APPENDIX 5

ENVIRONMENTAL BASELINE SURVEY FOR EIA IN LATTAKIA

APPENDIX 5 ENVIRONMENTAL BASELINE SURVEY (LATTAKIA)

The survey consists of three parts, water quality survey, household interview and secondary information collection and the survey was consigned to local consultant titled KOTHAR CONSORTIUM. The each component is summarized as follows:

5.1 WATER QUALITY SURVEY

5.1.1 Introduction

Water quality is commonly used to assess the impact of various human activities, such as solid-waste disposal sites, on the environment. Solid-waste and its extracts can easily be driven from landfills or from composting plants either to surface waters by the aid of wind, for example, or to the ground waters by the aid of rainfall, for example. Physical, chemical and biological survey of such waters should be carried out in order assess the environmental impact, and the extent of such impact can be used to suggest some solutions to avoid or minimize any adverse effects on the environment and to the human being.

Surface water is mostly used for irrigation and that of subterranean water is mostly used for drinking, irrigation and other domestic uses. Such usages make water survey in an area of utmost importance.

This part of the survey is devoted to assess the effect of the waste disposal and the composting plant sites at Al-Bassa (Lattakia) on some physical, chemical and biological characteristics of the surface and subterranean waters from human and agricultural point of view.

5.1.2 Survey Methodology and Activity Schedule

Three field trips were made by the study team (the specialists and technicians) on three successive days (during the period 10-12 August 2001, between 10am. and 6 pm. of the day) to study the quality of surface and subterranean waters. Photographs of the sampling stations were taken on Sep. 1st, 2001. Sampling stations were chosen after interviewing the resident people in the area and after monitoring the existing wells and surface waters available. Stations were then selected to represent the contrasting features of the sites (e.g. One of higher level than the plant and one of lower level) in order to reveal the effect of various parameters of the dumping and landfill sites on the water quality:

(1) Surface water sampling stations

The sampling locations and the location photographs are shown in Figure 5.1.1 and Figure 5.1.2, and the description of the locations are explained as follows:

- Landfill site:

Two surface water stations of the landfill site (SL1; Photo 1 and SL2; Photo 2, Map 1) were chosen for sampling. The first is a deep drainage depression (about 1m. depth)

surrounded by sandy agricultural land. The second station is a standing water accumulating from the landfill.

- Composting plant site:

Two surface water stations of the composting plant site: The first (SP1; Photo 3) is a 20cm. deep standing water formed by drainage from the nearby land. It is distanced about 400m. from the composting plant. The second station (SP2; Photo 4) is a channel (locally called: Al Sakia) running nearby (about 1000m.) the composting plant.

(2) Ground water sampling stations

- Landfill site:

Two ground water stations (GL1; Photo 5 and GL2; Photo 6, Map 1) were chosen for sampling. They are selected from the existing wells (5 and 16m. deep respectively) within the landfill.

- Composting plant site:

Two ground water stations: The first (GP1; Photo 7) is a 40m. deep well located close to (about 40m. before) the composting plant and near the administration of the plant. The second station (GP2; Photo 8) is a 31m. deep well located in a citrus orchard, 50m. next to the plant.

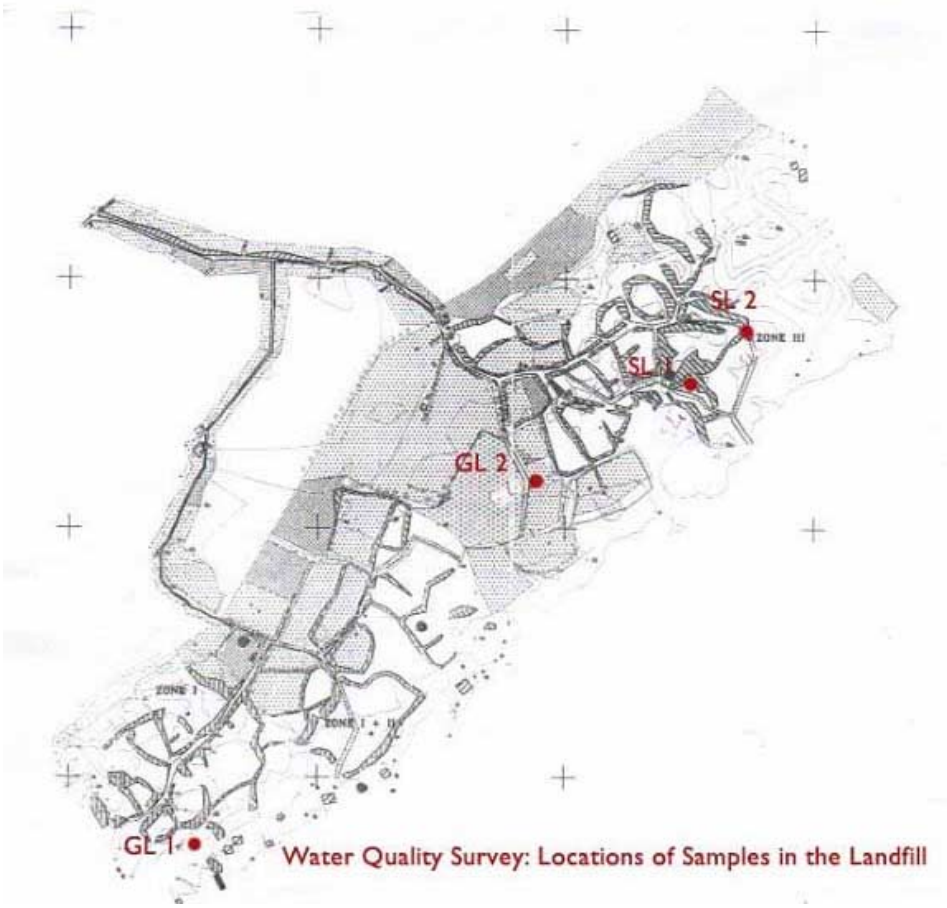

Figure 5.1.1 Sampling Location of the Water Quality Survey at Al-Bassa Disposal Site

5.1.3 Sampling Protocol and Analysis

Field measurements of surface and subterranean waters (temperature, water temperature, colour, thickness, pH, DO and Electric conductivity) were taken on site, using their respective meters. Measuring instruments used in this survey were carefully calibrated.

Water samples for the remaining parameters were also collected at the same occasions, using the standard methods of collection (Franson 1992, Forstner and Wittmann 1982). To insure the highest accuracy, water samples were chemically preserved in the field and kept in a mobile refrigerator. Samples had been analysed on arrival to the lab or, otherwise, were ideally stored till analysis.

COD was determined by the titrimetric method after acid-digestion, and BOD by measuring the dissolved-oxygen depletion after sample incubation on 20°C for 5 days. SS had been determined by weighing the residue of the water sample retained on the filter after drying to a constant weight at 105°C, and coliform by incubating the sample (at 37°C for 24h) and counting the germs using counting columns

SL1

SL2

SP1

SP2

GL1

GL2

GP1

GP2

Figure 5.1.2 Scenes of the Sampling Points of Water Quality Analysis

T-N was determined by the method described by Franson (1992) and T-P by the colorimetric method. Heavy metal concentrations were determined by Atomic Absorption Spectrometer using the method of Flame Atomic Absorption Spectrometry, AAS (for Zn), Electro- thermal Atomic Absorption Spectrometry, ETA (for Cd, Cu, Cr and Pb) or Hydride Generation/ Atomic Absorption Spectrometry (for As and Hg).

All analysis had been carried out in triplicates and the closest 2 readings were averaged. Quality Control and Quality Assurance tests were carried out to insure the highest possible accuracy of the analysis.

5.1.4 Survey Organization

Specialists and skilled chemists did survey and analysis, and Government-authorized laboratories were used as follows:

- Pollution Control Directorate in Damascus (affiliated to the Ministry of Irrigation).
- Atomic Energy Commission.
- Scientific & Environmental Research Centre.

5.1.5 Survey Results

The survey results, laboratory test, are summarized in Table 5.2.1 and explained as follows:

(1) Temperature, Colour, Thickness and Suspended Solids

As shown in table 1, air temperatures varied between 29-33.5°C. Such differences may have been aroused from the differences in sampling time during the day. Surface-water temperature varied between 26.6 and 33°C and subterranean water varied between 21.0, and 25.0°C with this water being suitable for drinking, from this point of view (temperature of the drinking water is 5-25°C according to Syrian guidelines 1995).

Subterranean water had no obvious colour but surface watercolour varies from greenish to yellowish depending on the type of suspended and dissolved materials. SL1 station and, in particular, SL2 station had noticeable quantities of Green Algae which gives a greenish appearance to the water. On the other hand, SP1 had noticeable amounts of suspended clay and organic extracts which give a yellowish appearance. Similarly SP2 which is a running water carrying large amounts of dissolved organic material had a pale colour with a darkish appearance on the sediment of the channel. Subterranean water is colourless.

Thickness of the waters varies from completely transparent (Subterranean waters) to turbid water, with maximum visibility of 8 and 25 cm. (for SL2 and SP1 respectively).

Suspended solids are noticeably high in all surface water stations (especially in SL2 and SP1) and in subterranean water.

(2) Acidity and Electric conductivity

Water acidity (pH) varies between 7.09-8.33 which lies within the recommended range for irrigation (6.5-8.4) or for drinking water (6.5-8.5; Syrian Guidelines, 1995).

Electric conductivity recorded in the surface waters (except in SP2) and ground water (except in GP1) make such waters not completely suitable (i.e. 750-3,000 Micromoz/cm. may cause problems to field crops, FAO 1985) when used for irrigation. Similarly, the subterranean water (GL1) is unsuitable for drinking (i.e. exceeds the maximum value recommended by Syrian guidelines 1995; 1,500 Micromoz/cm.). Moreover, all subterranean water stations (except GP1) are unsuitable for irrigation.

(3) Dissolved Oxygen, COD and BOD

Surface water of the landfill site is well oxygenated, probably due to the presence of large amounts of green algae, which produces oxygen by photosynthesis during the day. On contrast, surface water of composting plant, which seems to have lower amounts of green algae, is poorly oxygenated. Similarly, subterranean water of the landfill site is poorly oxygenated but that of the composting plant is well oxygenated.

COD concentration reaches very high levels in the surface waters of SP1 and SL2 stations. Such values are slightly high in the subterranean water of the landfill area (the value should not exceed 2ppm for drinking water according to Syrian guidelines 1995).

BOD values are noticeably high in the surface water of the landfill (SL2) and the composting plant (SP1).

(4) Coliform

All surface waters in the landfill and the composting plant (except SP2) has total coliform counts exceeded the maximum permissible limit for water used for irrigation of field crops likely to be eaten uncooked (i.e. <1,000 germs/100ml, WHO 1989). Subterranean water (GL1) is polluted by coliform (i.e. Exceeded Syrian maximum permissible limit for drinking water at emergency cases; 10 germs/100ml, Syrian Guidelines 1995). However, from this point of view, such water is still suitable for irrigation.

(5) Total Phosphorus and Total Nitrogen

Traces of phosphorus (total) were detected only in the surface waters of the composting plant. No phosphorus was detected in ground water. And Total nitrogen values were always below 0.0042%, the value that is acceptable either for irrigation or for drinking waters (Values of less than 5 ppm has no restrictions on use even in agriculture and 30ppm has sever restrictions, according to Syrian regulations, FAO 1985).

(6) Heavy metals (Cadmium, Mercury and Lead)

Cadmium concentration in surface water stations fall below the maximum permissible concentration in the irrigation waters (i.e. 10 ppb, Syrian Guidelines 1995, FAO 1992). The station SL2, however, still has a concentration close the maximum permissible concentration. Cadmium concentration in the subterranean water stations (except that of GL2) fall below the maximum permissible concentration in the drinking waters (i.e. 3 ppb). GL2, even it is unsuitable for drinking, it still suitable for irrigation.

Mercury concentration was always high, especially in the subterranean waters of both landfill and composting plant sites. This makes this water unsuitable at least for drinking (maximum permissible concentration in drinking water according to Syrian guidelines 1995 is 1 ppb).

Lead concentrations are always lower than the maximum permissible concentration either for irrigation (i.e. 5,000 ppb) or for drinking water (i.e. 10 ppb); the station GL2, has a concentration (9.49 ppb) close to the maximum permissible limit. Lead concentration was found to be high in marine sediment (max. 44,770 ppb) and benthic organisms (2,547 ppb in *Zostera marina*) in the shore next to the landfill area (Ibrahim 1999).

(7) Copper and Zinc

Copper concentrations were always lower than the maximum permissible concentration recommended either for irrigation (i.e. 200ppb) or for drinking water (i.e. 1,000ppb). Zinc concentrations follow similar trends as that of copper (maximum permissible concentration recommended for irrigation is 2,000ppb and for drinking is 3,000ppb). Generally, copper and zinc concentrations in subterranean water were lower than that of surface water.

A previous study (Ibrahim 1998) on heavy metal pollution in Al-Kabir Al-Shimaly river, which is somehow close to the landfill and composting plant sites showed extremely elevated levels of copper and zinc in the water (Max. 5,790 ppb and 121,740 ppb respectively), sediment (Max. 15,380 ppb and 11,936 ppb respectively) and in most river biota (Max. 392,080 ppb - and 143,180 ppb respectively in crustacean – crabs).

(8) Arsenic and Chromium

Arsenic concentration values in all sites were less than 200ppb. Chromium concentrations were always lower than the maximum permissible concentration recommended by Syrian guidelines (1995) and by FAO (1992) either for irrigation (i.e. 100 ppb) or for drinking water (i.e. 50 ppb). Chromium concentration values in most surface water stations are lower than those in subterranean stations.

(9) General Discussion and Suggestions

It can be concluded from the above-mentioned physical, chemical and biological parameters that the landfill and the composting plant sites obviously have adverse effects on both surface and subterranean waters in the two areas. Such effects make surface waters unsuitable for irrigation and most ground waters in the area unsuitable neither for drinking nor for irrigation. Such water will certainly affect human health if used for drinking or for irrigation because many harmful materials (such as heavy metals) will be accumulated in the crops and consequently reach human body after crop consumption.

