2156	1.69-1.73	0.2365	0.1391	0.0069	1.3-1.6	-
pH			6.14	6.06	5.53	8.4	7.26	8.3-8.4	7.37	7.28	7.49	6.5-7.8	-
Electric Conductivity (1:10)	mS/cm		9.74	14.31	14.04	4.5	10.35	5.0-5.5	11.11	6.51	0.37	-	-
Moisture		%	-	-	-	22.4	-	18.2-23.0	-	-	-	25-30	37.0-43.6
Metal and glass		%	-	-	-	-	-	0.62-0.83	-	-	-	-	<1
Heavy metal													
	As	ppm	-	-	-	-	-	-	-	-	-	-	0.736-0.917
	Cd	ppm	-	-	-	0.183	-	0.94-1.26	-	-	-	-	0.504-0.922
	Cr	ppm	-	-	-	70.4	-	61.1-67.2	-	-	-	-	37.1-59.3
	Cu	ppm	183.65	29.34	41.24	238.7	86.26	156.4-160.2	180.55	127.56	16.76	-	137.5-180.8
	Pb	ppm	-	-	-	71.7	-	45.0-68.3	-	-	-	-	116.9-168.9
	Hg	ppm	0.321	0.205	0.157	3.92	0.585	6.92-7.88	0.629	0.853	0.188	-	0.823-3.27
	Ni	ppm	35.63	21.07	25.49	136.1	17.19	45.4-46.3	60.11	80.51	193.58	-	16.9-22.1
	Zn	ppm	-	-	-	407.9	-	367-376	-	-	-	-	361-608

1.5 OPERATION DATA

1.5.1 Temperature

Fermentation temperature of market waste reached peak of about 70 deg. C in around 6 days. On the other hand, temperature of separated domestic waste did not have peak due to high moisture (more than 80 %). Therefore, in the later half of the study the second screening reject of the market coarse compost was added as moisture control of the waste.

Consequently the fermentation temperature reached peak of about 60 deg. C in around 6 days.

Figure 1.5.1 shows the daily composting temperature during the study.

1.5.2 Bulk density

Initial bulk density of the waste was 0.4 to 0.7 ton/m^3 and final one of coarse compost was around 0.4 ton/m^3 as shown Figure 1.5.2.

Table 1.5.1 and 1.5.2 shows the detailed bulk density of coarse compost.

1.5.3 .5.3 Moisture

Initial moisture of the pre-treated waste was 70 to 85 % and final one of coarse compost was around 35 % as shown Figure 1.5.3.

The detailed moisture data are shown in Table 1.5.3 and 1.5.4.

Original test data are shown in Appendix 13.

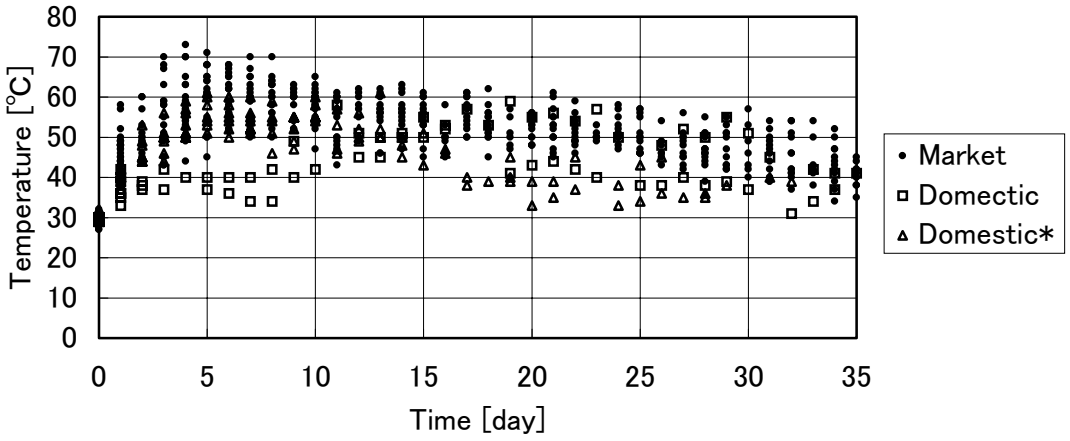


Figure 1.5.1 Temperture

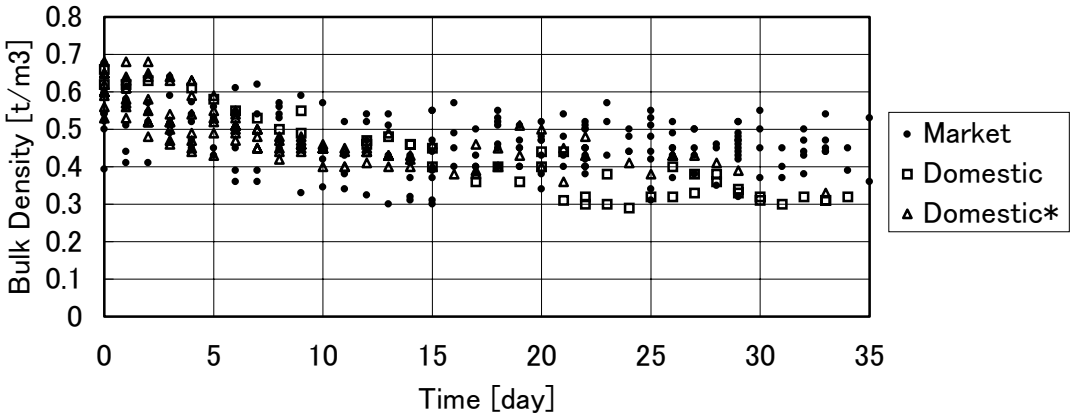


Figure 1.5.2 Bulk Density

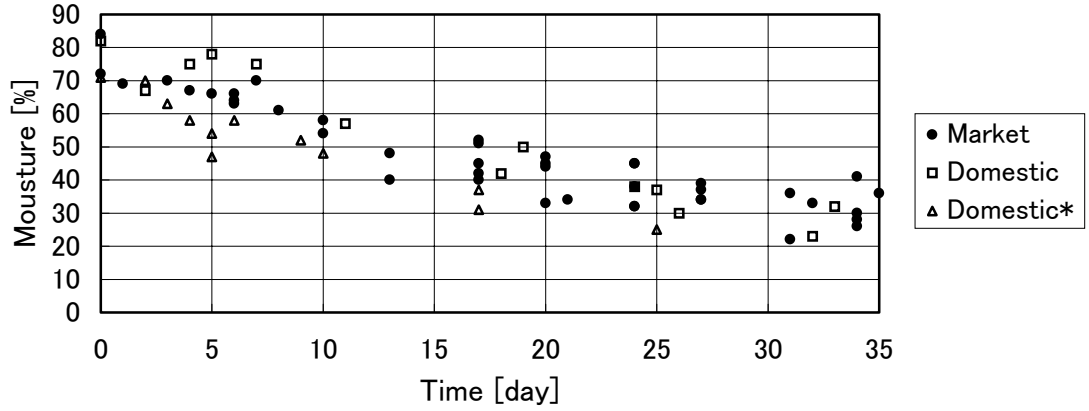


Figure 1.5.3 Moisture

Note: Domestic* means domestic waste with the second screening reject of market waste coarse compost for moisture control.

Table 0.1 Bulk Density of Market Waste Compost

(Unit: ton/m^3)

Sampling Date		First Reject 16 mm Screen	Second Reject 10 mm Screen	Fine compost
2001/7/22	A	0.26	0.46	0.63
	B	0.22	0.44	0.64
	C	0.26	0.44	0.64
	Ave.	0.25	0.45	0.64
2001/7/23	A	0.43	0.43	0.68
	B	0.38	0.46	0.65
	C	0.32	0.45	0.62
	Ave.	0.38	0.45	0.65
2001/7/24	A	0.42	0.46	0.61
	B	0.43	0.47	0.64
	C	0.44	0.48	0.64
	Ave.	0.43	0.47	0.63
Average		0.35	0.45	0.64
Composition Ratio	%	46.8	22.7	30.4
Overall(Before screening)		0.46		

Table 1.5.2 Bulk Density of Domestic Waste Compost

(Unit: ton/m^3)

Sampling Date		First Reject 16 mm Screen	Second Reject 10 mm Screen	Fine compost
2001/7/22	A	0.22	0.31	0.52
	B	0.22	0.31	0.51
	C	0.23	0.34	0.49
	Ave.	0.22	0.32	0.50
Composition Ratio	%	18.8	37.7	43.5
Overall(Before screening)		0.38		

Table 1.5.3 Moisture of Waste after shredding

Waste	Sampling Date		Moisture (%)
Market	2001/6/24	A	84.6
		B	83.5
		C	85.4
		Ave.	84.5
	2001/6/30	A	74.4
		B	71.9
		C	70.8
		Ave.	72.4
Domestic	2001/7/14	A	81.4
		B	82.9
		C	82.3
		Ave.	82.2
Domestic*	2001/7/28		71.3

Domestic* means moisture controlled domestic waste with second reject of market waste compost.

Table 1.5.4 Moisture of Fine Compost

Market Waste	
Sampling Date	Moisture (%)
2001/7/22	25.8
	29.3
	28.9
	28.6
	28.6
2001/7/23	26.2
2001/7/25	25.9
	29.1
	27.0
2001/7/29	25.5
	25.8
2001/8/2	27.9
	27.0
Average	27.4

Domestic Waste	
Sampling Date	Moisture (%)
2001/8/14	23.0
	21.5
	18.2
	22.4
2001/8/15	20.9
2001/8/20	27.1
2001/821	24.7
	25.9
Average	23.0

1.6 TEST EQUIPMENT

Main test equipment specifications are as follows:

(1) Crusher

(1) Type : Two(2) shafts blade type
(2) Motor : Geared motor, 5.5 HP, 380 V, 50 Hz, 72 r.p.m
(3) Rotating speed
- Motor side : 72 r.p.m
- Another side : 60 r.p.m

(1) Structure : Refer to Figure 1.6.1
(2) Preparation
- Design : JICA Study team
- Manufacturing : Syrian maker (according to supplied drawing)

(2) Hand screen

(1) Type : Wooden case, steel support type
(2) Dimension : 600 mmW x 1,000mmL x 200mmH
(3) Opening : 10 mm (2 mesh)
(4) Structure : Refer to Figure 1.6.2
(5) Preparation
- Design : JICA Study team
- Manufacturing : Syrian maker (according to supplied drawing)

(3) Moisture meter

(1) Type : Infrared light type portable moisture meter
(2) Model : FD-620 (Kett Co., Ltd.)
(3) Accuracy : 0.2 %

(4) Thermometer

(1) Type : Digital type portable thermo meter
(2) Model : SK-1250MC II
(3) Span : -30.0 to 150.0 Deg. C

1.7 CONTINUATION OF THE PILOT STUDY

The pilot study should be continued by Syrian side the following method.