The topography of the area rather than distance from the site (especially the composting plant one) seems to have an influence on the subterranean water quality. For example, the sampling well (GP2) has a distance from the composting plant similar to that of the sampling well (GP1) but the first well is lower in level comparing to the second one; yet GP2 has been obviously affected by the composting plant more than GP1.

Surface water is directly exposed to pollution from the landfill and the composting plants. Moreover, subterranean water in the area is extremely vulnerable to pollution for two reasons: this water is largely superficial (just few meters below land surface) and is covered mostly by sand which facilitates pollutants to reach the subterranean water layer. This necessitates careful management of the landfill and the composting sites.

It is believed that the fermentation chamber of the composting plant contributes much to the ground & surface waters pollution in the area and improving the method of fermentation may

minimise the problem. In addition, diverting larger quantities of Lattakia's solid waste into the composting plant much reduces the amounts of waste deposited in the landfill and consequently reducing the chance of surface and subterranean waters pollution. Moreover, widening the range of solid waste separation and management to include inorganic material and recycling such material will certainly reduce heavy metal pollution in the area.

In order to gain more information about the subject, samples from the soil, the crops and the cattle productions (such as milk and meat) should be collected from the area and analyzed to study the pollutants accumulation and its consequent effect on human beings.

Regarding that Syria is one of the countries which have the largest rate of population growth, the further step which should be taken for the long run is that to interfere with Syrian social habits in such a way to reduce the daily amounts of solid waste produced per capita. This is one of the ways by which we can keep our country clean and beautiful.

Table 5.1.1 Surface and subterranean water quality survey data of the proposed rehabilitation of landfill and composting plant sites

No.	Test	Unit	Surface Water Quality						Subterranean Water Quality		
			Landfill Site		Composting Plant Site		Landfill Site		Composting Plant Site		STD
			SL1	SL2	SP1	SP2	GL1	GL2	GP1	GP2	
1.	Air Temperature	Celsius	29.0	29.0	33.5	28.5	33.5	33.0	30.5	30.5	
2.	Water Temperature	Celsius	28.5	29.4	33.0	26.6	25.0	21.0	22.7	22.4	
3.	Colour		Green-ish	Pale-Green	Yello-wish	Pale	None	None	None	None	
4.	Thickness (Transparency)	Cm	50	8	25	90	Trans-parent	Trans-parent	Trans-parent	Trans-parent	
5.	SS	mg/l.	35	189.0	103	35	32.0	17.0	17.0	17.0	
6.	PH		7.64	8.33	7.14	7.67	7.12	7.13	7.78	7.09	7-8.5
7.	Electric Conductivity	Micromoz /cm.	1364	3110.0	1655	744	1767	863	561	1,092	
8.	DO	mg O2/l.	5.1	6.5	0.6	0.4	1.7	1.4	7.7	5.3	
9.	COD	mg O2/l.	0.0	432.0	1460	0.0	3	3	2	0.0	1-2
10.	BOD	mg O2/l.	0.7	80.0	75	11.0	1.4	0.1	0.5	0.3	4
11.	Coliform	Count/100 ml.	1,800 or more	2,400 or more	2,400 or more	460	93	<3	<3	<3	
12.	T-P	ppm	-	-	<1	0.59	-	-	-	-	
13.	T-N	%	0.00169	0.0035	0.004	0.00308	0.00028	0.00042	ND	0.00042	
14.	Cadmium (Cd)	ppb	0.75	9.65	0.76	0.27	1.19	5.65	0.25	0.27	10.0
15.	Mercury (Hg)	ppb	4.16	2.36	1.76	3.56	4.93	6.55	4.84	5.74	1.0
16.	Lead (Pb)	ppb	4.26	17.44	9.73	2.37	4.08	9.49	2.05	2.39	5.0
17.	Copper (Cu)	ppb	5.43	2.48	11.00	1.19	2.660	1.63	0.301	0.425	
18.	Zinc (Zn)	ppb	21.50	24.50	149.00	11.30	10.00	5.00	18.50	5.10	
19.	Arsenic (As)	ppb	<200	<200	<200	<200	<200	<200	<200	<200	
20.	Chromium (Cr+6)	ppb	1.11	1.24	4.65	1.02	0.69	8.12	15.79	14.76	

5.2 HOUSEHOLD INTERVIEW SURVEY- LATTAKIA

5.2.1 Introduction

The Household survey was carried out for the proposed municipal waste disposal management facilities, titled Al-Bassa cleansing Complex (ABC Complex) in order to attain public opinions from citizens who live in adjacent area to the proposed site and its environs.

5.2.2 Survey Methodology

The Survey was carried out by household interview with questionnaire method to household whish is selected by randomly. The questionnaire was prepared in advance and was tested which would work properly.

The Samples were selected at Al-Bassa and the adjacent villages and individual farms within 5 km radius from the Al-Bassa Landfill. The Samples include also households from the cities of Lattakia and Jableh, beyond the distance of 5 km from the landfill. Table 5.2.1 shows detail of selected households samples.

Table 5.2.1 Sampled Households Locations

Area	Households	No.
Lattakia-Alaedoun (Palestinian camp at the south of Lattakia)	(1 – 10)	10
Al Henadeh	(11 – 16)	6
Al Henadeh (Lonely House)	(17-18-19-20-21-22-23-24-25-26)	10
Al-Bassa	(27-43)	17
Shamet Almhelba (Lonely houses)	(44-48)	5
Al Hiker (Lonely Houses)	(49-53)	5
Nib Al Rez (Lonely Houses)	(54-59)	6
Al Kharnoba (Lonely Houses)	(60-62)	3
Al Sanoubr (Lonely Houses)	(63-67)	5
Scavengers	(68-75) – (103-104)	10
Shekh Al Hi (Al-Bassa)	(76-85)	10
Lattakia (different areas)	(86-89) - (105-110)	10
Jableh	(90-99)	10
Wood Factory	(100-102)	3
Total		110

Surrounding area of Al-Bassa disposal site mainly included like Al-Henadeh and Shekh Al-hi, and also lonely (individual) houses belonging to villages like Shamet Al-Mhelba, Al-Hiker, Nib Al-Rez and other villages between Lattakia and Jableh.

The selected households are shown in Figure 5.2.1. Red circles for dense locations surround the groups of households: Al-Aedoun, Wood factory, Al-Bassa, Shech Al-hi and Al-Henadeh. Households of each group are detailed in Table 5.2.2. All the other individual households are directly illustrated on the map with their respective numbers.

The Questionnaire was prepared by the Consultant, on the base of a model of contents provided by the JICA Study Team. The final Questionnaire included 65 Items (questions), grouped into the following categories shown in Annex 1.

(1) General Attributes of the Household

(2) Opinion on the present situation of the existing waste disposal Site

(3) Opinion on Al-Bassa Cleansing Complex (ABC Complex)

(4) Questions specific for the Scavengers (on the Site)

(5) Information about the Location of Household.

5.2.3 Schedule and Survey Organization

The Survey was prepared and implemented according to the following schedule:

Starting date	End date	Work	Note
August 11	August 16	Preparations of the Survey	Inception Report
August 17	August 23	Implementation of the Survey	Raw Data
August 25	August 30	Analysis and Partial Report	Partial Report
September 1	September 5	Preparation of draft Final report	Draft Final Report

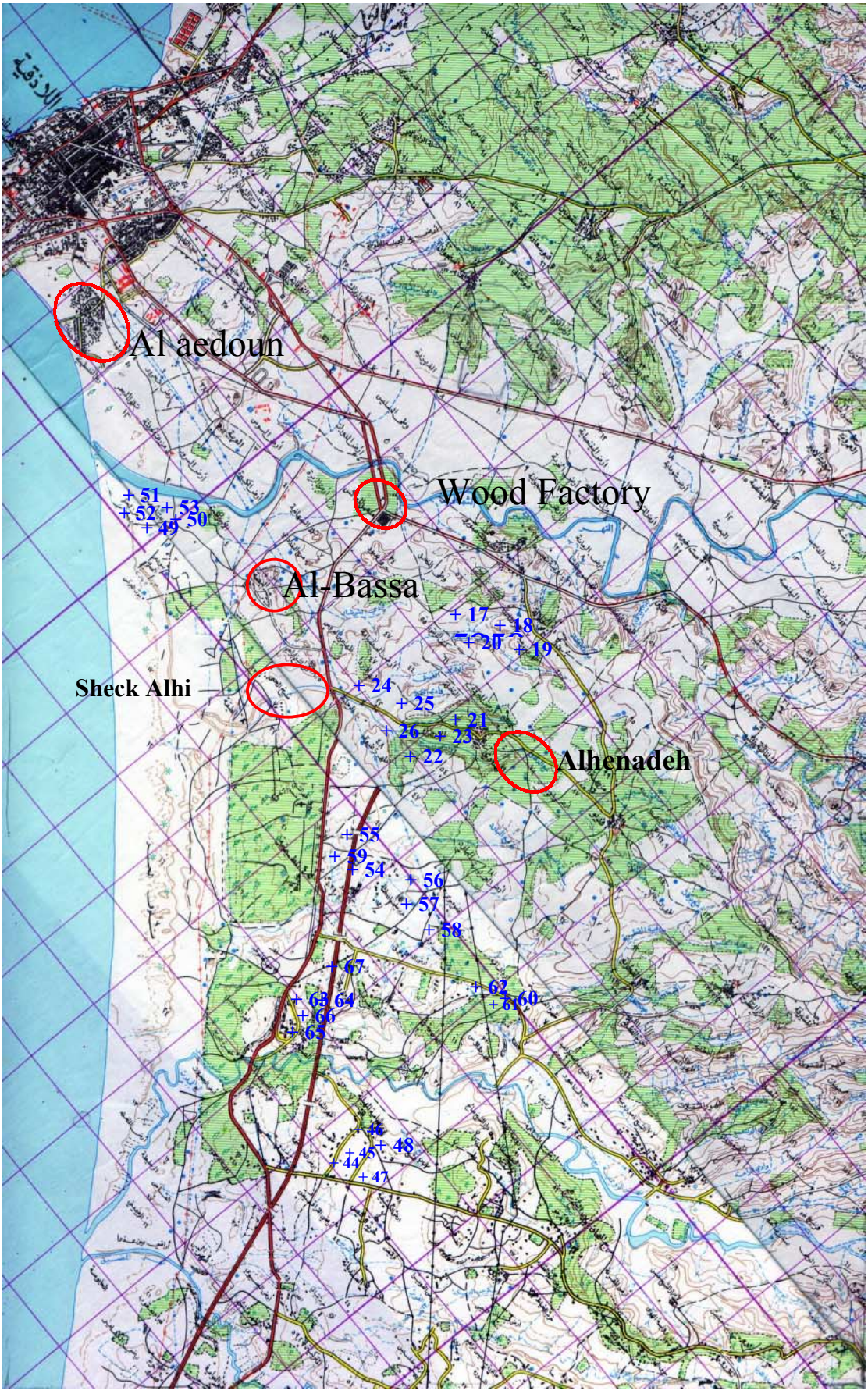

Figure 5.1.1 Locations of Interviewed Households

The Survey was implemented by Survey Team composed of 8 trained persons and a set of surveyor did interview at selected each household.

(1) Survey Results

The results of the Interview Survey reveal the following points:

1) General Attributes of the Households:

- 40% of the households are located in areas adjacent to the site of the landfill. This concerns respectively Al-Bassa 20% (village, scavengers and lonely households), Al-Henadeh 15% (village and lonely households) and the site Al-Hiker 5%. The exact location of each household is well presented on the map of Annex 1. This can help making more sophisticated analysis by the use of appropriate G.I.S. Techniques in order to reveal role of the spatial dimension in the environmental impact on the sites.
- 68% of the respondents are married, whereas 32% are single. This could be explained by the fact that the interviews were not exclusively carried out with the household keeper, but also with adult persons living in the household in the case of the absence of the later.
- Only 10% of the households have 5 members. And the total percentage of households having between 4 and 6 members is only 32%. This result is very different from habitual results obtained in Lattakia, where this percentage is 64%. This could be explained by the fact that rural Households count a bigger number of members than urban ones. Indeed, 27% of the surveyed Households do have between 9 and 11 members.
- The profession of the respondent can be divided into the main following categories:
  Public Employees 30%
  Farmers 22%
  Private Business 20%
- 17% of the interviewee doesn't work.
- 62% of the respondents have only a school degree (this includes education varying from elementary to secondary school). And 17% don't have any level of official education.
- Most of the respondent (55%) declares a monthly individual income less than 4,000 SP. Also 24% declare an income between 4,000 and 6,000 SP.
- The total Income of the Household is less than 5,000 SP in 40% of cases. 27% of the Households have a monthly Income between 9,000-15,000 SP, and even 8% of the households have a monthly Income higher than 25,000 SP.
- Most of the Houses are made of concrete. And concerning the Drinking Water, 53% of the Households have a water supply system but 44% of the Households depend on wells for drinking. The Type of Toilet is divided into 2 main categories: Hufra Sahiah for 49% of the Households and Sewerage System for 51%.

2) Opinion on the Existing Waste Disposal Site:

- 87% of the interviewees declare knowing Al-Bassa as the disposal site for Households Wastes. 67% of the Households declare suffering several problems from this site and 86% of the interviewees declares not having any benefits of this site. The 13% of the Households having benefits of the site is composed essentially of the Scavengers (10% of total interviewees), the other 3% are having different non-identified benefits.
- 75% of the interviewees declares not having illness in their families. Among the 25% declaring illness, mentions are made to Breath and Skin illness in most of the cases.
- Although 53% of the Households benefits of water supply (see above), 60% of the interviewees declares using Well water. These uses are distributed for Drinking (31%), Irrigation (25%) and other uses (12%).
- 50% of the interviewees declare smelling "bad" and "very bad" odours from the landfill. 8% declares smelling this odour all the time. This percentage is essentially composed of Households located at Al-Bassa, Al-Hiker and Al-Henadeh, which are the nearest villages to the disposal site. 14% declares smelling this odour by night times.
- Finally, 80% of the interviewees declare that the current disposal site should be closed. Nevertheless, 92% declares that the current disposal site should be rehabilitated.