1.7.1 Composting Condition

(1) Fermentation

(1) Pile : 1 pile contains 3 days material (Sta.-Mon, Tue-Thu)
(2) Turning : Every day
(3) Period : 2 Weeks

(2) Maturing

(1) Pile : 1 pile contains 6 days material(Sta-Tue)
(2) Turning : Once a week
(3) Period : 6 Weeks

1.7.2 Measurement Item

(1) Weight : Waste and compost
(2) Temperature : Every day, Every Pile by Thermometer
(3) Moisture
- Pile : At turning time by hand feeling
- Compost : 1 measurement /1pile by digital humidity meter

1.7.3 Evaluation of the Compost Effect on Agriculture

Syrian side should distribute the compost produced by the pilot study to farmers, then collect and summarize the results of following questionnaire.

Questionnaire Farmers who received Pilot Study Compost Sample

Name:_____
Address:_____

Q1. For what did you use the compost?
- ☐ Vegetable
- ☐ Fruit
- ☐ Tree planting
- ☐ Others ( )

Q2. How did you use the compost?
- ☐ Only compost
- ☐ Mixture with other fertilizer
- ☐ Others ( )

Q3. When did you use the compost?
- ☐ After harvest / Before the planting
- ☐ Beginning / During planting
- ☐ Others ( )

Q4. How much did you use the compost ?
Quantity ( ) kg
Applied area ( ) Donom

Q5. How is the affect of the compost?
- ☐ Bigger products amount
- ☐ Better product quality
- ☐ Others ( )

Q6. How did you feel the compost quality?
- ☐ Excellent
- ☐ Good
- ☐ Fair
- ☐ Not satisfied (Why?)
- ☐ Others ( )

Q7. According to your test, how much do you want to buy the compost?
Quantity ( ) kg
Applied area ( ) Donom

Q8. Do you have any comments for the compost?
( )

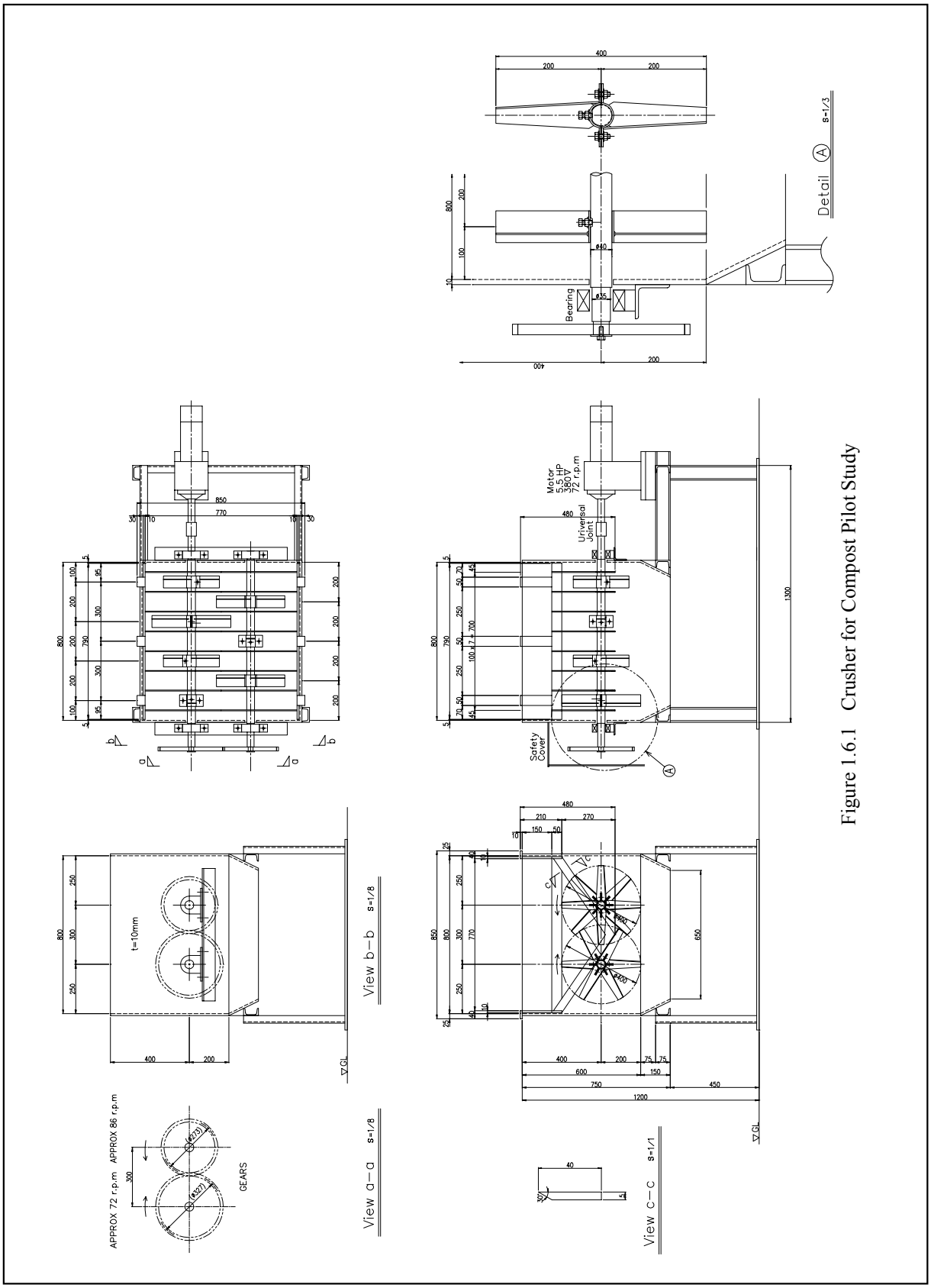


Figure 1.6.1 Crusher for Compost Pilot Study

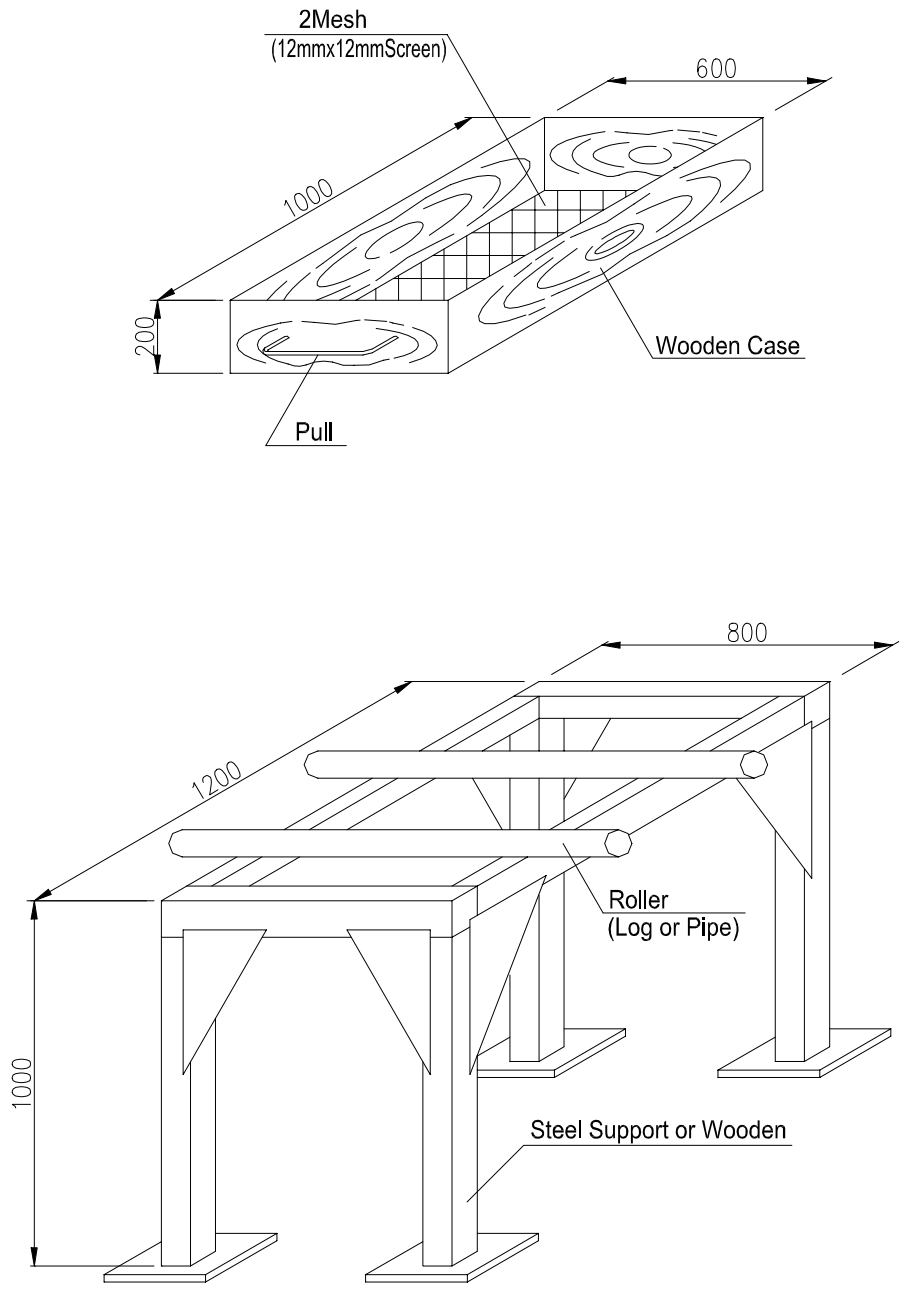


Figure 1.6.2 Temporary Hand Screan

SECTION 2

PUBLIC AWARENESS CAMPAIGN

SECTION 2 PUBLIC AWARENESS CAMPAIGN

The details of the public awareness campaign conducted in the study are shown in the following figures and tables.

"We don't Inherit Earth from Our Parents, We Borrow it from Our Children"

Did You Know?

Every Household Generates 2.5 kg of Domestic Wastes Every Day, Out of Which 1.5 kg are Composed of Organic Wastes…

Separated Organic Wastes Could be Easily Transformed into Useful Composts for Agriculture…

You are Participating to the Preparation of a Better Future for Your Children.

The Campaign is Organized by JICA Study Team in Lattakia and Municipality of Lattakia in Cooperation with Women's Union in Lattakia

THE **JICA** STUDY

ON SOLID WASTE MANAGEMENT AT LOCAL CITIES IN THE SYRIAN ARAB REPUBLIC

PUBLIC AWARENESS CAMPAIGNS ON ENVIRONMENT
LATTAKIA

LET'S KEEP OUR CITY CLEAN AND BEAUTIFUL

CAMPAIGN ON WASTE SEPARATION AT SOURCE

30 JUNE - 27 JULY

2001

"Let's Keep Our City Clean and Beautiful"

Dear Lady,

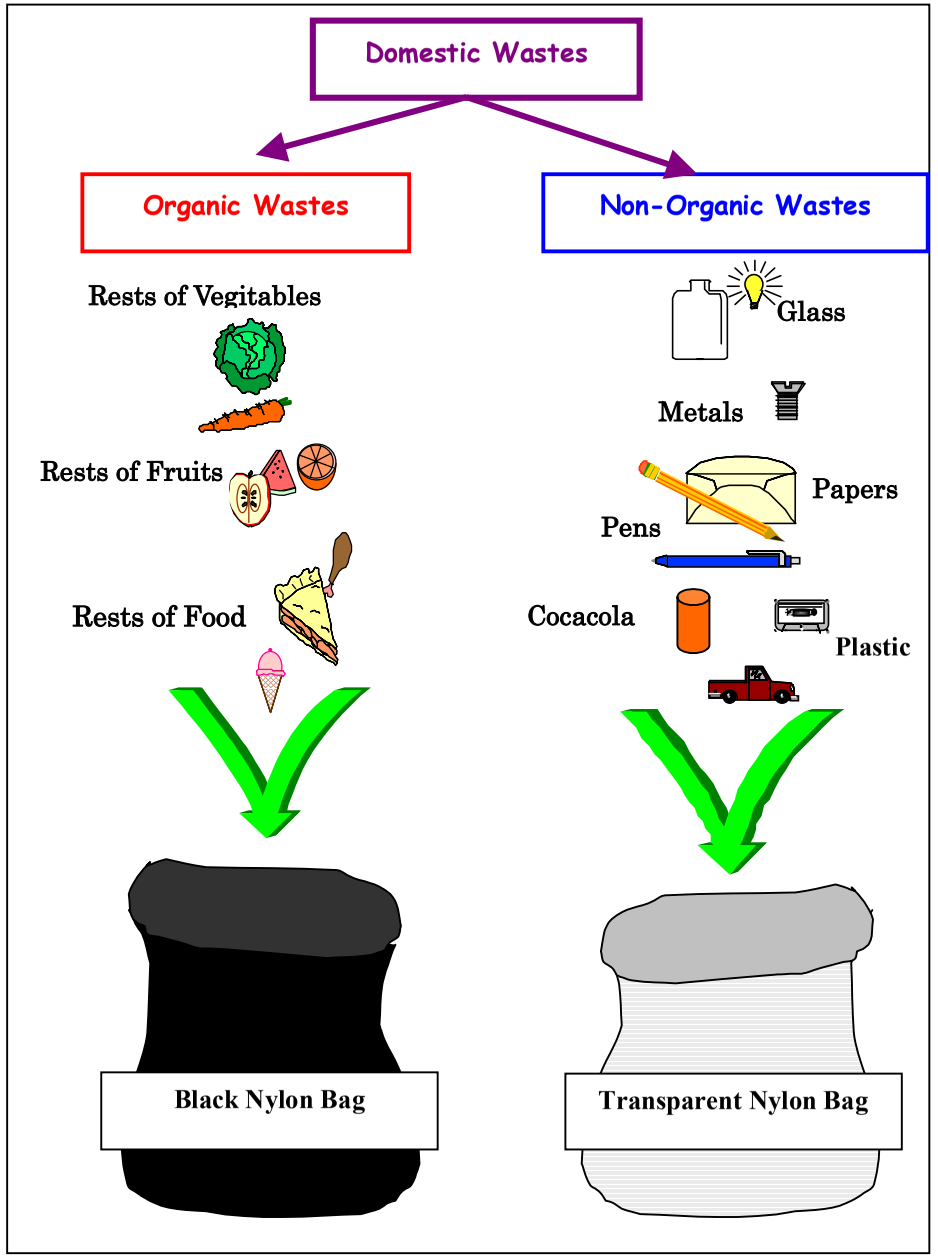
You are participating to an Experimental Campaign on Domestic Waste Separation at Source.

Every day, during the period of the Campaign, The Employees of the Cleaning Department in the Municipality shall take care of your own Domestic Waste.

The Municipality shall provide you two Separate Nylon Bags Every Day:

- One Black for Organic Waste
- One Transparent for Non-Organic Waste

All What You Are Asked to Do is to Put Your Wastes in the Suitable Bags… The Next Morning, The Employees of the Municipality Shall Knock at your Door to take the Two bags and Give You Two New Ones…and So On…