3) Opinions on the Proposed Al-Bassa Cleansing Complex (ABC Complex)

- 43% of the interviewees declare having already heard about the proposed Al-Bassa Cleansing Complex (ABC Complex). But this result should be taken with reserves. The interviewees seem to misunderstand the question as they reveal that they already saw the complex. It seems that the interviewees are taking this question as for the existing dumping site.
- Nevertheless, when the interviewees receive a clear explanation about the proposed rehabilitation of the Site, i.e. covering wastes with soil and planting trees and shrubs, they reveal positive opinion in 66% of the cases. In addition, 79% of the interviewees agree with the construction of a Composting Plant when they understand that this means the production of organic manure from organic municipal waste. Moreover, 90% of the interviewees agree with the construction of sorting center on the site.
- Thus, 81% of the interviewees agrees in total with the proposed Al-Bassa Cleansing Complex with all its components: Rehabilitation of the Landfill, Sorting Center and Composting Plant. In their grate majority, about 92% of the interviewees thinks that these projects will help reducing negative environmental impacts. And 87% of the interviewees think that future environmental impacts of these projects shall be better compared to the present conditions.

4) Specific Situation of Scavengers

The survey interviewed with 11 Scavengers in the total Sample. Indeed, one more Scavenger found in Lattakia (Al-Aedoun) is to be added to the 10 Scavengers interviewed at the site of Al-Bassa Landfill. The specific items related to Scavengers revealed the following points:

- 9 Scavengers, out of 11, estimate obtaining good income of their work.

- 6 of the Scavengers declared that Scavenging for them is a full-time work. 4 of the remaining 5 don't have any other work, even if they consider Scavenging as only part-time work.
- 6 Scavengers declare the will to continue this kind of work in the future, 5 persons are in search of another kind of work. Nevertheless, if the Scavenger is to choose between Scavenging or having a Job in the future Municipal Sorting Centre, 7 Persons declare their choice for Scavenging and only 4 persons revealed their will to switch to the new Job.

The Questionnaire for Household Interview at Al-Bassa

Environmental Baseline Survey at Al-Bassa Cleasing Complex
The JICA Study on Solid Waste Management At Local Cities in the Syrian Arab Republic

August 2001

1- Questionnaire No:
2- Date:
3- Address (area or zone): Name of respondent:

I. Attribute of household

4- Age of respondent:
5- Sex of respondent:
1- Male 2- Female
6- Marital status of respondent:
1- Single 2- Married
7- Number of your family members:
8- Age of your family members:
1- 2- 3- 4- 5- 6- 7- 8- 9-
9- Profession of respondent:
1- I do not work 2- Public employee 3- Privet employee
4- Private business 6- Farmer 7- Scavenger
10- Place of work:
11- Level of Education:
1- Non 2- School 3- Institute
4- University 5- Postgraduate 6- other:
12- Your monthly income:
13- The total of Your family monthly income:
14- How long do you live there?
15- How do you dispose your household waste?
16- Drinking water source:
1- Water supply 2- Well 3- Other
17- Structure of your house:
1- Concrete 2- Brick 3- Other
18- Do you have telephone:
1- Yes 2- No
19- Type of Toilet:
1- Hufra Sahiah 2- Sewerage

II. Present situation of the existing waste disposal site:

20- Do you know the existing disposal site in Lattakia Governorate? (Do you know where does your household waste go to be dumped?)
1-Yes 2- No
If yes please describe:
21- Are there any problems (odor, noise traffic, smoke, fire, insects, scattering plastic bags, etc.) there?
1-Yes 2- No
22- If Yes, please describe your problem:

23- Do you get any benefit from the disposal site?
1-Yes 2- No
24- If Yes, please describe your benefit from the site:
1-Breeding animals 2- Scavenging 3- Other:

25- Do you have or does your family have any illness?
1-Yes 2- No
26- If Yes, please describe the illness:

27- Do you use well water:

1-Yes 2- No
28- If Yes, how do you use the well water?
1- For drinking 2- For irrigating 3- Other:

29- Do you feel odor from the site?
1-Yes 2- No
30- If Yes, please describe the magnitude of odor:
1- Very Bad 2- Bad 3- Nothing

31- When do you feel odor?
1-All the time 2- A few time 3- Rainy season
4- Night time 5- Day time 6- Other:

32- Do you think that current disposal site should be closed:
1-Yes 2- No
33- If Yes, Please describe your reason:

33- Do you think that current disposal site should be rehabilitated:
1-Yes 2- No
34- If Yes, what is the main concern of your rehabilitation idea. Please describe your idea:

35- Do you think that it is necessary to facilitate treatment facilities of municipal waste:
1-Yes 2- No
36- If Yes, what kind of facilities is it necessary to facilitate. Please describe:

37- Do you have any other opinion (scattering plastic bags) for the site:
1-Yes 2- No
38- If Yes, please describe your idea:

III. Proposed Al-Bassa Cleansing Complex (ABC Complex)

39-Al-Bassa Cleansing Complex (rehabilitated landfill site, composting plant and sorting centre) is proposed on the site by Lattakia Governorate. Do you know this proposal?
1-Yes 2- No
40- If Yes, how did you know:

41- Do you agree with the rehabilitation of current dump site (covering soil and planting trees and shrubs):
1-Yes 2- No 3- I do not know
42- If Yes, please describe your opinion:
43- If No, please describe your opinion:

44- Do you agree with the construction of composting plant (producing organic manure from organic municipal waste):
1-Yes 2- No 3- I do not know
45- If No, please describe your opinion:

46- Do you agree with construction of sorting center (sorting organic and Non-organic wastes, and organic waste will be material of compost) on the site:
1-Yes 2- No 3- I do not know
47- If No, please describe your opinion:

48- Do you agree with proposed Al-Bassa Cleansing Center:
1-Yes 2- No
49- If No/yes, please describe your opinion:

50- Do you have any other opinion on proposed Al-Bassa Cleansing Center:
1-Yes 2- No
51- If Yes, please describe your opinion:

52- Do you have any opinion on solid waste management in Lattakia Municipality:
1-Yes 2- No

53- If Yes, please describe your opinion:

54- Do you think the rehabilitation of the current disposal site will reduce a negative environmental impact (problems)?
1-Yes 2- No
55-Do you think the transfer station will have negative impacts (problems)?
1-Yes 2- No
56- Do you think the composting plant will have negative impact (problems)?
1-Yes 2- No
57- In total, how do you evaluate environmental impacts compared to present conditions?
1- Getting worse 2- Same 3- Getting better

IV. Scavenging on the Site. (for scavengers)

58- How do you evaluate your work, is it good income:
1-Yes 2- No
Describe your reason:

59- For you, scavenging is:
1-Full time job 2- Part time job

60- Is there any other job for you:
1-Yes 2- No

61- Do you want to continue this job:
1-Yes 2- No
Describe your reason:

62- What do you think if the disposal site is closed? Please describe:

63- Do you want to continue this work if the cleansing canter provides job opportunities such as sorting municipal waste:
1-Yes 2- No
If no, describe your reason:

Information to be Provided by the Interviewer:

64-Interview location:
1- Inside the disposal site 2- < 1 km 3- < 2 km 4- < 5 km 4- > 5 km

65- Number of attendee for the interview: Persons

Surveyor: Signature:

Supervisor: Signature:

5.3 SECONDARY INFORMATION COLLECTION

Available secondary information was collected in the study and compiled in the survey report.

APPENDIX 6

ENVIRONMENTAL BASELINE SURVEY FOR EIA IN HOMS

APPENDIX 6 ENVIRONMENTAL BASELINE SURVEY IN HOMS

6.1 INTRODUCTION

The survey is composed of three parts, water quality analysis, opinion pool survey and secondary information collection. The survey was consigned to the Unit of Professional Practice at Chemical Engineering Department, Chemical and Petroleum Engineering Faculty, Al-Bassa University and following experts were participated on this survey.

- Prof. Dr. Eng. Adnan Ghata, The head of P.P.U.
- Prof. Dr. Munir Bitaar
- Prof. Dr. Eng Ahmed Al-Mahmuod
- Ass. Prof. Dr.Eng.Fuaad Atalah
- Ass. Prof. Dr. Eng. Adnan Chechk Hamoud
- Dr. Eng. Farhan Alfin
- Ch. Eng. Fadi Alessas
- Tech. Sadek Almusetef
- Tech. Esam Al rastanawe
- Tech. Fatima al kourdy

The summary of the survey is as follows:

6.2 SURFACE WATER QUALITY SURVEY

Surface water quality of proposed compost plant sites was measured in accordance with following conditions shown in Table 6.2.1.

Table 6.2.1 Measuring Conditions for Surface Water Quality

Sampling location	Rivers and ponds in and adjacent area
Number of sample	4
Measurement substances	13 items; Temperature,Water temperature, Colour, pH, thickness, Electric Conductivity, DO, COD, BOD, SS, Coliform, T-P, T-N
Laboratory test	Samples shall be tested at authorized laboratory by the Syrian government or internatonal organizations

6.2.1 Sampling and Analysis Method

6 samples, groundwater (Sample 1, 2, 3, 6), irrigation channel (Sample 4) and Orontes River water (Sample 5), were collected.

Heavy metals cations, nitrate, phosphate and chloride ions were measured with Spectrophotometer HACH DR 4,000U and the conductivity was measured with HACH LF 330 Biolock.

(1) Sampling Locations

The following points were selected for sampling.

1) Ground Water

- Sample 1: well of dip 100 m, production from 60 m, flow rate of 1.5 inches Tube, irrigational area about 700 m^2
- Sample 2: well of dip 97 m, production from 75 m, flow rate of 3.0 inches Tube, irrigational area about 3,300 m^2
- Sample 3: well of dip 100 m, production from 60 m, flow rate of 3.0 inches Tube, irrigational area about 1,700 m^2
- Sample 6: well of dip 85m, production from 46 m, flow rate of 1.5 inches Tube, irrigational area about 2,000 m^2

2) Irrigation Water

- Sample 4: Irrigation Channel Water located at –Alkarabis Sample 5: Orontes River Water located at Abbara casino

3) Channel Water

- Samples Analysis contains pH, COD (Chemical Oxygen Demand), BOD5 (Biochemical Oxygen Demand), SS (Suspended Solids), DO (Dissolved Oxygen), NO_3^-, PO_4^{3}, Cl, Escherchia. Coli (colony of bacteria/mL) and heavy metal, Fe, Zn, Cd, Pb, As, Hg.

6.2.2 Results of Water Quality

The results of water quality are shown in Table 6.2.2 to Table 6.2.7.

Table 6.2.2 Results of Sample 1

	Items	Unit	Syr. Stand. Drinking.	Syr. Stand. Irrigation	Result	Methods (*)
1	PH	mg/L	7-8.5	6.5-8.5	7.23	HACH one combination PH electric method
2	COD	mg/L	1-2	-	2.2	Dichromate Reactor Digestion method
3	BOD_5	mg/L	0	4	1	Respirometric method (using The BOD Track Apparatus)
4	SS	mg/L	-	-	3	Photometric method Wavelength 810 nm
5	DO	mg/L	-	4	7.81	Aside modification of Winchers method using the Digital Titration
6	$N\text{-}NO_3^-$	mg/L	40	60	14.4	Wavelength 410 nm
7	PO_4^{3-}	mg/L	0.5	3.5	0.05	Wavelength 430 nm
8	T-Cl	mg/L	200	150	0.01	Amperometric forward titration Using the digital titration
9	Fe	mg/L	1	-	0.17	Wavelength 477 nm
10	Zn	mg/L	5	-	0.09	Zincon method Wavelength 620 nm
11	Cd	µg/L	10.0	10.0	13.0	Dithizone method Wavelength 515 nm
12	Pb	µg/L	5.0	-	1	Wavelength 477 nm
13	As	µg/L	0.05	0.1	0.043	Silver diethyldithiocarbamate Method and wavelength 520 nm
14	Hg	µg/l	1.0	1.0	0,8	Mercury extraction method
15	Conductivity	µS/cm	200	1,200	183	

	Items	Unit	Syr. Stand. Drinking.	Syr. Stand. Irrigation	Result	Methods (*)
16	Escherchia Coli	Colony of bacteria/ 100mL	0	-	3	Membrane Filtration method

Note: (*) HACH water analysis Handbook (ISO 9001 certified), HACH Company Loveland, Colorado, U.S./A., Copyright 1997, by Hach Company

Table 6.2.3 Results of Sample 2

		Unit	Syr. Stand. Drinking	Syr. Stand. Irrigation	Result	Methods (*)
1	PH	mg/L	7-8.5	6.5-8.5	7.4	HACH one combination PH electric method
2	COD	Mg/L	1-2	-	2.7	Dichromate Reactor Digestion method
3	BOD_5	mg/L	0	4	2	Respirometric method (using the BOD Trak Apparatus)
4	SS	mg/L	-	-	1	Photometric method Wavelength 810 nm
5	DO	mg/L	-	4	8.39	Aside modification of Winchers method using the Digital Titration
6	$N\text{-}NO_3^-$	mg/L	40	60	13.1	Wavelength 410 nm
7	PO_4^{3-}	mg/L	0.5	3.5	0.01	Wavelength 430 nm
8	Cl	mg/L	200	150	0.04	Amperometric forward titration Using the digital titration
9	Fe	mg/L	1	-	0.08	Wavelength 477 nm
10	Zn	mg/L	5	-	0,11	Zincon method Wavelength 620 nm
11	Cd	µg/L	10.0	10.0	11.2	Dithizone method Wavelength 515 nm
12	Pb	µg/L	5.0	-	2	Wavelength 477 nm
13	As	mg/L	0.05	0.1	0,04	Silver diethyldithiocarbamate method and wavelength 520 nm
14	Hg	µg/L	1.0	1.0	0,4	Mercury extraction method
15	Escherchia Coli	colony of bacteria/ 100mL	0	-	3	Membrane Filtration method