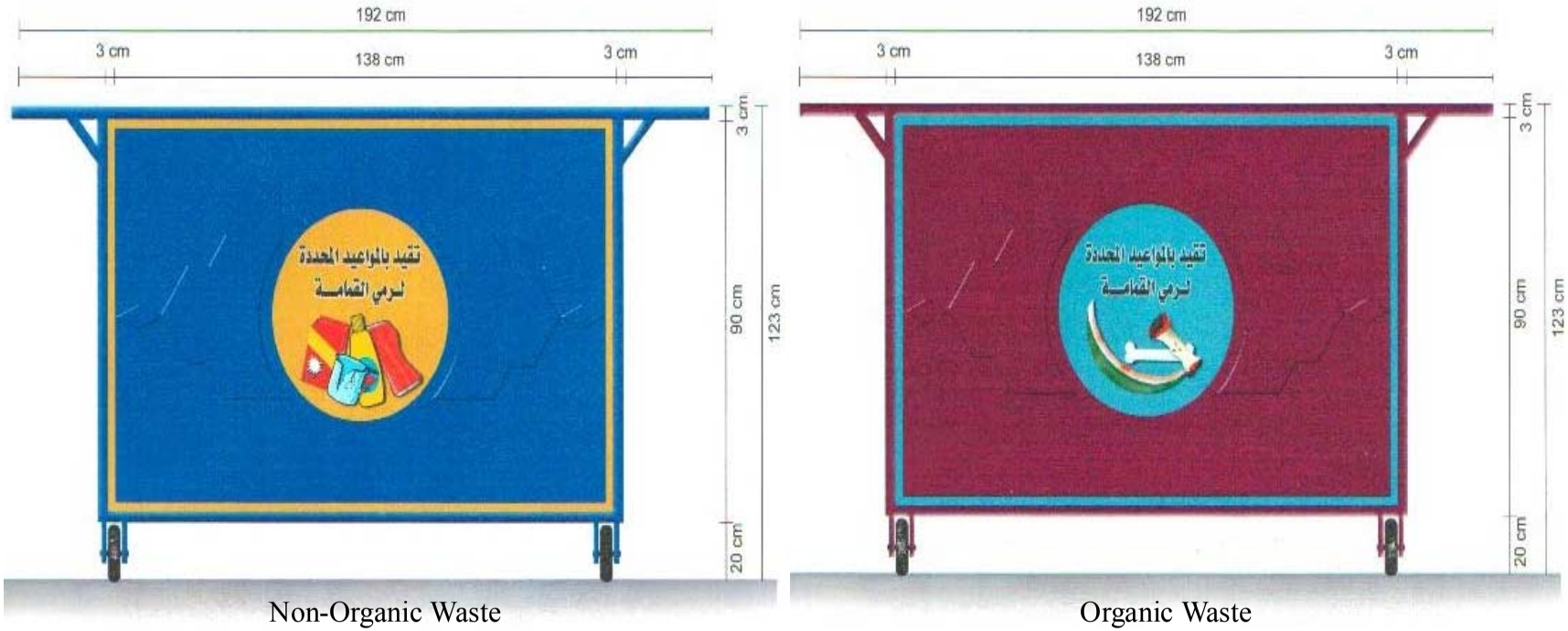


Figure Color & Draft Design of Containers

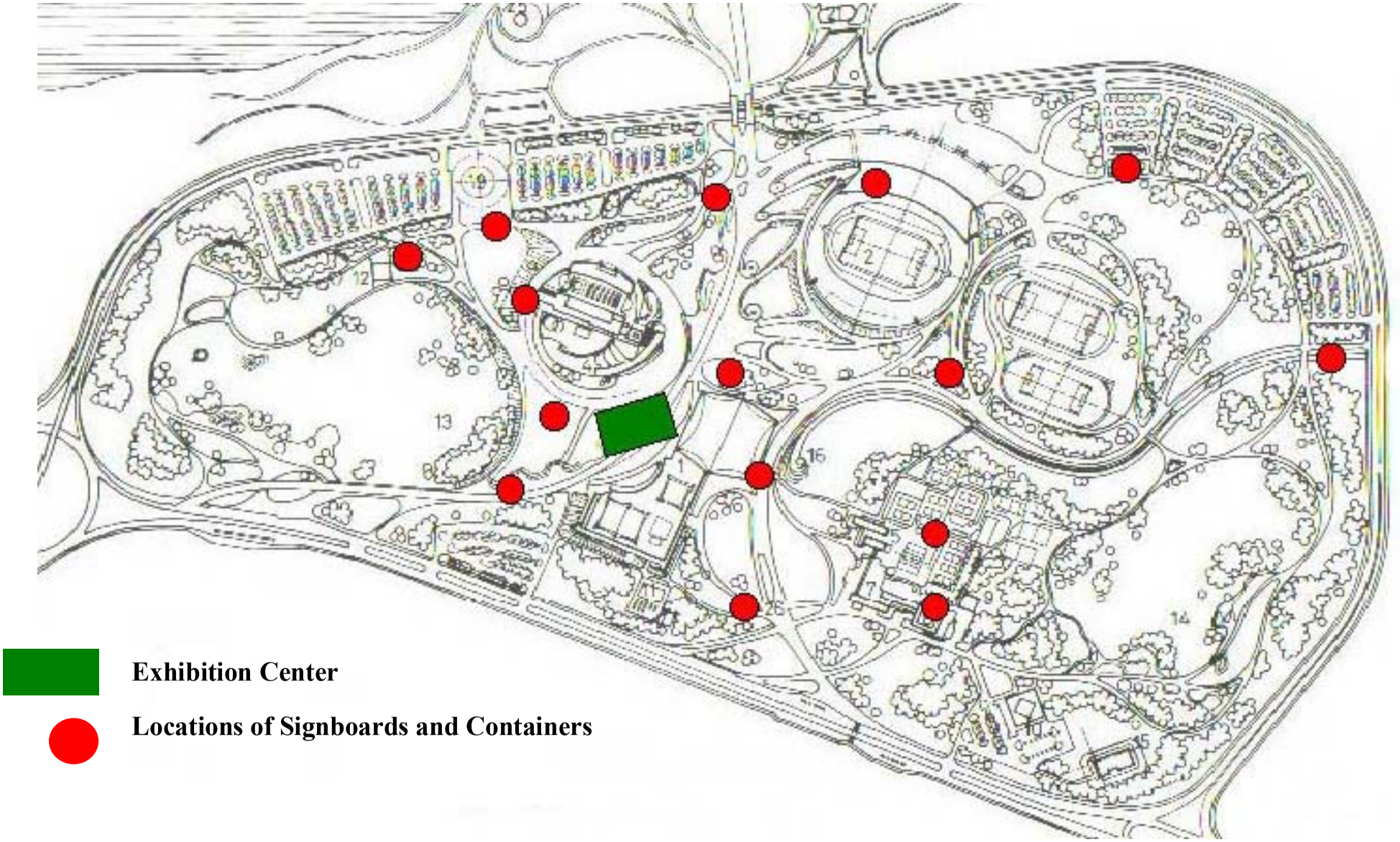

Exhibition Center
Locations of Signboards and Containers

Photo 1 Compost Pilot Study

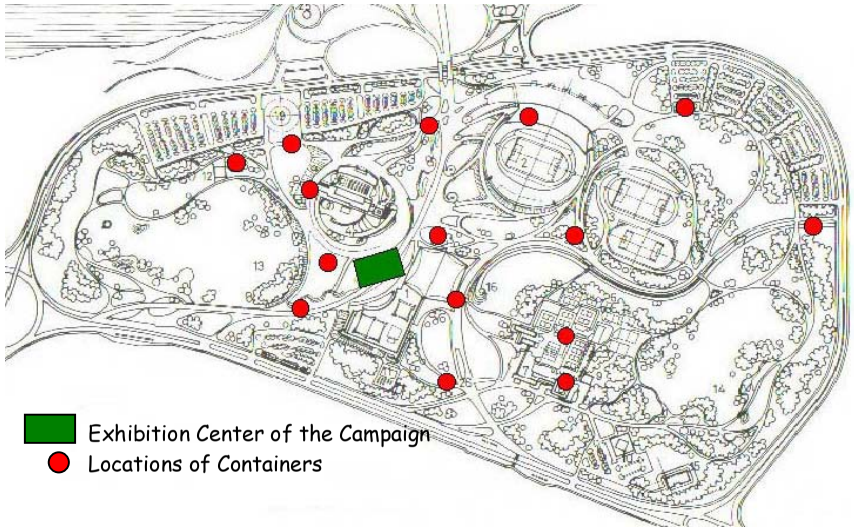
Photo 2 Improvement of Al Bassa Site

Photo 3 Improvement of Al Bassa Site

Photo 4 Scavengers in Al Bassa Site

Photo 5 Cleansing Workers

Photo 6 Waste Collection



The main Artistic Events
The Maine Hall
21 Pm

Date	Artistes
Fri 3 August	وضاح شبلي- سعدون جابر- أصالة نصري- الياس كرم
Sat 4 August	سميرة سمرة- سهام بارهيم- نهاد طربيه- دانية مصطفى- صابر الرباعي
Sun 5 August	بسام حسن- رانيا شعبان- نعيم حمدي- مجد القاسم- محمد اسكندر
Mon 6 August	سميرة يزبك- حمام خيري- نجوى كرم- عاصي الحلاني
Thus 7 August	صباح فخري وفرقته
Wend 8 August	ميادة بسيليس- كنانة القصير- نور مهنا- فضل شاكر-شهد برمدا
Thir 10 August	عبير فضة- أحمد الجنبري- هويدا- علاء زلزلي

THE **JICA** STUDY
ON SOLID WASTE MANAGEMENT AT LOCAL CITIES
IN THE SYRIAN ARAB REPUBLIC

PUBLIC AWARENESS CAMPAIGNS ON ENVIRONMENT
LATTAKIA

LET'S KEEP OUR CITY
CLEAN AND BEAUTIFUL

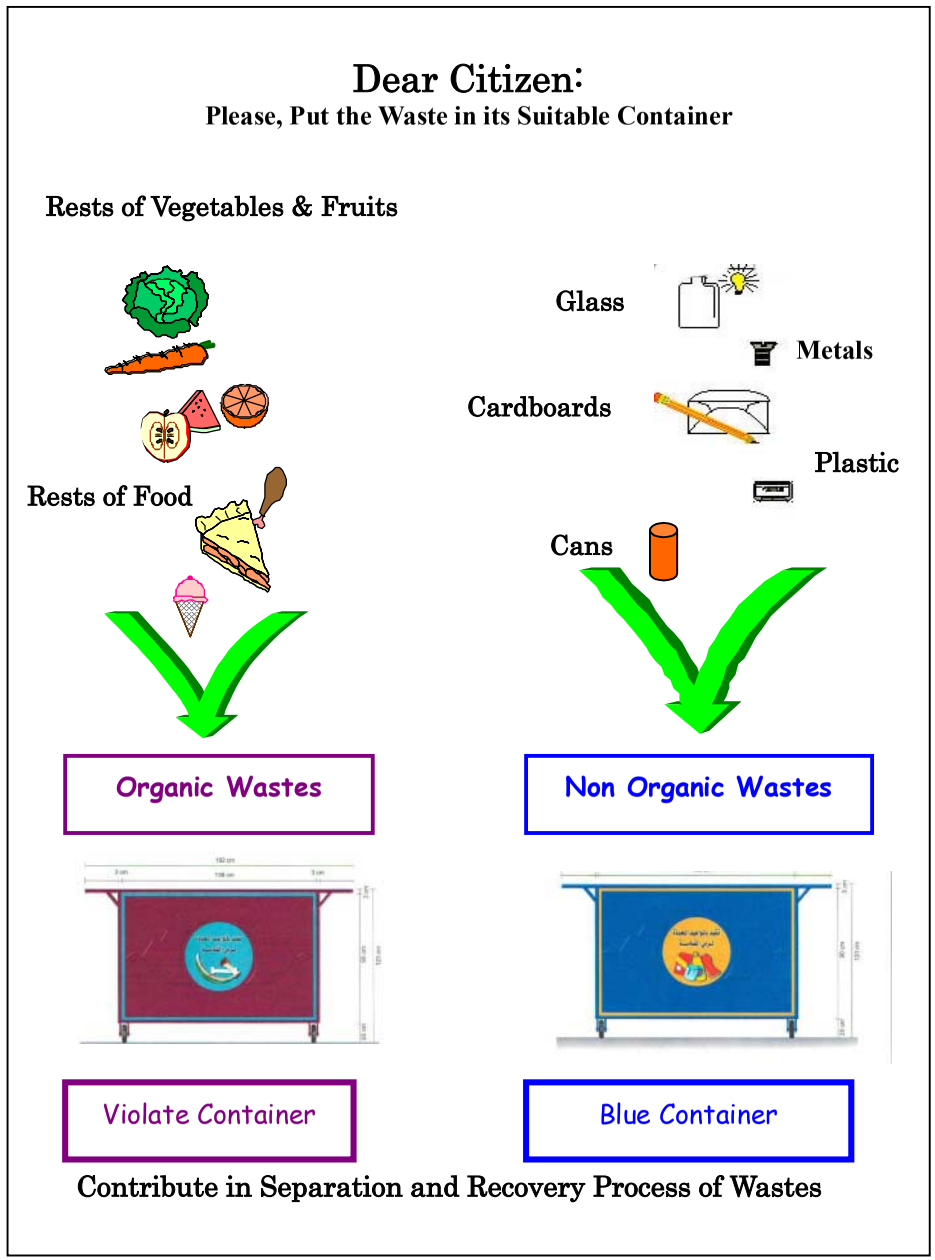
DEMOSTRATION CAMPAIGN AT AL-MAHABBA FESTIVAL
SPORTIVE CITY OF LATTAKIA
2-12 AUGUST 2001

Dear Citizen

City cleanliness requires your active contribution in this campaign by "putting the waste in its suitable container"

For your information:

- Every household in Lattakia and surrounding cities generate about (2.5)Kg of solid waste daily, out of which (2)Kg is organic waste (food residual..).
- Continuous increase of solid waste (SW) leads more environmental and hygienic deterioration.
- Reducing solid waste leads the minimization of pollution, energy and costs.
- Solid waste is valuable; let us contribute in separating and recovering it.
- Organic SW is suitable for the production of compost, which is necessary for agriculture.
- Non- organic SW (glass, metal, plastic, paper, cardboards, bottles..) are reused as product friendly to environment.
- Recycling is a profitable industry and helps in natural resources conservation.



Scenario of the Video Program

No.	Script	Scenes
1	Introduction: Developed countries aim to minimize pollution and environmental deterioration due to huge increase of industries and technologies in the world and to continuous population growth and the enhancement of the life style, which increase the human consumption. This will cause an increase in the amount of the generated solid waste. The untreated solid wastes are considered as a source of poisonous gases and liquids, which cause deterioration to life through polluting the earth and the atmosphere. In other words cause the pollution of the main elements of human life.	• Scenes of the city - Arial - Qaws Alnasser - Alslaibeh • Scenes of waste - Containers - Streets - Kornish
2	But where does the waste come from? Of course it comes from the households and consists of residual food and many materials that are used daily by human beings. Also it comes from offices, markets and from resets thrown directly to streets, and that results in accumulation of wastes.	• Random waste • Waste bags in the households and the offices • Commercial street • Throwing cigarettes, cans, handkerchief and coffee cups from cars.
3	So, huge efforts are made by the cleaning departments in the cities to dispose the city from its waste, by using containers for collecting waste, big number of manual and mechanical cleaning devices and vehicles to collect and dispose wastes.	• Container and its emptying. • Cleaning workers- tractor while working
4	And the process of waste disposal begins from the household, from the family and the household wife. People are used to the common way of disposing wastes by randomly putting the wastes in nylon bags and then throwing the bags into the container. So, the ways of disposing waste differ according to person's behavior and awareness.	Throwing waste into containers
5	- Flashes of household wives (The way of disposing domestic wastes) - A flash of the juice seller.	
6	And the deference between the individual's behavior in this field cause some problems between the citizen and the cleaning workers, who bear the greatest suffering because they are those who collect and dispose wastes, so they have the right to express their point of view.	Transporting waste
7	- A flash of a cleaning worker: The difficulties of the work; the random disposal of wastes - A flash of a cleaning observer: The random throwing of waste bags near the container; and nobody is strict with the disposal timing.	A child throwing the waste near the container
8	But, wait a minute…there are persons who are interested in wastes. There are groups for scavenging and selling wastes. Can you explain that to us? According to the principle (goal justifies method), those scavengers search containers and scavenge it randomly and take the useable waste materials. By this way they realize their aim, which is to obtain money for the waste regardless of the mass they left behind.	• Children while scavenging. • Gathering recyclable waste on the roof of a household
9	Let us come back to the city waste and its disposal, where does the waste go after being collected?	Waste collection vehicles moving.
10	After the collection of wastes from the container, it is transported by special vehicles to AL-Bassa disposal, the well-known disposal site in which the wastes of Lattakia, Jableh, AL-Hafee and AL-Qordaha are disposed.	• Distributed scenes • *AL*-Bassa disposal
11	Ok, the wastes are collected and transported to Al-Bassa disposal site, what is the problem?	• *AL*-Bassa disposal
12	This disposal forms an environmental problem, which clearly does not go with the beauty of the adjacent sandy shore, a subject for an important future turisimic investments. Noting that no control of the landfill operation is available.	The sandy shore in the kornish
13	About this problem, some of the official and specialists in the city talked to us: - Flash of the City Mayor. - Flash of D. Adel Awad. - Flash of the Minister of the Environment.	• *AL*-Bassa disposal

No.	Script	Scenes
14	Lattakia governorate is one of the Syrian governorates that started for many years looking for an appropriate treatment of solid waste, considering that Lattakia is one of the important governorates in Syria, and that was realized by the agreement with JICA.	• Touristical sites in Lattakia. • Formal meetings (without the JICA Study Team)
15	What is JICA?	JICA (fixed scene)
16	JICA is the Japan international Cooperation Agency, established in 1974, and is the official agency in Japan which is concerned in expanding and developing the programs of cooperation between Japan and the developing countries to contribute in developing and supporting the social and economic development programs there. JICA takes the responsibility of transferring the necessary technical assistance by means of the human cooperation and funding to execute the cooperation programs. Mr. Ozawa, JICA representative in Syria, talked to us About JICA activities in Syria:	JICA activities in the world (JICA film)
17	Interview with Mr. Ozawa(in the Meridian)	JICA activities in Syria, pictures of the precious studies: Transport, railway, solid waste management
18	What about JICA activities concerning solid waste management in Lattakia?	Focus on Solid waste management study
19	JICA is funding a comprehensive study to plan the solid waste management in the main cities on the Syrian coast including Lattakia, Jableh, AL-Qordaha and AL-Hafeh. This study includes: Master plan of solid wastes management, feasibility study of priority project, pilot study on improvement of Al-Bassa disposal site, production of better quality compost by manual and public awareness campaign on environment.	• JICA Study Team working in the offices • Rehabtation of the AL-Bassa disposal • Women's Union meeting • Scenes of the separation campaign • Scenes of the compost factory.
20	- Interview with Mr. Abe. - Interview with Mr. Igarashi - Interview with Mr. Yamauchi (the rehabilitation of AL-Bassa disposal).	• Abe in the Arabic Cultural Center • Yamauchi in the Meridian
21	It is clear that the solution of the waste problem in cities is partly in waste recycling. From paper waste can be made new paper, plastic and metal wastes are melted and then recycled and the organic wastes which consist of residual food can be used to produce composts (organic fertilizer), and the quality of this composts depends on the type of collected wastes, which should not include any plastic or metal materials. And for this reason it's important to sort wastes at source, so the organic waste can be shifted to the compost factories, and the non-organic waste is gathered for further recycling.	
22	Interview with Mr. Yamauchi (producing compost)	Scenes of the compost
23	Interview with Mr. Shimizu (explain the process of transferring the waste into compost).	Explaining the process of making compost
24	And thus, environmental public awareness campaigns were organized in Lattakia concentrating on the importance of waste sorting in separate containers. 200 households in Lattakia were chosen for the separation campaign and each was asked to sort the domestic waste in two nylon bags, black one for organic waste and the transparent one for non- organic waste.	• Detailed scenes of the separation campaign • The 2 nylon bags • Cleaning workers collecting the bags
25	This Campaign was executed during July, in close cooperation with the Women's Union in Lattakia, and it included a visit of the participated household wives to AL-Bassa disposal site and the experimental compost factory.	• Women's Union meeting • Scenes of the household visit to AL-*Bassa*
26	Also, a comprehensive public awareness campaign was organized in AL-Assad Sportive City in Lattakia during the thirteen AL-Mahabeh festival.	Arial scenes of the *AL-Assad* sportive city
27	A flash of Sief AL-Deen Slaiman	• Container distribution (located on the sportive city map) • Manufacturing the signboard and the waste baskets.
28	An interview with Eng. Issam Wakel (about the study)	

No.	Script	Scenes
29	And thus, this study and the accompanied campaigns were accomplished in close cooperation with JICA Study Team and other local participants. That was after a Counterpart Team was formed from the city council and including a number of engineers, administrators and technical to supervise the different stages of the study and its campaigns with JICA study Team.	Scenes of: • The Arabic Culture Center meeting (the organizing Structure) • The Meridian seminar
30	- Flash of Mr. Yamauchi (cooperation is very good) - Flash of Mr. Issam Wakel (about the study) - Flash of Mr. Yahia AL-Massri (the missions of the Counterpart Team)	
31	The human being is the main purpose of this campaign, as he belongs to the environment he lives in. And the more he is aware of the results of his activities, the more he enjoys a continues and healthy life, which is the main purpose of this project.	Scenes of the work and the city cleanness
32	- An interview with D. Adel Awad. - Interview with Dr. F Adeli (Minister of the Environment) - An interview with the governor (The future plans) - Interview with the Minister of Local Administration	The city of Lattakia
33	After all we say: That is for your, and your children health …. And for the safety of your air and environment, let's work always together to keep our city clean and beautiful.	The campaign's slogan

Note: The JICA Study Team

The JICA Study on Solid Waste Management At Local Cities in the Syrian Arab Republic

Public Awareness Campaigns on Environment-Lattakia

Separation at Source Campaign

Questionnaire Survey Before

1- Questionnaire No: **2-Date:**

Address:

3- Street Name: **4- Building No:** **5- Building name:**

6- Distinguish marks: **7- Flour No:** **8- Apartment No:**

9- Area category: ☐

1- Low income ☐ **2- Middle income** ☐ **3- High income** ☐

4- Residential ☐ **5- Commercial** ☐ **6- Mixed residential** ☐

10- Name of the family:

11- Profession of the household husband:

12- Name of the household wife: **13- Phone Number:**

14- Age of the household wife: **15- Household members Number:**

16- Profession of household wife: ☐

1- Housewife ☐ **2- Public employee** ☐ **3- Privet employee** ☐

4- Private business ☐ **5- Other:**

17- Monthly household income:(Total)

18- Monthly household expenditure:(Total)

19- State of residence: ☐

1- Ownership ☐ **2- Rent** ☐ **3- Pawn** ☐

4- Other

20- Level of Education: ☐

1- Non ☐ **2- School** ☐ **3- Institute** ☐

4- University ☐ **5- Post graduate** ☐ **6- Other:**

21- What is your system of Waste Collection: ☐

1- House ☐ **2- Container** ☐ **3- Street** ☐

4- Uncollected ☐ **5- Other:**

22- Who discharge your waste from the household: ☐

1- Municipality ☐ **2- Individual collectors** ☐ **3- Household member** ☐

23- How often is your waste discharged: ☐

1- Daily ☐ **2- Every second day** ☐ **3- Weekly** ☐

4- Never ☐ **5- Don't know** ☐

24- How do you collect your waste: ☐

1- In nylon bag ☐ **2- In nylon container** ☐ **3- In metal container** ☐

4- Other:

25- Do you check your household waste before being collected: ☐
1- Yes ☐ **2- No** ☐

26- What kind of materials you can find in your waste, arrange them by quantity: ☐☐☐
1- Food **2- Glass** **3- Paper** **4- Batteries**
5- Textile **6- Plastic** **7- Metal** **6- Other**
Order: 1- **2-** **3-** **4-**

27- What do you do with your residual food: ☐
1- Throw it ☐ **2- Feed animals** ☐ **3- Give it** ☐

28- What do you do with your residual plastic and glass: ☐
1- Sell it ☐ **2- Throw it** ☐ **3- Use it** ☐ **4- Give it** ☐

29- What do you do with your old magazines & newspapers: ☐
1- Sell it ☐ **2- Throw it** ☐ **3- Use it** ☐ **4- Give it** ☐

30- What is the percentage of useful materials in your waste: ☐
1- 50% ☐ **2- More** ☐ **3- Less** ☐

31- What kind of useful materials you can find in your house waste: ☐

32- Do you know where does the waste go after its collection: ☐
1- Yes ☐ **2- No** ☐

- If yes, to where:

33- Do you have an idea about waste sorting: ☐
1- Yes ☐ **2- No** ☐

34- Do you sort your waste: ☐
1- Yes ☐ **2- No** ☐

35- Do you have an idea about recycling: ☐
1- Yes ☐ **2- No** ☐

36- Do you have an idea about organic waste recycling: ☐
1- Yes ☐ **2- No** ☐

37- Do you have an idea about paper recycling: ☐
1- Yes ☐ **2- No** ☐

38- Do you have an idea about plastic recycling: ☐
1- Yes ☐ **2- No** ☐

39- Do you have an idea about glass recycling: ☐
1- Yes ☐ **2- No** ☐

40- Do you know the benefits from recycling: ☐☐
1- Yes ☐ **2- No** ☐

- If Yes, what are they:
1- Economic benefits ☐ **2- Resource saving** ☐ **3- Saving trees** ☐ **4- Reduction of air pollution** ☐
5- Producing fertilizers ☐ **6- Environmental improvements** ☐ **7- Other:**