Note: (*) HACH water analysis Handbook (ISO 9001 certified), HACH Company Loveland, Colorado, U.S./A., Copyright 1997, by Hach Company

Table 6.2.4 Results of Sample 3

		Unit	Syr. Stand. Drinking	Syr. Stand. Irrigation	Result	Methods (*)
1	PH	mg/L	7-8.5	6.5-8.5	7.54	HACH one combination PH electric method
2	COD	mg/L	1-2	-	3.5	Dichromate Reactor Digestion method
3	BOD_5	mg/L	0	4	1	Respirometric method (using The BODTrak Apparatus)
4	SS	mg/L	-	-	1	Photometric method Wavelength 810 nm
5	DO	mg/L	-	4	8.01	Azide modification of Winkher method using the Digital Titration
6	NO_3^-	mg/L	40	60	10.8	Wavelength 410 nm
7	PO_4^{3-}	mg/L	0.5	3.5	0.02	Wavelength 430 nm
8	T-Cl	mg/L	200	150	0.04	Amperometric forward titration using the digital titration
9	Fe	mg/L	1	-	0.04	Wavelength 477 nm
10	Zn	mg/L	5	-	0.10	Zincon method Wavelength 620 nm
11	Cd	µg/L	10.0	10.0	11.1	Dithizone method wavelength 515 nm
12	Pb	µg/L	5.0	-	3	Wavelength 477 nm
13	As	mg/L	0.05	0.1	0.042	Silver diethyldithiocarbamate Method and wavelength 520 nm
14	Hg	µg/L	1.0	1.0	0.42	Mercury extraction method
15	Escherchia Coli	Colony of bacteria/ 100mL	0	-	4	Membrane Filtration method

Note: (*) HACH water analysis Handbook (ISO 9001 certified), HACH Company Loveland, Colorado, U.S./A., Copyright 1997, by Hach Company

Table 6.2.5 Results of Sample 4

		Unit	Syr. Stand. Drinking	Syr. Stand. Irrigation	Result	Methods (*)
1	PH	mg/L	7-8.5	6.5-8.5	7.80	HACH one combination PH electric method
2	COD	mg/L	1-2	-	93	Dichromate Reactor Digestion method
3	BOD_5	mg/L	0	4	1	Respirometric method (using the BODTrak Apparatus)
4	SS	mg/L	-	-	32	Photometric method Wavelength 810 nm
5	DO	mg/L	-	4	6.74	Azide modification of Winkher Method using the Digital Titration
6	NO_3^-	mg/L	40	60	0.7	Wavelength 410 nm
7	PO_4^{3-}	mg/L	0.5	3.5	5.8	**Wavelenght 430 mm**
8	T-Cl	mg/L	200	150	0.03	Amperometric forward titration using the digital titration
9	Fe	mg/L	1	-	0.12	Wavelength 477 nm
10	Zn	mg/L	5	-	0.11	Zincon method Wavelength 620 nm
11	Cd	µg/L	10.0	10.0	30.5	Dithizone method Wavelength 515 nm
12	Pb	µg/L	5.0	-	2.0	Wavelength 477 nm
13	As	mg/L	0.05	0.1	0.198	Silver diethyldithiocarbamate Method and wavelength 520 nm
14	Hg	µg/L	1.0	1.0	0,5	Mercury extraction method
15	Escherchia Coli	Colony of bacteria/ 100mL	0	-	195	Membrane Filtration method

Note: (*) HACH water analysis Handbook (ISO 9001 certified), HACH Company Loveland, Colorado, U.S./A., Copyright 1997, by Hach Company

Table 6.2.6 Results of Sample 5

		Unit	Syr. Stand. Drinking	Syr. Stand. Irrigation	Result	Methods (*)
1	PH	mg/L	7-8.5	6.5-8.5	7.57	HACH one combination PH electric method
2	COD	mg/L	1-2	-	107	Dichromate Reactor Digestion method
3	BOD_5	mg/L	0	4	6.1	Respirometric method (using the BODTrak Apparatus)
4	SS	mg/L	-	-	6	Photometric method Wavelength 810 nm
5	DO	mg/L	-	4	5.55	Azide modification of Winkher Method using the Digital Titration
6	NO_3^-	mg/L	40	60	1.5	Wavelength 410 nm
7	PO_4^{3-}	mg/L	0.5	3.5	5.3	Wavelength 430 nm
8	Cl	mg/L	200	150	0.05	Amperometric forward titration using the digital titration
9	Fe	mg/L	1	-	0.19	Wavelength 477 nm
10	Zn	mg/L	5	-	0	Zircon method Wavelength 620 nm
11	Cd	µg/L	10.0	10.0	33.5	Dithizone method Wavelength 515 nm
12	Pb	µg/L	5.0	-	Under range	Wavelength 477 nm
13	As	mg/L	0.05	0.1	0.06	Silver diethyldithiocarbamate Method and wavelength 520 nm
14	Hg	µg/L	1.0	1.0	0,35	Mercury extraction method
15	Escherchia Coli	Colony of bacteria/ 100mL	0	-	200	Membrane Filtration method

Note: (*) HACH water analysis Handbook (ISO 9001 certified), HACH Company Loveland, Colorado, U.S./A., Copyright 1997, by Hach Company

Table 6.2.7 Results of Sample 6

		Unit	Syr. Stand. Drinking	Syr. Stand. Irrigation	Result	Methods (*)
1	PH	mg/L	7-8.5	6.5-8.5	7.80	HACH one combination PH electric method
2	COD	mg/L	1-2	-	3.2	Dichromate Reactor Digestion method
3	BOD_5	mg/L	0	4	1	Respirometric method (using The BODTrak Apparatus)
4	SS	mg/L	-	-	2	Photometric method Wavelength 810 nm
5	DO	mg/L	-	4	7.04	Azide modification of Winkher Method using the Digital Titration
6	NO_3^-	mg/L	40	60	14.3	Wavelength 410 nm
7	PO_4^{3-}	mg/L	0.5	3.5	0.47	Wavelength 430 nm
8	Cl	mg/L	200	150	0.04	Amperometric forward titration using the digital titration
9	Fe	mg/L	1	-	0.09	Wavelength 477 nm
10	Zn	mg/L	5	-	0	Zincon method Wavelength 620 nm
11	Cd	µg/L	10.0	10.0	38.00	Dithizone method Wavelength 515 nm
12	Pb	µg/L	5.0	-	Under range	Wavelength 477 nm
13	As	mg/L	0.05	0.1	0.042	Silver diethyldithiocarbamate Method and wavelength 520 nm
14	Hg	µg/L	1.0	1.0	0.35	Mercury extraction method
15	Escherchia Coli	Colony of bacteria/ 100mlL	0	-	3	Membrane Filtration method

Note: (*) HACH water analysis Handbook (ISO 9001 certified), HACH Company Loveland, Colorado, U.S./A., Copyright 1997, by Hach Company

6.2.3 Discussion

All the water samples are not useful for human being and not drinkable by the reasons of:

- The value of COD is not high,
- The value of BOD is ranging between 1 – 3mg/L which must be zero,
- The bacterial analysis refers to a small pollution.

The relationship between COD and BOD5, that means the COD:BOD5 is used to assess the chances of success of biological processes in wastewater treatment.

The COD:BOD5 ratio is:

Ca. 2	In domestic waste waters
Below 2	In commercial waste waters
Above 2	In waste waters discharged from the food and beverage industries

Quotients in excess of 2 down to 2 indicate that biological processes largely remove BOD5 and the COD-causing substances. The biological decomposition starts immediately and proceeds.

The COD:BOD5 ratio of the samples 1, 2, 3 and 4 is ca. 2 and this water resample domestic waters .The ratio of sample 5 is 5.35 and of sample 6 is 3.87. Both samples (5 and 6) resample wastewater discharged from the food and beverage industries

6.3 HOUSEHOLD INTERVIEW SURVEY

Opinion poll of implementation of proposed waste disposal management project shall be surveyed in accordance with following conditions shown in Table 6.3.1.

Table 6.3.1 Conditions of Interview Survey

Sampling location	Adjacent area of the proposed projects
Number of sampling	Approximately 50
Method of survey	Household interview
Data process	Interview results shall be processed as simple

This interview survey is carried out for proposed Homs Cleansing Center in order to attain public opinions from citizens who live in adjacent area to the proposed site and its environs.

Collected data and information were obtained from the adjacent area of proposed project inside the disposal site and around it with 5 km radius, the number of people participate in sampling interview were 50. The method of survey was household interview with using questioner with following main points:

- Attribute of household.
- Present situation of existing disposal waste disposal site.
- Proposed Homs cleansing center.
- Scavenging on the site (for Scavengers).

- Information to be provided by the interviewer.

The Interviewee category:

The Number of attendee for the interview:
/50/ Persons

Table 6.3.2 shows the summary statics for discrete variables.

Table 6.3.2 Summary Statistics for Discrete Variables

1-3 Sex	Count	Percent	1-4 Occup	Count	Percent	1-7	Count	Percent
M	44	88.00	S	10	20.00	bigamy	1	2.00
F	6	12.00	F	20	40.00	married	41	82.00
N=	50		WLE	10	20.00	single	8	16.00
			WHE	10	20.00	N=	50	
			N=	50				
1-13	Count	Percent	1-14	Count	Percent	1-15	Count	Percent
Other	13	26.00	Other	9	18.00	No	30	60.00
Well	21	42.00	Conrete	41	82.00	Yes	20	40.00
Water	16	32.00	N=	50		No=	50	
N=	50							
2-1	Count	Percent	2-2	Count	Percent	2-4	Count	Percent
Yes	48	96.00	No	6	12.00	No	41	82.00
No	2	4.00	Yes	44	88.00	Yes	9	18.00
N=	50		N=	50		N=	50	
2-6	Count	Percent	2-8	Count	Percent	2-10	Count	Percent
No	30	60.00	No	18	36.00	No	7	14.00
Yes	20	40.00	Yes	32	64.00	Yes	43	86.00
N=	50		N=	50		N=	50	
2-13	Count	Percent	2-15	Count	Percent	2-17	Count	Percent
No	7	14.00	Yes	31	62.00	No	20	40.00
Yes	43	86.00	No	19	38.00	Yes	30	60.00
N=	50		N=	50		N=	50	
2-19	Count	Percent	3-1	Count	Percent	3-3	Count	Percent
No	22	44.00	No	14	28.00	I don't	6	12.00
Yes	28	56.00	Yes	36	72.00	Yes	33	66.00
N=	50		N=	50		No	11	22.00
						N=	50	
3-5	Count	Percent	3-7	Count	Percent	3-9	Count	Percent
Idon't	4	8.00	I don't	6	12.00	Yes	15	30.00
Yes	17	34.00	Yes	15	30.00	No	28	56.00
No	29	58.00	No	29	58.00	I don't	7	14.00
N=	50		N=	50		N=	50	
3-11	Count	Percent	3-13	Count	Percent	3-15	Count	Percent
Yes	16	32.00	No	40	80.00	no	42	84.00
Idon't	15	30.00	Yes	10	20.00	I don't	1	2.00
No	19	38.00	N=	50		yes	7	14.00
N=	50					N=	50	
3-17	Count	Percent	3-18	Count	Percent	3-19	Count	Percent
no	23	46.00	I don't	1	2.00	I don't	2	4.00
yes	27	54.00	no	11	22.00	no	8	16.00
N=	50		yes	38	76.00	yes	40	80.00
			N=	50		N=	50	
4-1	Count	Percent	4-2	Count	Percent	4-4	Count	Percent
Yes	9	90.00	Yes	9	90.00	No	5	50.00
No	1	10.00	No	1	10.00	Yes	5	50.00
N=	10		N=	10		N=	10	

Note: F: Farmer, S=Scavenger, WLE= Low educational workers from near villages, WHE=High educational workers

6.3.1 Discussion

This interview survey is carried out for proposed Homs Cleansing Center. More then 44 men and 6 woman from the citizens who lives in adjacent area told their opinion in order to attain public opinions from citizens to the proposed site.

The statistical studies show 40% were farmer, 20% were scavengers, 20% worker with low education (les then 9 classes) and the last 20% were high educational workers from the area. 96% know the existing disposal site and 88% have problems from odor, smoke, insects, 86% feel odor from the site at rainy season, 42% use the water from the wells for drinking and irrigation. 18% only have benefit from the disposal site and 82 don't have, 40% thinks that some of there family had illness from the site, like skin problems, favor, stomach illness, only 62% like that the current disposal to be rehabilitated, 66% agree that the current site must cover with soil and planting with tree, 22% don't believe that any tree will grow there, 12% say we don't know if it is good. 58% don't agree with the construction of transfer station or composting plant or storing center or proposed Homs Cleaning Center and 38% agree with it.

But 80% don't have any other opinion on proposed HCC, and 84% don't have any opinion on solid waste management in Homs Municipality. 54% thinks that the rehabilitation of current site will reduce a negative E.I (problems) and 75% think that the transfer station have negative E.I. and 80% think that the composting plant have negative E.I. But 50% think that the future environmental impact will be the same . 90% of scavengers agree that the income is good and they want to continue this job, only 59% of them wont to work in HCC such as sorting the municipal waste.

The most of people lives there (near the disposal site) are from poor category and for the scavengers the disposal site is very important for sorting municipal waste and have good income and for them it is not important to have new cleaning centre. And the farmer there doesn't agree with rehabilitation existing disposal site or have storing, storing centre or they wont from the responsible people change the place of disposal site. See the following appendix.

The Questionnaire for Household Interview Survey in HOMS

The Study on
Solid Waste Management at Local Cities in the Syrian Arab republic (JICA)

1-Attribute of household:

1-1 Address (Area or Zone)
1-2 Age:
1-3 Sex:
1-4 Occupation:
1-5 Place of your work:
1-6 How long do you live there:
1-7 Marital status:
1-8 Number of family members:
1-9 Age of your family members:
1-10 Education status of interviewee:
1-11 You're monthly income and a total family monthly income:
1-12 How do you dispose your household waste?
1-13 Drinking water source:
Water supply Well Others
1-14 Structure of your house
Concrete Brick Others (wooden, tent, etc.)
1-15 Do you have telephone?
Yes No

2-Present situation of the existing waste disposal site:

2-1 Do you know the existing disposal site in Homs Municipality?
Yes No
1. Bayadha 2. Dier Baalbeh 3. Zidal 4. Toudmor Road
2-2 Are there any problems (odor, noise traffic, smoke, fire, insects, scattering plastic bags, etc.) there?
Yes No
2-3 If Yes, please describe your problem.
2-4 Do you get any benefit from the disposal site?
Yes No
2-5 If yes, please describe your benefit (breeding animals, scavenging, etc.) from the site
2-6 Did you or your family have any illness?
Yes No
2-7 If Yes, please describe the illness.
2-8 Do you use well water?
Yes No
2-9 If Yes, how do you use the well water (for drinking, irrigation, etc.)?
2-10 Do you feel odor from the site?
Yes No
2-11 If Yes, please describe the magnitude of odor
Very bad Bad Nothing
2-12 When do you feel odor?
All the time A few Rainy season Night time Day time
2-13 Do you think that current disposal site should be closed?
Yes No
2-14 If Yes, Please describe your reason.
2-15 Do you think that current disposal site should be rehabilitated?
Yes No
2-16 If yes, what is the main concern of your rehabilitation idea. Please describe your idea.
2-17 Do you think that it is necessary to facilitate treatment facilities of municipal waste?
Yes No
2-18 If yes, what kind of facilities is it necessary to facilitate. Please describe.
2-19 Do you have any other opinion (scattering plastic bags) for the site?
Yes No
2-20 If yes, please describe your idea.

3-Proposed Homs Cleansing Center:

3-1 Homs Cleansing Center (rehabilitated landfill site, composting plant, transfer station and sorting center) is proposed on the site by Homs Municipality. Do you know this proposal?
Yes No

3-2 If Yes, how did you know?
3-3 Do you agree with the rehabilitation of current dump site (covering soil and planting trees and shrubs)?

Yes No I do not know

3-4 If No, please describe your opinion.
3-5 Do you agree with the construction of transfer station (transport municipal waste from the city to the station and re-transport to a new final disposal site (Maghlia)) on the site?
Yes No I do not know

3-6 If No, please describe your opinion.
3-7 Do you agree with the construction of composting plant (producing organic manure from organic municipal waste)?
Yes No I do not know

3-8 If No, please describe your opinion.
3-9 Do you agree with construction of sorting center (sorting organic and Non-organic wastes, and organic waste will be material of compost) on the site?
Yes No I do not know
3-10 If No, please describe your opinion.
3-11 Do you agree with proposed Homs Cleansing Center?
Yes No
3-12 If No, please describe your opinion; if Yes, please describe your opinion.
3-13 Do you have any other opinion on proposed Homs Cleansing Center?
Yes No
3-14 If Yes, please describe your opinion.
3-15 Do you have any opinion on solid waste management in Homs Municipality?
Yes No
3-16 If Yes, please describe your opinion.
3-17 Do you think the rehabilitation of the current disposal site will reduce a negative environmental impact (problems)?
Yes No
3-18 Do you think the transfer station will have negative impacts (problems)?
Yes No
3-19 Do you think the composting plant will have negative impact (problems)?
Yes No
3-20 In total, how do you evaluate the future environmental impacts compared to present conditions?
Getting worse Same Getting better

4- Scavenging on the Site. (for scavengers)

4-1 How do you evaluate your work, is it good income?
Yes No
4-2 Do you want to continue this job?
Yes No
4-3 What do you think if the disposal site is closed? Please describe.

4-4 Do you want to continue this work if the cleansing canter provides job opportunities such as sorting municipal waste
Yes No

Information to be Provided by the Interviewer:

Interview location:
Inside the disposal site:
< 1 km < 2 km < 5 km > 5 km

Interviewee category:
Farmer (F)
Scavenger (s)
From near villages Low educational workers (wle)
High educational workers (whe).

/50/ Persons

6.4 HOMS SEWAGE TREATMENT PLANT

6.4.1 Process Design and General Design Data

(1) Flows

The following flows relating to the treatment plant design have already been established in the Pre-investment Study and can be summarized as follows:

Table 6.4.1 Flow relating to Treatment Plant

	m^3/d	1/s
Mean Flow	133.900	1.550
Maximum Flow to works (in wet weather)	259.000	3.420
Maximum Flow to receive full treatment	233.300	2.700
Minimum Flow	69.100	800

(2) Crude Sewage Strength and quality

The Characteristics of the sewage determined be measurement of existing sewage strengths and projections of pollution loads adopted for the treatment plant design are set out below:

Table 6.4.2 Characteristics of Sewage

5 day biochemical oxygen demand BOD_5	507 mg/L
Suspended Solids	512 mg/L
Total BOD_5 loading	68.680 kg/d
Total SS loading	67.880 kg/d
Average COD/BOD ratio	2.20 : 1.00
Estimated Average Nutrient concentration BOD : N : P ratio	100 : 4.7 : 1.0

(3) Effluent Standards

The effluent standards adopted as a result of the Pre-investment Study are :

Table 6.4.3 Effluent Standards

BOD_5	40 mg/L
SS	40 mg/L
Faecal Coliform Count	MPN per 100 ml 1.5×10^5

6.5 SYRIAN SAFE DRINKING WATER ACT (STANDARD NO. 45)

The following show the allowable limits based on Syrian Safe Drinking Water Act.

Table 6.5.1 Allowable Limits related to Syrian Safe Drinking Water Act

	Admissible (mg/L)	Upper limit (mg/L)
$CaCO_3$	300	650
PH	7-8.5 unit	6.5-9.2
Fe	0,3	1,0
Mn	0,1	0,5
Zn	5	15
Cu	1	1,5
Mg	50	150
Ca	75	200
SO_4^{2-}	200	400
Cl^-	200	600
F^-	0,6	1,5
NO_3	15	40
NH_3	0	trace
NO^{2-}	0	0
PO_4^{2-}		0.5
Pb		0,05
Se		0,01
As		0,05
Cr^{6+}		0.05
CN^-		0,001
Cd		0,01
E.Coli		1/100 mL
COD		1-2 mg/L
BOD_5	0	0

6.6 GENERAL STANDARD FOR IRRIGATION WATER AND FISHING WATER OF ORONTES RIVER

The following shows the general standard for irrigation.

Table 6.6.1 General Standards for Irrigation

	Mg/L
BOD_5	4
DO	4
DO (%)	40-60 %
TDS	800
$N\text{-}NH_3$	1,2
SO_4^{2-}	250
Cl^-	150
Mg^{2+}	10
K^+	7
NO_3^-	60
PO_4^{2-}	3.5

	Mg/L
S^{2-}	0,5
CN^-	0,02
Phenols	2
Al^{3+}	5
As	0,1
Be	0,1
B	0,75
Cd	0,01

6.7 SECONDARY DATA AND INFORMATION COLLECTION

6.7.1 Social Environment

(1) Administrative Boundary

The survey area is an arable land with a total area of 35,000 m^2 approximately. It surrounded by a large area, one part of which is planted with vegetables, the second part is plowed and the third is recently planted with trees.

The mentioned survey area occupies the landed area number 1615, 1616, 1617 from the sixth landed area in Homes municipality. It's located at the north of city Homs 5 km far from city center, and 550 m to the east of the road Homs-Hama.

The survey area is directly surrounded on the west side and north side by Homs irrigation canal, on the east side by the road and on the south side by plowed land. On the north and partially on the east directly beyond the Homs irrigation canal there is Derbaalbeh waste disposal site.

(2) Demography and Community

As it was mentioned before, the survey area is a cultivated land. Some farmers from Derbaalbeh inhabit it, their number is estimated to be 30 people, and they live in concrete buildings. In addition to their work in land they exhume grub in the waste and reclaim recyclable materials such as plastic, metals,

In the near adjacent areas some people (scavengers) live in tents, breed livestock and grub in the waste reclaiming some recyclable material. Their number is estimated to be around 50 people.

Also in the adjacent areas some farmers live in separate buildings, their number is estimated to be 200 people.

The average population density is 200 capita/km^2 (approximately). Number of households is approximately 20.

Distribution of community and its characteristics:

The people existing in the survey and adjacent areas can be distributed into the following groups:

- The farmers: most of them exist during the working time of the day some of them stay in the farms
- The craftsmen: there are some workshops in the adjacent areas like workshop for stone cut, concrete tubes and stoves. All of these workshops are located in the west side and southwest of the survey area.
- The employees: there are some governmental establishments in the west and southwest of the survey area like seed grain silo and ginning of cotton.

(3) Economic Activities

1) Industrial and commercial activities:

In the adjacent areas of survey area within Homs municipality there are the following industrial activities:

- Homs Sugar Company: it's located on the southwest 2 km far from the survey area. Number of employees is. It produces sugar, vegetable oil, baker's yeast, alcohol, soap, and cologne.
- Homs Diary Company: it's located closed to Homs sugar company on the south side. Number of employees is 300. It produces milk , yogurt , cheese , butter and ghee **.**

2) Amount of agricultural products

The land in the surrounded adjacent areas can be classified as following:

- Planted land with seasonal crops (winter and summer).
- Planted with trees like olives and almonds (recent planted 3 years) grown (10-15 years).

The main plants and its productivity are listed below:

Table 6.7.1 Main Plants and Productivity

Plant	Productivity
Wheat	3,500 kg/ha
Potatoes	30,000 kg/ha
Tomatoes	15,000 kg/ha
Sugar beat	35,000 kg/ha
Cotton	3,000 kg/ha

In addition to mentioned above crops there are some plants which usually are planted in relatively little amounts like corn, beans,, aubergine , soya,

(4) Land Use

The current land of the survey area is use for agricultural purposes, there is no future use and development plans except what was mentioned. The land use is restricted by the use of current waste disposal site.

(5) Water Rights and Rights of Common

The existent Homs irrigation canal, which forms the western and northern boundaries of the survey area, flows intermittently in summer and irrigates the west side land only, the survey area is irrigated by well water.

The irrigation fee using canal is 12,000 SP/ha paid a year for General Irrigation Directory of Orantes Basin (GIDOB).

The water getting out from the well is rationed and it is planned to install the well by flow meter. The well digging is under controlled by GIDOB either for drinking and irrigation purposes.

(6) Transportation

As it was mentioned before the survey area is surrounded from the east side by road 20 m of width, at the southeastern corner of the survey area this road goes 750 m to the east where it reaches to the current cemetery. The length of the part of this road coming from Derbaalbeh is about 1,400 m. At a distance of 200 m far from the southeastern corner of the survey area this road is connected with the road Homs – Hama by a road 20 m width too. This transportation network is in a good condition.

It's planned to build a wide road, it's supposed to connect Derbaalbeh with the road to Damascus through the waste disposal site.

The existing transportation network usually is not crowded and basically during the daytime serves the following aspects:

- Waste transportation vehicles.
- Agricultural vehicles.
- Military vehicles.
- Vehicles going to the cemetery

(7) Infrastructure and Public Facilities

In the survey area itself there is not any kind of public facility such as school, hospital, public market, urban drainage facility, sewerage treatment facility, high-voltage electric cable, water pipeline, telephone cable, etc

In the adjacent areas there are a waste disposal site and crude oil pipeline.

(8) Archaeological and Cultural Property

In the survey area there is not any kind of archaeological, monument, historical attributes and cultural assets. In the adjacent areas there are two mosques, one of both is active and it's located at a distance of 1000 m to the northwest near the road to Hama, the other one is under building at a distance of 500 m to the southwest.

(9) Hygiene and Public Health Conditions

The hygiene and public health conditions in Syria, including Homs, is considered to be good. The national vaccination campaigns against infectious diseases are continuous. The epidemic diseases are rare, some of them may be discovered in summer in the poor and low educational communities, but as soon as they are discovered the responsible governmental hygiene authorities take the required measures.

The most general diseases are the respiratory system and diarrhea. The nutrition conditions in Syria including Homs are considered to be moderately good.

(10) Related Environmental Legislations

The State Ministry of Environmental Affairs was created in Syria 1995, then starting from 1992 some directorates were created in the country, one of them in central Syria (Homs and Hama), its headquarters is located in Homs. In 1997 a branch of the directorate was created in Hama.

This concerning of the environmental affairs was accompanied with developing of environmental legislation as standards and drafts of a law. The following examples illustrate some aspects:

- Syrian standard 45/1996 for drinking water;
- Syrian standard 2014/1998 for solid waste disposal and composting;
- Directing levels for wastewater discharge to the municipal sewerage;
- Directing levels for water quality of river, irrigation and fish culture.
- Law of smoking prevention in transport and public places;
- Law of hunting prevention;
- Law of trees cut and forests offensive prevention;
- Law of arranging of long-vehicles traffic into cities;
- Law of disposal of the old vehicles;
- Law of plant and animal defended;
- Law of antiques protection and trading prevention.

6.7.2 Natural Environment

(1) Geology, Topography and Soil

The survey area is a cultivated and level land, its soil is clayey. The adjacent areas are also cultivated but level to sloping land.

(2) Hydrology

In the survey area and adjacent areas there are no river systems, they are belonging to the river Orantes basin. In the survey area also there is no drainage system for surface water. In the adjacent area there is Homs irrigation canal, it’s fed from Quatteana lake, located at a

distance of 16 km in the southwest. The flow system of the canal is intermittent and rationed; it's used in summer for agricultural purposes.

(3) Meteorological Conditions

The climate of the survey area is semi-arid, the temperature varies during the year in a wide range, the average of maximum temperature falls on July and August but the average of minimum falls on December and January. The next table illustrates the variation in temperature (°C) during the years 2000 and 2001 by months.