41- Do you know from which natural resources we fabricate paper: ☐
1- Yes ☐ **2- No** ☐

- If yes, what is it:

42- Do you know from which kind of waste we fabricate compost: ☐
1- Yes ☐ **2- No** ☐

- If yes, what is it:

43- Do you think that burning waste can increase air pollution: ☐
1- Yes ☐ **2- No** ☐

44- Do you think that recycling can decrease scavenging: ☐
1- Yes ☐ **2- No** ☐

45- Do you think waste separation should be made by: ☐
1- The family ☐ **2- The municipality** ☐ **3- Private foundation** ☐

46- Do you think sorting is something to be done: ☐
1- In the house ☐ **2- Outside** ☐

47- Level of satisfaction with the present waste collection in your house/business: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐

48- How much do you pay for the municipality for cleaning tax per year:
49- How much do you pay for private collection per month:

50- Do you agree to share a demonstration project about SW separation: ☐
1- Yes ☐ **2- No** ☐

51- Do you have any idea about any group doing recycling in Lattakia: ☐
1- Yes ☐ **2- No** ☐

Surveyor: **Signature:**

Supervisor: **Signature:**

Consultant Office

1- Number: **2- Path:**

The JICA Study on Solid Waste Management At Local Cities in the Syrian Arab Republic
Public Awareness Campaigns on Environment-Lattakia
Separation Campaign at Source
Questionnaire Survey After

Campaign date and timing

52- The date of Separation Campaign(July) was: ☐
1- Suitable ☐ **2- Un suitable** ☐ **3- No opinion** ☐
If it was Un suitable, which mounth do you suggeste:

53- The period of the Separation Campaign was: ☐
1- Short ☐ **2- Medium** ☐ **3- Long** ☐
4- No opinion ☐

54-What is your opinion about the timing of waste collection done by the cleaning workers: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- No opinion ☐

55- Do cleaning workers abide by collection period: ☐
1- Yes ☐ **2- No** ☐

56- What is your opinion about the waste collection done by the cleaning workers: ☐

Campaign understanding

57- The understood of waste separation was: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- No opinion ☐

58- What is your opinion about the color of the waste bags: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- No opinion ☐

59- What is your opinion about the separation campaign brochures distributed by staff of the campaign: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐

Campaign Implementation

60- How was the cooperation of the family members in waste saparation: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- No opinion ☐

61- Cooperating in waste separation is: ☐
1- Necessary ☐ **2-Unecessary** ☐ **3- No opinion** ☐

62- Separating waste at the household was: ☐
1- Succesful ☐ **2- Nerly succesful** ☐ **3- Unsuccesfule** ☐
4- No opinion ☐

63- The difficulty in waste separation was: ☐
1- Insufficient cooperation from family members ☐ **2- Non understanding of waste separation by children** ☐
3- Other resons ☐

64- Is ther any benefits for the household from waste separation: ☐

1- Yes ☐ **2- No** ☐

If yes, what are the benefis: ☐

1- Health ☐ **2- Environment** ☐ **3- Social** ☐
4- Recycling ☐

65- The visit to Al- Bassa disposal site and the compost factory was: ☐

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Surprising ☐ **5- Un surprising** ☐ **6- I did not go** ☐
7- No opinion ☐

66- What is your opinion about the whole separation campaign: ☐

1- Useful ☐ **2- Useless** ☐

If useless, any suggestion:

The future

67- Is it necessary for you to be provided with two nylon bags to separate your domestic waste:

1- Yes ☐ **2- No** ☐

68- Will you continue separating your domestic waste without being provided with two nylon bags: ☐

1- Yes ☐ **2- No** ☐

69- Will you go on separating your domestic waste with the existence of doubled containers in the streets: ☐

1- Yes ☐ **2- No** ☐

The JICA Study on Solid Waste Management At Local Cities in the Syrian Arab Republic

Public Awareness Campaigns on Environment-Lattakia

Sportive City Campaign

Questionnaire Survey

1- Questionnaire No: **2- Date:**

General information

3- Gender of respondent:

1- Male ☐ **2- Female** ☐

4- Age:

5- City of origin:

6- Profession:

1- Public employee ☐ **2- Privet employee** ☐ **3- Private business** ☐
4- Student ☐ **5- Unemployed** ☐ **6- Other:**

7- Level of Education:

1- Non ☐ **2- School** ☐ **3- Institute** ☐
4- University ☐ **5- Post graduate** ☐ **6- Other:**

Sportive city

8- What is your opinion about the level of cleanness of the sportive city:

1- Very good ☐ **2- Good** ☐ **3- Acceptable** ☐
4- Bad ☐ **5- Very bad** ☐ **6- Other:**

9- What is your opinion about the number of containers in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

10- What is your opinion about containers distribution in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

11- What is your opinion about containers design in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

12- What is your opinion about waste basket distribution in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

13- What is your opinion about waste basket design in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

14- What is your opinion about signboard distribution in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

15- What is your opinion about signboard design in the sportive city:

1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

The campaign

16- What is your opinion about the campaign title in the sportive city: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

17- What is your opinion about the exhibition in the sportive city: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

18- What is your opinion about the compost produced from organic waste: ☐
1- Good ☐ **2- Acceptable** ☐ **3- Bad** ☐
4- Need to be improved ☐
How:

Recycling

19- Do you know what will be the advantage of waste sorting: ☐
1- Economic ☐ **2- Environmental** ☐ **3- Recycling** ☐
Why:

20- Do you know the advantage of waste separation at households: ☐
1- Yes ☐ **2- No** ☐
If yes what is the advantage:

21- Do you know what will be done for the separated waste: ☐
1- Yes ☐ **2- No** ☐
If yes what:

22- Do you know what is the natural resource to make papers: ☐
1- Yes ☐ **2- No** ☐
What:

23- Do you know the materials used to make compost: : ☐
1- Yes ☐ **2- No** ☐
If yes what:

24- Do you know where does the collected waste go:
1- Yes ☐ **2- No** ☐
If ves were:

Your city

25- Are you satisfied from the present situation of your city cleanness: ☐
1- Yes ☐ **2- No** ☐

26- What is the main problem: ☐
1- Carelessness of people ☐ **2- Poor performance of workers** ☐ **3- Inadequate collect** ☐
4- Shortage in containers ☐ **4- Bad location of containers** ☐ **5- Inadequate positions of containers** ☐

27- Where you or your family members threw the waste: ☐
1- Inside the container ☐ **2- Outside the container** ☐ **3- In the street** ☐
4- Anywhere ☐

28- What are the percentage of the people who discharge waste in the container: ☐
1- 30% ☐ **2- 50%** ☐ **3- More** ☐
4- Specify ☐

29- Why do you think some people do not put waste in the container: ☐

1- Carelessness ☐ **2- Laziness** ☐ **3- Distance** ☐
4- No penalty ☐ **5- Other:**

30- Keeping clean around the container is: ☐

1- Possible ☐ **2- Difficult** ☐ **3- Impossible** ☐

31- Keeping clean around the container is rely on: ☐

1- People ☐ **2- Workers** ☐ **3- Both** ☐

32- To keep the aria clean, do you know how often is the waste should be collected: ☐

1- Twice a week ☐ **2-Once a day** ☐ **3- Twice a day** ☐
4- No idea ☐

Surveyor: **Signature:**

Supervisor: **Signature:**

SECTION 3

REHABILITATION AND OPERATION IMPROVEMENT OF AL-BASSA DISPOSAL SITE

SECTION 3 REHABILITATION AND OPERATION IMPROVEMENT OF AL-BASSA DISPOSAL SITE

"Pilot study on the Rehabilitation and Operation Improvement of Al-Bassa Disposal Site" has been carried out on June, July, and August 2001.

Based on the daily inspection, weekly reports listed below have been prepared by the joint work between the Counterpart Team and the JICA Study Team.

Weekly reports are basically composed of the follows items.

- Activities of the week
- Issues and measures of the week
- Events of the week
- Drawing showing the work progress of the week
- Photos of the week
- Data sheets of daily incoming vehicles (i.e. incoming vehicle registration sheets, incoming vehicle analysis/ daily base, and weekly analysis)
- Others

Table 3.1

Week	Period	Main event	Weekly Report
			Outline
1	June 09 (Sat) – June 15 (Fri)	Pilot study commenced (June 09)	Week 1
2	June 16 (Sat) – June 22 (Fri)		Week 2
3	June 23 (Sat) – June 29 (Fri)		Week 3
4	June 30 (Sat) – July 06 (Fri)		Week 4
5	July 07 (Sat) – July 13 (Fri)		Week 5
6	July 14 (Sat) – July 20 (Fri)	Receiving waste started (July 14) Incoming vehicle registration started Inspection tour by Women's Union	Week 6
7	July 21 (Sat) – July 27 (Fri)		Week 7
8	July 28 (Sat) – Aug 03 (Fri)		Week 8
9	Aug 04 (Sat) – Aug 10 (Fri)	Opening ceremony of control house/ meeting with waste-pickers (Aug. 09) Two working phase operation started	Week 9
10	Aug 11 (Sat) – Aug 17 (Fri)		Week 10
11	Aug 18 (Sat) – Aug 24 (Fri)		--
12	Aug 25 (Sat) – Aug 31 (Fri)		--

Note: "Incoming vehicle registration sheets" and "Incoming vehicle analysis (daily base)" are attached only for the week 10, for reference.