Table 6.7.2 Meteorological Condition

Month	2000		2001	
	Av. max. Temp.	Av. min. temp.	Av. max. Temp.	Av. min. temp.
January	11.0	23.0	12.2	3.8
February	12.9	2.6	14.3	4.7
March	16.1	4.5	20.4	8.5
April	22.8	11.5	23.0	10.4
May	27.4	14.0	28.6	14.0
June	32.1	17.6	32.9	18.4
July	36.4	22.5		
August	34.5	21.4		
September	31.0	19.3		
October	25.5	13.6		
November	21.1	6.6		
December	11.9	5.3		

The humidity: In the survey and adjacent areas it's relatively low and estimated to be 71 - 91% during January and 43 –72% during June and July.

The precipitation: The nearest monitoring station (Homs station) is located 1.5 km to the southwest of the survey area. The annual average rainfall registered at the station covers the period from September to May per annum (rainfall season).

The annual average rainfalls for the five last years are as follow:

Table 6.7.3 Annual Average Rainfall

Rainfall Season	Av. Rainfall, mm
1996 – 1997	449.2 mm
1997 – 1998	453.2 mm
1998 – 1999	224.3 mm
1999 – 2000	246.6 mm
2000 – 2001	387.9 mm

The annual normal average rainfall is 439 mm.

Wind: the wind is blowing from the northwest; its annual average velocity is estimated to be 5.6 m/s.

(4) Surface and Subterranean Water Quality

Despite the quality of surface water it's used in irrigation and drinking by the people living in the survey and adjacent areas.

(5) Flora and Fauna

The survey area has no special flora or fauna; it's just an agricultural land.

The vegetation in Homs is not classified formerly in details.

(6) Landscapes and Visual Amenity

The survey area has no importance in terms of natural, historical and cultural landscape.

(7) Air Pollution

The contents of NO_X, SO_2, CO_2, etc are expected to be in the normal levels, there is no source of emission in the survey and adjacent areas except the waste disposal site.

(8) Noises and Vibration

The survey area actually is far from continuous sources causing noise and vibration. The only noticeable noise in the survey area is due to the vehicles transporting wastes.

(9) Odour

The survey area suffers from the odor originated from the waste disposal site.

APPENDIX 7

TOPOGRAPHIC AND WATER QUALITY ANALYSIS SURVEY AT AL-BASSA DISPOSAL SITE IN LATTAKIA

APPENDIX 7 TOPOGRAPHIC AND WATER QUALITY ANALYSIS SURVEY AT AL-BASSA DISPOSAL SITE IN LATTAKIA

7.1 7.1 GENERAL

7.1.1 Location of Well

Figure 7.1.1 shows the location of the wells, A and B. The wells are located 600 m from the Mediterranean Sea in Al-Bassa lands.

7.1.2 Collected Samples

The samples were collected and submitted to the General Authority for Drinking Water and Sanitary Drainage in Lattakia Governorate. The samples were sent on July 22nd 2001 with the official letter No. 6605.

7.1.3 Date of Sampling

Sampling was conducted on July 22nd 2001.

7.1.4 Date of Analysis

The analysis started on July 23rd 2001.

7.1.5 Method of Sampling

(1) For Well A

The following manners were carried out for the sampling:

- Diesel pump was fixed to pump the water for 3 hours. The pump discharge was 16.5 l/sec.
- The samples for biological analysis were collected in glass bottles of 0.25 liter capacity. The bottles were sterilized at temperature of 140 – 150 centigrades before collecting the samples and tightly closed after collecting the samples.
- The samples were stored in special refrigerator for 1 hour before starting the analysis.

(2) For Well B

Same procedure was made as well A. The pump discharge was 33 liter/sec.

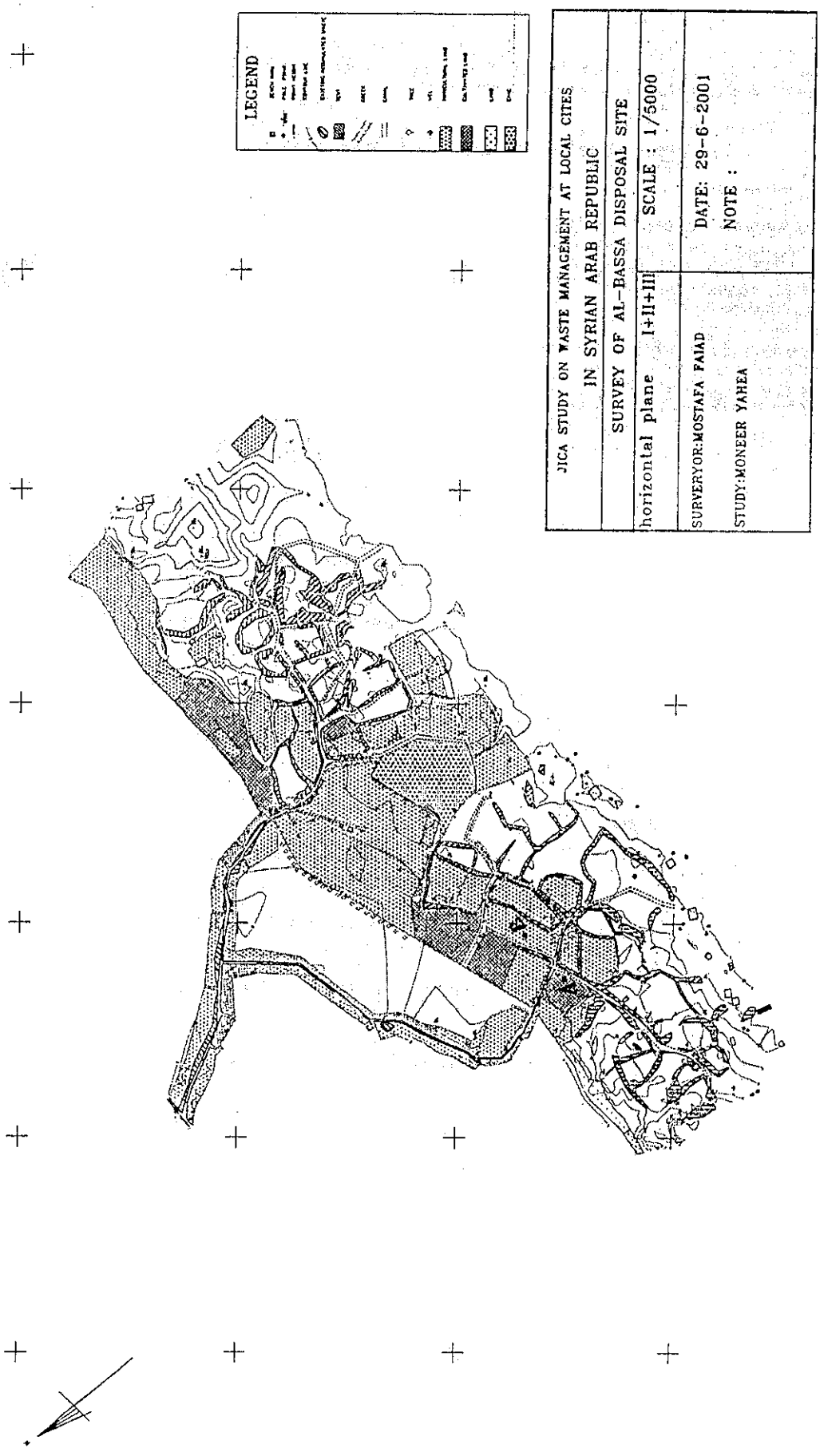

Figure 7.1.1 Location Map of Well

7.1.6 Methodology

The test and analysis were carried out by the following manners.

(1) Temperature

The atmospheric temperature was measured as 22 Centigrade degree.

(2) Temperature of Sample Water

The temperature of the sample water was 23 Centigrade degree.

(3) Color

The watercolor of the sample was examined by visual observation. It didn't look translucent.

(4) Turbidity

For measuring the turbidity, the turbidity measuring apparatus was adjusted by chemical standard liquid given by the manufacturing company, American Hach. Then, the turbidity was examined by Turbidity meter model 2100 P, 1999. The sample was shaken well in order to mix the sample and to have harmonic mixture to get accurate results. 15 mm of the sample was filled in the Kuvitta.

(5) pH

pH was measured by Orion-410 An apparatus.

Three reagents were used to adjust the apparatus. After finishing the adjustment, the cathode was put after washing the distilled water.

The results were obtained on the digital screen.

(6) Electric Conductivity

The conductivity was measured by American Apparatus Model 150 Co. Then the cathode was washed by the distilled water. The cathode was immersed in the sample as it was washed with detergent water. The results were obtained on the digital screen of the apparatus. The results were measured in μs/cm.

(7) Dissolved Oxygen (DO)

Zero (0) calibration was carried out for the apparatus and the measuring range from 0 to 60 ppm was set.

The temperature was examined for the expected temperature from 0 to 40 Centigrade degree.

The electrode was immersed until the results appeared on the digital screen.

(8) COD (Chemical Oxygen Demand)

After the sample was heated up to 150 Centigrade degree, 2 ml of the sample was taken.

Then, the reagent was added to the sample. After the sample was cooled to 120 Centigrade degree, COD value was measured on the digital screen.

(9) Bio Chemical Oxygen Demand (BOD)

A special bottle was used for measuring BOD.

A magnetic bar was put in each bottle. CO_2 was absorbed in the bottle. BOD apparatus was put in the Autoclave at the expected temperature. BOD bottle was opened and closed after 30 to 40 minutes. Finally, the results were obtained after 7 days.

(10) Suspended Solids (SS)

The Liquefying Paper was weighted after drying for 15 minutes under the temperature of 100 to 105 Centigrade degree. The sample was liquefied by 100 ml water and dried for 20 minutes and weighted. The difference between the two weights showed the final result.

(11) Coliform

- The round glass pots with 9 to 10 cm diameter and 2 cm depth were used.
- They were distilled under 145 Centigrade degree until the germ began to plant.
- The atmospheric planting liquid was prepared from three Getol 7 Agar which was designed for planting germs with weight of about 7.5 G from the substance and dissolved in 250 ml detergent water. The mixture was well mixed in the bottle and it was put in hot water for half hour after starting temperature of 100 Centigrade degree. Then, the plating atmosphere was sterilized in an autoclave at the temperature of 21 for 45 minutes.
- The planting liquid was poured in the bottle above mentioned.
- Before liquefying the germ, the germ separation was well sterilized by flame and left from 2 to 5 minutes for cooling. Then 100 ml of the sample was taken and liquefied in the separation pot on liquefying paper. The paper was carried out directly as quickly as possible with a private sterilized tweezer without hand touching of any testers to the liquefying paper.
- The place and date of the planting were registered, then it was put in a Germ Autoclave under the temperature of 37 Centigrade degree +- 0.2 for 24 hours.

(12) T-P (PO_4^{3-})

T-P was measured by the apparatus of DR-2010 based on the program of No. 490 which has the wavelength of 890. The sample with T-P was inserted in the apparatus by showing the phosphate generation for 20 minutes. The results were obtained on the apparatus digital screen.

(13) T-N (NO_3^-)

T-N (NO_3^-) was measured on DR-2010 apparatus based on the program of No. 355 which has the wavelength of 600.

(14) NH_4^+

NH_4^+ was measured on DR-2010 apparatus based on the program of No. 380 which has the wavelength of 425.

(15) NO_2

NO_2 was measured on DR-2010 apparatus based on the program of No. 371 which has the wavelength of 507.

(16) SO_4^{2-}

SO_4^{2-} was measured on DR-2010 apparatus based on the program of No. 680 which has the wavelength of 450.

(17) Fe^{3+}

Fe^{3+} was measured on DR-2010 apparatus based on the program of No. 255 which has the wavelength of 510.

(18) F^-

F^- was measured on DR-2010 apparatus based on the program of No. 190 which has the wavelength of 580.

(19) K^+ and Na^+

K^+ and Na^+ were measured on Flame Photometer 410 apparatus. The sample was inserted in the apparatus to be measured. The final results were obtained on the digital screen. Table 7.1.1 shows the conditions of each examination.

Table7.1.1 Summary of Each Examination

N	Element	Program No.	Wave Length	Working Time	Name of Apparatus
1	T-P	490	890	20	DR-2010
2	T-N	355	500	1	DR-2010
3	NH_4	380	425	1	DR-2010
4	NO_2	371	507	20	DR-2010
5	SO_4	680	450	5	DR-2010
6	Fe	255	510	3	DR-2010
7	F	190	580	1	DR-2010

(20) Heavy Metals

The samples for measuring heavy metals were delivered to the Water Establishment Laboratory in Lattakia, then were measured by Atomic Absorption Spectrometer.

1) Flame

This is given by ppm unit. The following elements were measured after verifying the concentration.

Table 7.1.2 shows above results.

Table 7.1.2 Summary of Flame Examination

(Unit in ppm)

No.	Element Name						
	Cr	Pb	Zn	Cu	Hg	As	Cd
1	1	10	0.2	1	0	0	0.25
2	2	20	0.5	2	20	10	0.5
3	5	30	1	5	50	20	0.75

2) Vapor

The vapor of Hg and As were analyzed by ppb unit.
The gas used here is Esteline air and argon.
Table 7.1.3 shows the results.

Table 7.1.3 Summary of Vapor Examination

(Unit in ppb)

No.	Element Name	
	Hg	As
1	10	10
2	20	20
3	50	50

3) Furnace

This work is carried out by high flame system by ppb unit. The gas used here is argon.

Table 7.1.4 shows the results of the furnace examination.

Table 7.1.4 Summary of Furnace Examination

(Unit in ppb)

No.	Element Name			
	Cr	Pb	Zn	Cu
1	5	15	0.2	10
2	10	30	0.5	20
3	20	50	1	50

7.1.7 Results of Analysis

The results of the analysis are shown in Table 7.1.5, 7.1.6, 7.1.7 and 7.1.8.

Table 7.1.5 Sample No. Well B, July 23th 2001

Name of Element	Measured Values for Lattakia Lab. B Sample	Syrian Standard Qualification 45-1994	Unit
Temperature	22-23	-	Centigrade Degree
Turbidity	1.5	5	N.T.U.
pH	7.5	6.5-8.5	
Conductivity	1,250	1,500	ms/cm
Total Hardness	500	500	mg/l
Ca^{2+}	116.2	200	mg/l
Mg^{2+}	51	150	mg/l
Cl^{-}	102	250	mg/l
SO_4^{2-}	140	250	mg/l
NO_3^{-}	51	45	mg/l
Fe_2^{+}	0.03	0.3	mg/l
Na^{+}	70	200	mg/l
K^{+}	1.7	-	mg/l
NO_2	0.1	0.01	mg/l
NH_4^{+}	0.15	0.05	mg/l
PO_3^{3-}	0.12	0.5	mg/l
F^{-}	0.36	0.4	mg/l
COD	15	2	mg/l
BOD	4	-	mg/l
DO	6.6	-	mg/l
SS	7	-	mg/l
AS^{+}	Zero	0.01	mg/l
Pb^{2+}	0.005	0.01	mg/l
Cu^{2+}	0.0012	1	mg/l
Cr^{2+}	Zero	0.05	mg/l
Cd^{2+}	Zero	0.005	mg/l
Zn^{2+}	Zero	3	mg/l
Hg^{2+}	0.0003	0.001	mg/l

Table 7.1.6 Sample No. Well A, July 23th 2001

Name of Element	Measured Values for Damas Lab. A	Syrian Standard Qualification 45-1994	Unit
Temperature	22-23	-	Centigrade Degree
Turbidity	24	5	N.T.U.
pH	7.65	6.5-8.5	
Conductivity	1,453	1,500	ms/cm
Total Hardness	480	500	mg/l
Ca^{2+}	132	200	mg/l
Mg^{2+}	36.48	150	mg/l
Cl^{-}	149.1	250	mg/l
SO_4^{2-}	135	250	mg/l
NO_3^{-}	105.6	45	mg/l
Fe_2^{+}	0.31	0.3	mg/l
Na^{+}	79.8	200	mg/l
K^{+}	2.6	-	mg/l
NO_2	1.49	0.01	mg/l
NH_4^{+}	0.02	0.05	mg/l
PO_3^{3-}	0.42	0.5	mg/l
F^{-}	0.23	0.4	mg/l
COD	24	2	mg/l
BOD	20	-	mg/l
DO	6.8	-	mg/l
SS	DTS873	-	mg/l
AS^{+}	Zero	0.01	mg/l
Pb^{2+}	Zero	0.01	mg/l
Cu^{2+}	0.0068	1	mg/l
Cr^{2+}	Zero	0.05	mg/l
Cd^{2+}	Zero	0.005	mg/l
Zn^{2+}	Zero	3	mg/l
Hg^{2+}	Zero	0.001	mg/l

Table 7.1.7 Sample No. Well B, July 23th 2001

Name of Element	Measured Values for Damas Lab. B Sample	Syrian Standard Qualification 45-1994	Unit
Temperature	22-23	-	Centigrade Degree
Turbidity	1.8	5	N.T.U.
pH	7.7	6.5-8.5	
Conductivity	1238	1500	ms/cm
Total Hardness	460	500	mg/l
Ca^{2+}	112	200	mg/l
Mg^{2+}	43.78	150	mg/l
Cl^{-}	127.8	250	mg/l
SO_4^{2-}	132	250	mg/l
NO_3^{-}	49.28	45	mg/l
Fe_2^{+}	0.03	0.3	mg/l
Na^{+}	58.88	200	mg/l
K^{+}	6.9	-	mg/l
NO_2	0.11	0.01	mg/l
NH_4^{+}	0.01	0.05	mg/l
PO_3^{3-}	0.15	0.5	mg/l
F^{-}	0.12	0.4	mg/l
COD	20	2	mg/l
BOD	2	-	mg/l
DO	7	-	mg/l
SS	DTS740	-	mg/l
AS^{+}	-	0.01	mg/l
Pb^{2+}	Zero	0.01	mg/l
Cu^{2+}	Zero	1	mg/l
Cr^{2+}	Zero	0.05	mg/l
Cd^{2+}	Zero	0.005	mg/l
Zn^{2+}	Zero	3	mg/l
Hg^{2+}	Zero	0.001	mg/l

Table 7.1.8 Results of Total Samples

Name of Element	Lattakia Lab. B Sample	Damas. Lab. A Sample	Damas Lab. B Sample	Syrian Standard Qualification 45-1994	Unit
Temperature	22-23	22-23	2-23	-	Centigrade Degree
Turbidity	1.5	24	1.8	5	N.T.U.
pH	7.5	7.65	7.7	6.5-8.5	
Conductivity	1250	1453	1238	1500	ms/cm
Total Hardness	500	480	460	500	mg/l
Ca^{2+}	116.2	132	112	200	mg/l
Mg^{2+}	51	105.6	43.78	150	mg/l
Cl^{-}	102	149.1	127.8	250	mg/l
SO_4^{2-}	140	135	132	250	mg/l
NO_3^{-}	51	105.6	49.28	45	mg/l
Fe_2^{+}	0.03	0.31	0.03	0.3	mg/l
Na^{+}	70	79.8	58.88	200	mg/l
K^{+}	1.7	2.6	6.9	-	mg/l
NO_2	0.1	1.49	0.11	0.01	mg/l
NH_4^{+}	0.15	0.02	0.01	0.05	mg/l
PO_3^{3-}	0.12	0.42	0.15	0.5	mg/l
F^{-}	0.36	0.23	0.12	0.4	mg/l
COD	15	24	20	2	mg/l
BOD	4	20	2	-	mg/l
DO	6.6	6.8	7	-	mg/l
SS	7	DTS873	DTS740	-	mg/l
AS^{+}	Zero	-	-	0.01	mg/l
Pb^{2+}	0.005	Zero	Zero	0.01	mg/l
Cu^{2+}	0.0012	0.0068	Zero	1	mg/l
Cr^{2+}	Zero	Zero	Zero	0.05	mg/l
Cd^{2+}	Zero	Zero	Zero	0.005	mg/l
Zn^{2+}	Zero	Zero	Zero	3	mg/l
Hg^{2+}	0.0003	Zero	Zero	0.001	mg/l

7.2 COMMENTS ON CHEMICAL ANALYSIS

7.2.1 For Well A

- The obtained results for NO3 and NO2 were doubled of the allowable limits for the drinking water. This is due to the agricultural activity in the area by using organic and non-organic fertilizers to feed the plants. Another is because the well is newly used and no pumping from the well.
- Other results were within the allowable limits in the Syrian Standards No 45 except for COD.

7.2.2 For Well B

- NO_3 and NO_2 were lower compared to Well A. This is estimated to be due to the continuos pumping from the well for agricultural use.
- Other results were within the allowable limits in the Syrian Standards No 45 except for COD.

7.2.3 Biological Analysis

The results of the analysis shows that both of Well A and Well B were polluted with small amount of coliform bacteria.

APPENDIX 8

SOLID WASTE QUALITY ANALYSIS SURVEY (LATTAKIA)

APPENDIX 8 SOLID WASTE QUALITY ANALYSIS SURVEY (LATTAKIA)

8.1 INTRODUCTION

The Study shall cover the all area of the Lattakia City, Jableh City, Al Haffeh City and Al Qurdaha City in Lattakia Governorate (excluding rural area).

The JICA Study Team will conduct a Solid Waste Quality Survey in the Study area. The JICA Study Team will engage a qualified local Consultant to carry out the Solid Waste Quality Study in the Study area in accordance with the following specifications.

8.2 SPECIFICATIONS

8.2.1 General

The Survey can be divided into two components: Solid waste quality survey at source and existing compost plant. Outline of each component is described as follows.

(1) Solid Waste Quality Survey at Source

The Survey is required as a part of the Master Plan Study to identify the quality of different waste types generated in the Study area. The Survey will provide basic information required for formulation of the Master Plan.

(2) Solid Waste Quality Survey at Existing Compost Plant

The Survey is required as a part of the Compost Plan. In the Survey, the Consultant analyzes the quality of hauling wastes and composts of existing compost plant.

8.2.2 Work Items and Contents

The contents of the Work shall be as follows:

(1) Solid Waste Quality Survey at Source

From the waste collected for the unit generation rate survey, samples will be collected and analyzed for identification of the waste composition.

The number of samples is as follows.

Lattakia	22 samples
Jableh	3 samples
Total	25 samples

For detail, see the next table.

Table 8.2.1 Survey on Solid Waste Quality at Source

	Waste Generating Source		Sampling Number		
	Category	Generating Place	Lattakia	Jableh	Total
1	Household	High Income	3	1	4
		Middle Income	3	1	4
		Low Income	3	1	4
2	Commercial	Shopping Street	2	-	2
		Office	2	-	2
		Restaurant	2	-	2
		Hotel	2	-	2
	Public Institution	Public Office	2	-	2
		School	1	-	1
3	Market		2	-	2
4	Public Place	Road	(2)	-	(2)
		Public Park	(2)	-	(2)
Total			22 (26)	3	25 (29)

Note 1: Numerical value in the parenthesis stands for the samples applied for the composition and bulk density surveys

Note 2: Sampling shall get in other days in case the samples are plural

The items to be surveyed and analyzed are as follows;

- Physical Contents Analysis (Combustibles, Moisture, Ash)
- C/N ratio

(2) Solid Waste Quality Survey at Existing Compost Plant

Number of Items

Hauling Waste; 3 Days x 3 Samples = 9 Samples
Compost (final product); 3 Days x 3 Samples = 9 Samples
Total 18 Samples

Table 8.2.2 Solid Waste Quality Survey at Existing Compost Plant

Hauling (arriving at the facility) Waste	Compost
Physical Composition Foods Papers Textiles Plants/Trees Plastics Rubbers/Leathers Metals Bins Glasses Soil/Stones/Ceramics (toxic wastes like battery are surveyed separately)	Analysis Items Grading Analysis Organic composition (%) C/N ratio Hydrogen (%) Moisture (%) Metals and Glasses (%)
Chemical Element (%) C, H, N, P, S, O	Heavy Metals (ppm) As, Pb, Cd, Hg, Cr, Ni, Cu, Zn

Table 8.2.3 Results of Waste Composition at generation Source (1)

	Weight	Non-comb	Moisture	Ash	Combustible	C/N Ratio		Measure	
							Moisture	Ash	Combustible
Domestic Waste									
Lattakia									
High Income									
13th Soleeba	2,100	1.43	63.57	7.57	28.86	86	64.49	17.55	82.45
14th Tishrenn Un	2,740	1.46	59.31	16.38	24.31	51	60.19	38.03	61.97
Middle Income									
13th Soleeba	2,450	13.90	53.44	22.21	24.35	55	62.07	25.44	74.56
14th Tabiat	2,350	2.98	68.33	9.58	22.08	40	70.43	23.02	76.98
15th Tishrenn Un	2,000	1.10	65.03	5.36	29.61	31	65.75	12.58	87.42
16th Jumhoria	2,200	1.45	78.13	3.65	18.22	53	79.28	10.75	89.25
Low Income									
13th Al Quds	2,400	20.00	36.18	54.18	9.64	21	45.22	78.00	22.00
14th Uariat	2,325	2.15	71.63	9.00	19.37	126	73.20	26.12	73.88
15th Al Baath	2,400	6.25	68.07	19.44	12.49	44	72.61	51.35	48.65
Weighted Average									
Jableh									
High	2,200	2.27	68.82	7.43	23.75	31	70.42	17.84	82.16
Middle	2,300	3.04	72.56	12.03	15.40	68	74.84	36.86	63.14
Low	2,250	1.78	73.10	7.09	19.81	82	74.42	21.15	78.85
Average									
Other Waste									
Shopping Street									
15th Soleeba	1,500	13.33	28.67	24.94	46.39	110	33.08	20.02	79.98
16th Sheikhdaher	1,500	22.00	37.86	35.55	26.59	91	48.54	33.76	66.24
Office									
14th Soleeba	1,450	51.72	3.77	85.58	10.65	22	7.81	76.08	23.92
15th Soleeba	210	0.00	43.40	3.78	52.82	43	43.40	6.67	93.33
Restaurant									
13th Sheikhdaher	2,500	3.80	74.97	7.73	17.30	56	77.93	18.51	81.49
14th Sheikhdaher	3,075	35.28	24.57	57.26	18.16	28	37.97	54.76	45.24
Hotel									
14th Kalaa	2,390	3.14	60.87	8.02	31.12	89	62.84	13.55	86.45
15TH Sheikhdaher	1,900	5.63	64.81	12.05	23.14	58	68.68	21.71	78.29
Public Office									
16th Sheikhdaher	1,800	0.00	33.87	13.23	52.90	110	33.87	20.00	80.00
17th Soleeba	500	0.00	54.35	5.48	40.17	79	54.35	12.00	88.00
School									
17th Soleeba	2,900	3.69	6.42	29.48	64.10	70	6.67	28.69	71.31
Market									
16th Soleeba	3,500	0.29	86.75	3.35	9.90	47	87.00	23.62	76.38
16th Al Baath	2,300	0.00	83.97	6.92	9.11	59	83.97	43.18	56.82

Table 8.2.3 Results of Waste Composition at generation Source (2)