The Pilot Study on
Improvement of Al-Bassa Disposal Site

Weekly Report

Outline…

Outline…

Following is a brief description of:

The Pilot Study on Improvement of Al-Bassa Disposal Site…

1. Key Features

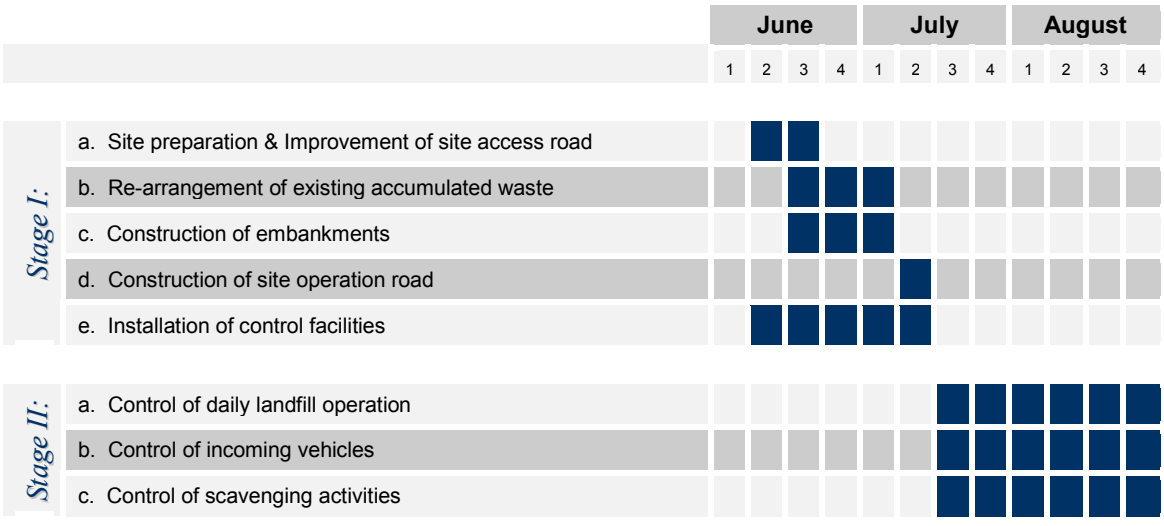
Stage I:

a. Site preparation / improvement of access road.
b. Re-arrangement of existing disorderly accumulated waste.
c. Construction of embankments.
d. Construction of site operation road.
e. Installation of control facilities:
    a. Guard House.
    b. Fence.
    c. Monitoring well.
    d. Leachate collection pipes.
    e. Leachate pond.
    f. Gas removal pipe.

Stage II:

a. Control of daily landfill operation.
b. Control of incoming vehicles.
c. Control of scavenging activities.

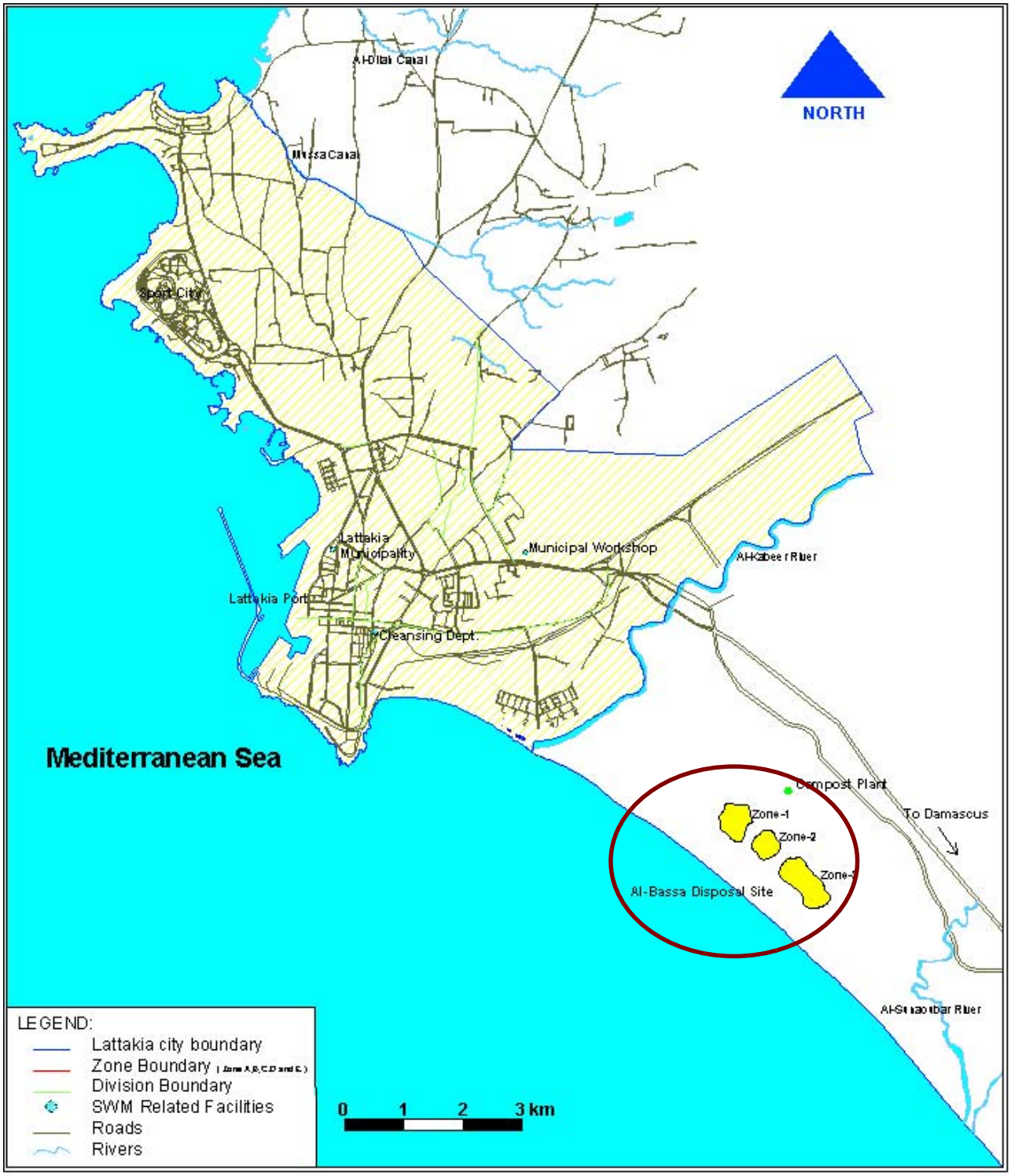
2. Implementation Schedule



Note:
In June, July & August 2001, pilot study will be carried out under the supervision of JICA Study Team. However, after September, Syrian side will carry it out continuously.

Location of Al-Bassa Disposal Site

Following is a map shows the location of Al-Bassa Disposal Site.



The Pilot Study on
Improvement of Al-Bassa Disposal Site

Weekly Report

Week 1 ...

June 9th – 15th, 2001

Week 1

June 9th – 15th, 2001

Introduction

The Pilot Study has been started in June 9th, 2001.

The site plan of the Pilot Study prepared based on the topographic survey map & sections prior to the work start.

Specifications of the equipments rented by *JICA Study Team* in order to carry out the Pilot Study is as follows:

Equipment:	Mark	Model	Reg. Plate No.
Bulldozer	Caterpillar	D8H	-
Backhoe	Poclain	90C	-
Dump Truck	Mercedes		742157

1. Site Preparation

Clean up and leveling of an entrance area of the Pilot Study area (approx. 0.5 ha); i.e. surroundings of proposed control house and fence, has been carried out by bulldozer and loader in this week.

> *Targeted Pilot Study area in total is part of zone 1 of Al-Bassa disposal site, an area of about 3 hectares.*

2. Improvement of Site Access Road

Tarmac was supplied to some poor parts of the access road between the Compost Plant and Al-Bassa Disposal Site. And for the access road inside the Pilot Study Area, construction debris was supplied mainly to the low level area in order to high up and grade up the conditions.

> *During this week, all the site preparation work had been completed.*

3. Re-arrangement of existing accumulated waste

Re-arrangement of existing accumulated waste has started by two bulldozers (one is rented by *JICA Study Team* and the other is supplied by the municipality), one dump truck and one backhoe (figures 1.2 & 1.3).

> *Topographic survey result shows that the estimated volume of the existing waste in the Pilot Study Area is about 7,400 m³.*

4. Construction of embankment

The construction of embankment by using the re-arranged accumulated waste as a core of embankment (figure 1.4), and covered by soil & construction debris (figures 1.5 & 1.6), has been started.

According to the topographic conditions, the surrounding embankments should be implemented in three parts, will be referred to as embankments 1, 2 and 3 (figure 1.1).

During this week, 50% of embankment 1 and 15% of embankment 2 had been completed (total length of embankment 1 is about 65 m and embankment 2 would be 120 m long).

Later in this week, backhoe was used to compact the waste and to make the shaping at the slope and leveling for the top of the embankment (figures 1.7 & 1.8).

5. Installation of Control Facilities

1. Control House:

Construction of the Control House foundation has completed, reinforced bars for columns has been installed (figure 1.9).

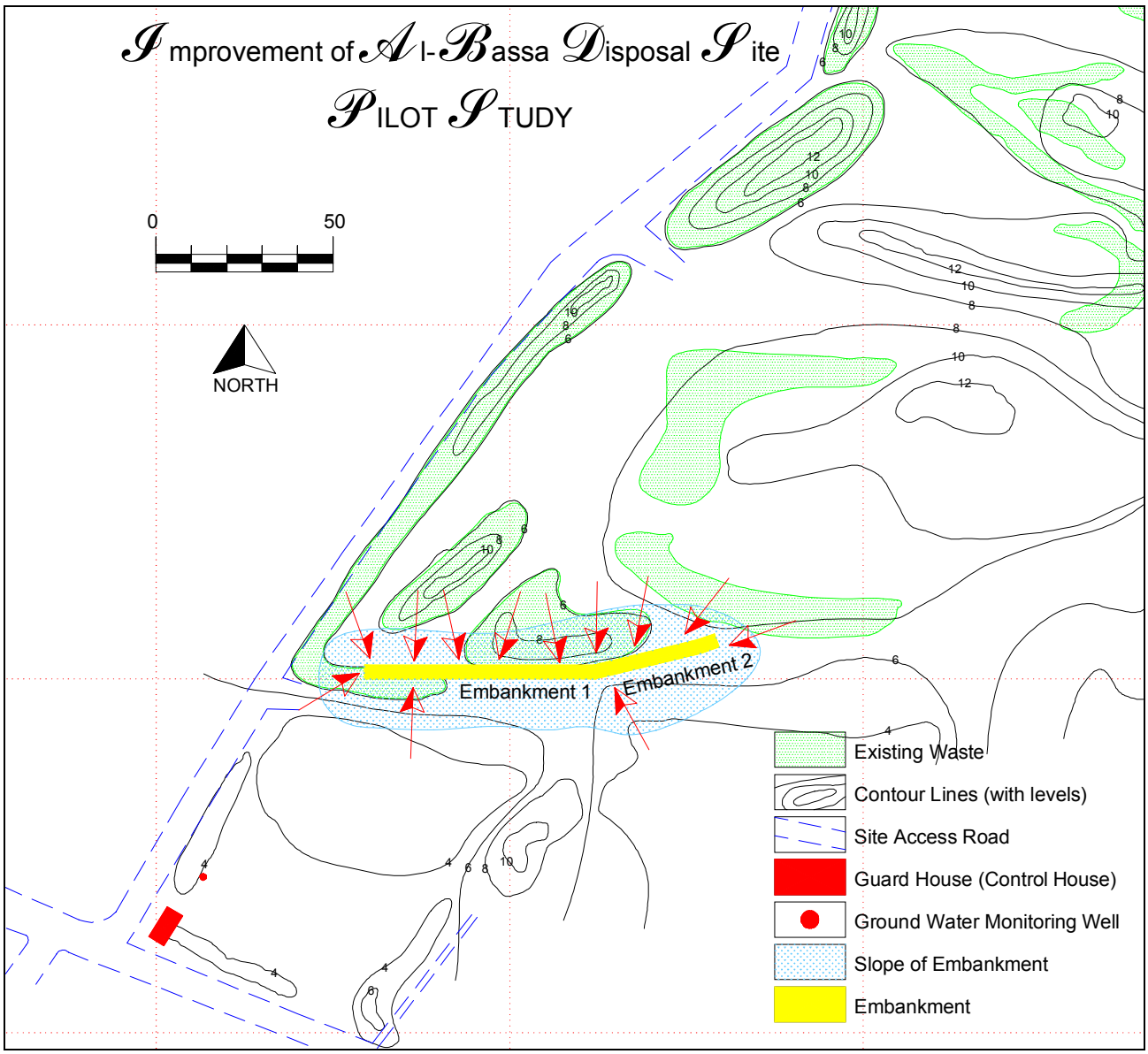
2. Monitoring Well:

Monitoring well had been installed, the depth of which is 12 m (figure 1.10).

6. Remarks

- Cover soil leads the drastical reduction of pollutant; such as birth/growth of the flies, offensive odor, waste self-burning…etc.
- Applied push-up method is rather efficient for the compaction of waste.

Drawing of the progress in week 1



(Figure 1.1) Map shows the Pilot Study progress in ***week 1:*** *July 9th – 15th, 2001*

Some photos of the operations in week 1: July 09th – 15th, 2001

(Figure 1.2) Removal of existing accumulated waste by bulldozer

(Figure 1.3) Re-arrangement of existing accumulated waste by bulldozer

(Figure 1.4) Construction of embankment: Cover soil is applied on the removed waste (core of embankment)

(Figure 1.5) Construction of embankment: Cover soil is applied over the cored waste of embankment with compaction by bulldozer (1:4 slope)

(Figure 1.6) Construction of embankment: Construction debris is applied for the further compaction.

Some photos of the operations in week 1: July 09th – 15th, 2001

(Figure 1.7) Site clean up and embankment (1) view from south.

(Figure 1.8) Site clean up and embankment (2) view from south

(Figure 1.9) Foundations of control house

(Figure 1.10) Installation of monitoring well

The Pilot Study on
Improvement of Al-Bassa Disposal Site

Weekly Report

Week 2 ...

June 16th – 22nd, 2001

Week 2

June 16th – 22nd, 2001

Introduction

The Pilot Study has scheduled the following activities to be carried out during this week:

- Re-arrangement of existing accumulated waste.
- Construction of embankments.
- Installation of control facilities.

1. Re-arrangement of existing accumulated waste:

The operations of re-arrangement of existing accumulated waste, is continued this week by the bulldozer rent by *JICA Study Team*. This re-arranged waste is used as core of the embankments, as already started in week 1 (figures 2.1 & 2.2)

2. Construction of embankments:

Construction of the embankments continued from week 1 in cooperation between the bulldozer and the backhoe, as the bulldozer is pushing and compacting the existing accumulated waste as core of the embankments, then covers the waste with the sand forming a 1:4 slope, while the backhoe is assisting in leveling the top of the embankment as well as shaping the slope (figure 2.3).

Later on this week, construction debris is applied on the top of the embankment, and also to form an entrance / access to the top of the embankment, for the purpose of smooth access / movement of landfill equipments and inspection vehicles (figure 2.4).

The layers of the embankments are therefore consisting of (figures 2.5 & 2.6):

- Re-arranged accumulated waste (as core).
- Cover soil on the slopes.
- Construction debris on the top.

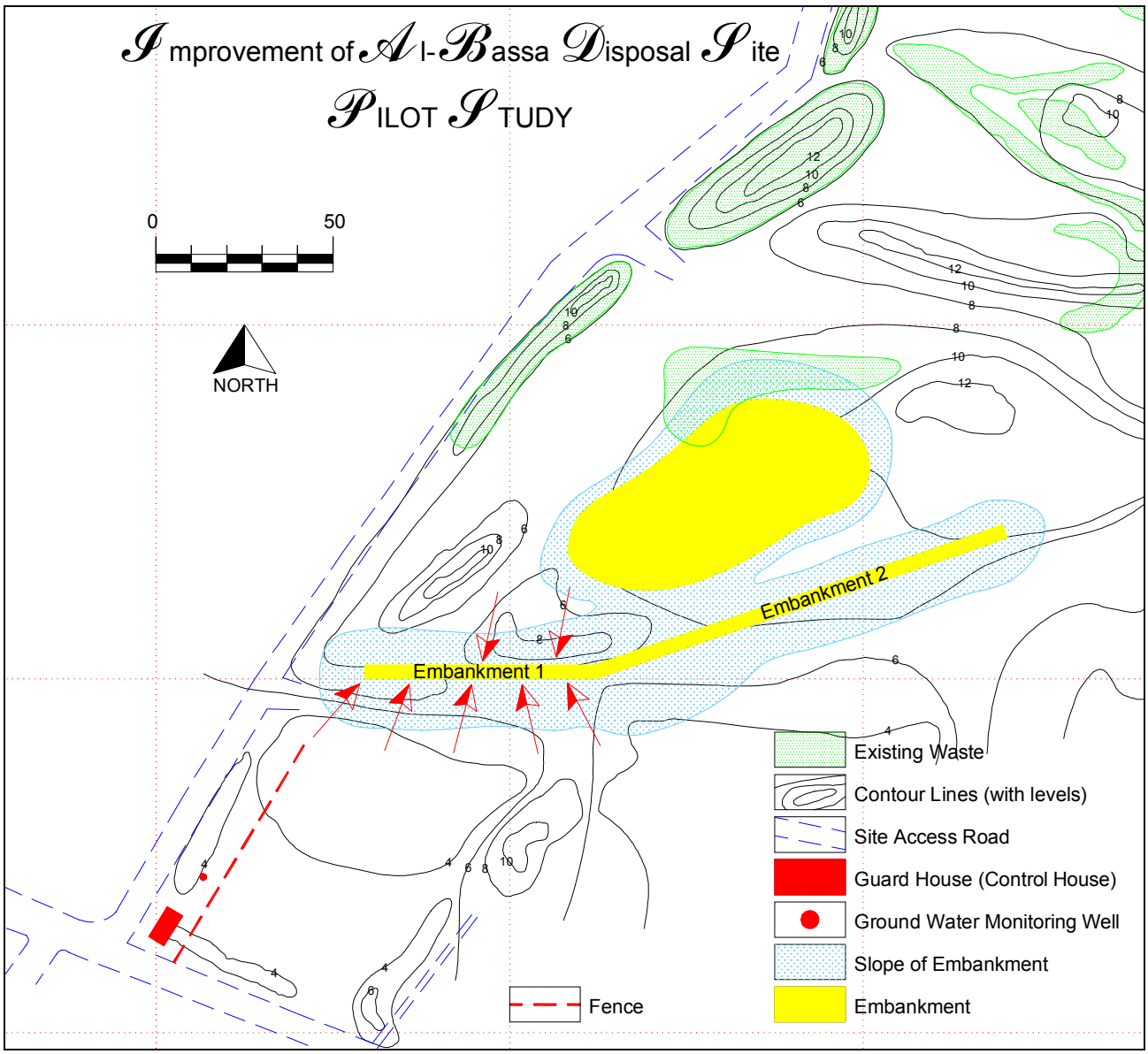
> *During this week, 85 % of embankment 1 has been completed.*
> *Construction debris is applied to approximately 50 % of the embankment 1 i.e. about 30 m (figure 2.7).*
> *No progress in the embankment 2.*

3. Control Facilities:

1. Control House:

During this week, walls are being built and almost completed, and wooden shuttering for the roof is raised (figure 2.8).

Drawing of the progress in week 2



(Figure 2.1) Map shows the Pilot Study progress in ***week 2:*** *June 16th – 22nd, 2001*

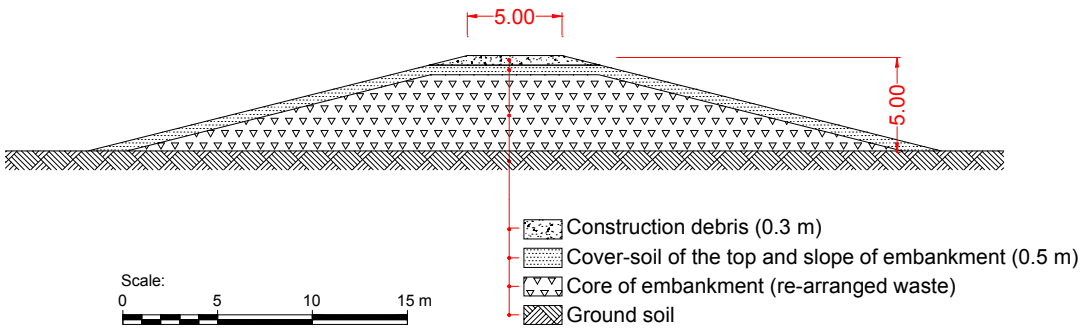
Some photos of the operations in week 2: June 16th – 22nd, 2001

(Figure 2.2) Re-arrangement of existing accumulated waste as core of embankment 1

(Figure 2.3) The work of bulldozer and backhoe in construction the embankment 1

(Figure 2.4) Inspection vehicles is accessing to the top of embankment 1

(Figure 2.5) Layers of the embankments: (re-arranged accumulated waste "core", cover-soil sand "slope" and construction debris "top")



(Figure 2.6) Section of the embankment 1

Some photos of the operations in week 2: June 16th – 22nd, 2001

(Figure 2.7) 50 % of embankment 1 is supplied with construction debris

(Figure 2.8) Control house at the end of week 2