	Moisture	Ash	Organic	C/N	Moisture	Ash	Organic	C/N
Lattakia High Income	63.6	7.6	28.8	86	63.6	7.6	28.8	86
Lattakia High Income	59.3	16.4	24.3	51	59.3	16.4	24.3	51
Lattakia Middle Income	53.4	22.2	24.4	55	53.4	22.2	24.2	55
Lattakia Middle Income	68.3	9.6	22.1	40	68.3	9.6	22.1	40
Lattakia Middle Income	65.0	5.4	29.6	31	65.0	5.4	29.6	31
Lattakia Middle Income	78.1	3.7	18.2	53	78.1	3.7	18.2	53
Lattakia Low Income	36.2	54.2	9.6	21				
Lattakia Low Income	71.6	9.0	19.4	126	71.6	9.0	19.4	126
Lattakia Low Income	68.1	19.4	12.5	44	68.1	19.4	12.5	44
Jableh High Income	36.2	54.2	9.6	31				
Jableh Middle Income	72.6	12.0	15.4	68	72.6	12.0	15.4	68
Jableh Low Income	73.1	7.1	19.8	82	73.1	7.1	19.8	82
Shopping Street	28.7	24.9	46.4	110	28.7	24.9	46.4	110
Shopping Street	37.9	35.5	26.6	91	37.9	35.5	26.6	91
Restaurant	75.0	7.7	17.3	56	75.0	7.7	17.3	56
Restaurant	24.6	57.2	18.2	28				
Hotel	60.9	8.0	31.1	89	60.9	8.0	31.1	89
Hotel	64.8	12.1	23.1	58	64.8	12.1	23.1	58
Market	86.7	3.4	9.9	47	86.7	3.4	9.9	47
Market	84.0	6.9	9.1	59	84.0	6.9	9.1	59
Office	3.8	85.6	10.6	22				
Office	43.4	3.8	52.8	43	43.4	3.8	52.8	43
Public Office	33.9	13.2	52.9	110	33.9	13.2	52.9	110
Public Office	54.3	5.5	40.2	79	54.3	5.5	40.2	79
School	6.4	29.5	64.1	70	6.4	29.5	64.1	70
Domestic								
Average	62.1	18.4	19.5	57.3	67.3	11.2	21.5	63.6
Diversion	13.8	17.6	6.8	29.4	7.3	6.2	5.5	28.1
Min	36.2	3.7	9.6	21.0	53.4	3.7	12.5	31.0
Max	78.1	54.2	29.6	126.0	78.1	22.2	29.6	126.0
Commercial								
Average	57.8	19.5	22.7	67.3	62.6	14.1	23.4	72.9
Diversion	73.6	18.7	12.2	27.0	22.2	11.7	13.1	23.6
Min	24.6	3.4	9.1	28.0	28.7	3.4	9.1	47.0
Max	86.7	57.2	46.4	110.0	86.7	35.5	46.4	110.0
Office								
Average	28.4	27.5	44.1	64.8	34.5	13.0	52.5	75.5
Diversion	22.4	34.0	20.6	33.8	20.5	11.7	9.8	27.6
Min	3.8	3.8	10.6	22.0	6.4	3.8	40.2	43.0
Max	54.3	85.6	64.1	110.0	54.3	29.5	64.1	110.0
Market								
Average	85.4	5.2	9.5	53.0	85.4	5.2	9.5	53.0
Diversion	1.9	2.5	0.6	8.5	1.9	2.5	0.6	8.5
Min	84.0	3.4	9.1	47.0	84.0	3.4	9.1	47.0
Max	86.7	54.2	9.9	59.0	86.7	6.9	9.9	59.0

Table 8.2.4 Results of Waste Composition transported to Existing Compost Plant (Lattakia)

		1	2	3	4	5	6	7	8	9	Average	Average
1	Hauled Waste	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia		
	Date	18	18	18	19	19	19	20	20	20		
	Collection Place	Hameedia	Soleeba	Kamiliya	Mashaher	Ziraa	Oniya	Shehraslan	Shehraslan	Shehraslan		
	Sample Weight	13.44	13.12	12.13	12.82	13.44	12.25	13.30	11.97	12.65		
1	Physical Composition											
	Foods	51.33	56.00	43.50	56.00	28.50	76.10	20.27	60.97	38.96	51.91	49.97
	Paper	17.11	28.30	5.40	6.70	50.10	4.30	12.96	12.19	31.17	18.65	21,68
	Textile	4.28	0.50	0.50	0.00	0.00	0.00	3.60	0.00	3.90	0.88	1.95
	Plastic	20.32	10.00	39.40	10.00	16.30	15.00	12.80	9.75	25.97	18.50	17.86
	Plants/Tree	6.42	4.00	5.40	0.00	4.00	4.30	3.80	0.00	0.00	4.02	0.00
	Rubber/Leathers	0.00	0.00	0.00	6.60	0.00	0.00	0.00	0.00	0.00	1.10	0.00
	Metals	0.54	1.00	5.40	10.00	0.00	0.00	0.00	7.32	0.00	2.82	3.66
	Bins	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Glasses	0.00	0.00	0.00	6.80	0.10	0.10	9.56	0.00	0.00	1.17	0.00
	Soil/Stone/Ceramics	0.00	0.20	0.40	3.90	1.00	0.20	37.01	9.77	0.00	0.95	4.89
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
1	Chemical Elements											
	Carbon	57.69	59.33	58.41	57.71	58.60	58.40	57.44	58.00	58.17	58.36	57.87
	Hydrogen	4.46	4.28	4.34	4.36	4.36	3.32	4.23	4.60	4.41	4.19	4.41
	Nitrogen	1.32	1.20	1.25	1.35	0.90	1.17	1.02	1.22	1.01	1.20	1.08
	Phosphor	0.24	0.36	0.32	0.59	0.08	0.55	0.11	0.15	0.27	0.36	0.18
	Sulfur	0.33	0.47	0.48	1.28	0.33	0.54	0.55	0.46	0.43	0.57	0.48
	Oxygen	35.96	34.36	35.20	34.71	35.73	36.02	36.65	35.57	35.71	35.33	35.98
	Total	100.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00		
1	Carbon/Nitrogen	43.70	49.44	46.73	42.75	65.11	49.91	56.31	47.54	57.59	49.61	53.82

Table 8.2.5 Results of Compost Composition transported at Existing Compost Plant (Lattakia)

		1	2	3	4	5	6	7	8	9	Average	Average
2	Compost	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia	Lattakia	Damascus	Damascus	Damascus		
	Date	18	18	18	19	19	19	20	20	20		
	Plastic	1.28	1.12	1.89	0.63	3.22	2.14	3.23	5.49	4.50	1.71	4.41
	Glass Stone	15.90	30.80	16.60	20.40	22.40	44.20	5.38	2.81	6.49	25.05	4.89
	Total	17.18	31.92	18.49	21.03	25.62	46.34	8.61	8.30	10.99	26.76	9.30
2	Particle Size											
	more than 25 mm	0	0	0	0	4	4	0	0	0	1.33	0.00
	5 - 25 mm	52	84	76	72	82	86	89	88	85	75.33	87.33
	2 - 5 mm	19	6	6	10	4	2	6	7	9	7.83	7.33
	under 2 mm	29	10	18	14	10	12	5	5	6	15.50	5.33
	Total	100	100	100	96	96	100	100	100	100		
2	Compost Element											
	Organic Composition	36.35	24.31	39.00	31.89	30.69	30.55	48.73	52.94	39.50	32.13	47.06
	Hydrogen	5.63	5.74	5.62	5.63	5.44	5.36	8.63	9.44	9.14	5.57	9.07
	Moisture	12.90	13.63	12.68	13.23	11.69	10.44	37.04	43.59	41.10	12.43	40.58
	Metal/Glass	< 1.00	4.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	1.10	0.50
	C/N Ratio	16.10	17.40	20.70	34.90	30.20	39.30	78.60	52.00	65.40	26.43	65.33
3	Heavy Metal											
	Pb (120,150)	95.2	121.5	522.1	150.1	113.4	83.3	168.9	142.8	116.9	180.9	142.9
	Cu (150,250)	261.2	334.8	137.3	180.5	1,577.4	175.8	180.8	137.5	168.5	444.5	162.3
	Ni (50,70)	47.0	51.6	50.9	55.8	80.4	50.9	22.1	17.0	16.9	56.1	18.7
	Cr (100,150)	64.9	43.6	51.6	53.1	72.7	41.1	41.3	59.3	37.1	54.5	45.9
	Cd (3,5)	0.932	0.822	7.336	0.393	0.912	0.584	0.504	0.818	0.922	1.8	0.7
	Zn (350,500)	508.7	499.9	442.1	602.6	428.8	390.7	608.4	411.3	361.2	478.8	460.3
	Hg (1.0,3)	2.890	3.058	2.425	5.349	2.891	1.903	3.247	1.136	0.823	3.1	1.7
	As (15,25)	1.798	1.612	2.066	3.579	3.079	2.269	0.811	0.917	0.736	2.4	0.8

Note: Item (A, B) means that A is limit of first class and B is limit of second class. Yellow exceeds limit of second class.

Table 8.2.6 Results of Waste Composition at Generation Source in Lattakia and Jableh (1)

Unit in kg

Domestic Waste	Lattakia City						Jableh City					
	High Income		Middle Income		Low Income		High		Middle		Low	
Food, vegetable	14.73	22.27	18.53	18.27	9.12	31.69	20.12	23.67	27.20	6.60	13.25	13.12
Paper	1.30	2.98	2.90	4.30	2.80	3.74	1.10	1.10	1.92	1.60	1.15	0.15
Plastic	1.44	4.31	1.91	2.29	1.20	3.50	2.32	2.32	1.80	0.80	1.04	0.73
Rubber & Leather					0.52							
Wood	0.03	0.03	0.05				0.46	0.46	0.37		0.06	
Textile	0.16	0.20	0.34	0.20	0.08	0.70	2.64	2.64	0.63	0.34	0.10	0.36
Metal	0.20	0.15	1.50	0.19	0.07	0.30	0.73	0.73	0.48			
Glass	0.37	0.35	0.50	0.58	0.41		0.43	0.43	0.50	0.32		
Ceramic	0.35					0.92						0.17
Stone & Sand							2.30	2.30			0.80	
Others < 5mm	0.11	6.00	0.50	0.09	0.18	0.86			0.82	0.06	0.34	0.05
Bones		0.80			0.34	0.26						
Plant leaf												
Others > 5mm												
Total	18.69	37.09	26.23	25.92	14.72	41.97	30.10	33.65	33.72	9.72	16.74	14.58

Commercial Waste (Lattakia)	Shop		Private Office		Restaurant		Hotel		Public Office		School	Market		Road		Park
	1	2	1	2	1	2	1	2	1	2	1	1	2	1	2	1
Food, vegetable		1.32			12.60	30.99	25.95	1.33			0.37	16.00	61.26	13.54	25.68	4.53
Paper	1.63	1.17	0.39	0.18	0.23	6.27	1.60	0.74	4.69	0.19	6.00	0.14	0.53	12.22	8.10	0.82
Plastic	1.12	0.90	0.29	0.03	0.50	3.83	1.43	0.33	0.20	0.14	1.00	0.12	1.15	14.86	5.04	1.51
Rubber & Leather														2.22	0.35	0.02
Wood	0.10							0.70			0.52				0.18	
Textile							0.30	0.60				0.23		2.00	0.33	0.13
Metal	0.04	0.05			0.32	1.90	0.50	0.16			0.75		0.16	0.73	0.23	0.09
Glass	0.20	0.95				15.39	0.70	0.50			0.20			0.48	1.14	1.40
Ceramic																
Stone & Sand			5.20								0.70			11.75		0.31
Others < 5mm									0.13	0.13			0.09		0.30	
Bones						0.15		0.38					3.84			
Plant leaf														3.60		5.22
Others > 5mm					0.06									7.10		
Total	3.09	4.39	5.88	0.21	13.71	58.53	30.48	4.74	5.02	0.46	9.54	16.49	67.03	68.50	41.35	14.03

Table 8.2.6 Results of Waste Composition at Generation Source in Lattakia and Jableh (2)

Unit in kg

Domestic Waste	Lattakia City						Jableh City					
	High Income		Middle Income		Low Income		High		Middle		Low	
	L-high	L-high	L-mid	L-mid	L-mid	L-mid	L-low	L-low	L-low	J-high	J-mid	J-low
Food, vegetable	78.8	60.0	70.6	70.5	62.0	75.5	66.8	70.3	80.7	67.9	79.2	90.0
Paper	7.0	8.0	11.1	16.6	19.0	8.9	3.7	3.3	5.7	16.5	6.9	1.0
Plastic	7.7	11.6	7.3	8.8	8.2	8.3	7.7	6.9	5.3	8.2	6.2	5.0
Rubber & Leather	-	-	-	-	3.5	-	-	-	-	-	-	-
Wood	0.2	0.1	0.2	-	-	-	1.5	1.4	1.1	-	0.4	-
Textile	0.9	0.5	1.3	0.8	0.5	1.7	8.8	7.8	1.9	3.5	0.6	2.5
Metal	1.1	0.4	5.7	0.7	0.5	0.7	2.4	2.2	1.4	-	-	-
Glass	2.0	0.9	1.9	2.2	2.8	-	1.4	1.3	1.5	3.3	-	-
Ceramic	1.9	-	-	-	-	2.2	-	-	-	-	-	1.2
Stone & Sand	-	-	-	-	-	-	7.6	6.8	-	-	4.8	-
Others < 5mm	0.6	16.2	1.9	0.3	1.2	2.0	-	-	2.4	0.6	2.0	0.3
Bones	-	2.2	-	-	2.3	0.6	-	-	-	-	-	-
Plant leaf	-	-	-	-	-	-	-	-	-	-	-	-
Others > 5mm	-	-	-	-	-	-	-	-	-	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Commercial Waste (Lattakia)	Shop		Private Office		Restaurant		Hotel		Public Office		School	Market		Road		Park
	1	2	1	2	1	2	1	2	1	2	1	1	2	1	2	1
Food, vegetable	-	30.1	-	-	91.9	52.9	85.1	28.1	-	-	3.9	97.0	91.4	19.8	62.1	32.3
Paper	52.8	26.7	6.6	85.7	1.7	10.7	5.2	15.6	93.4	41.3	62.9	0.8	0.8	17.8	19.6	5.8
Plastic	36.2	20.5	4.9	14.3	3.6	6.5	4.7	7.0	4.0	30.4	10.5	0.7	1.7	21.7	12.2	10.8
Rubber & Leather	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	0.8	0.1
Wood	3.2	-	-	-	-	-	-	14.8	-	-	5.5	-	-	-	0.4	-
Textile	-	-	-	-	-	-	1.0	12.7	-	-	-	1.4	-	2.9	0.8	0.9
Metal	1.3	1.1	-	-	2.3	3.2	1.6	3.4	-	-	7.9	-	0.2	1.1	0.6	0.6
Glass	6.5	21.6	-	-	-	26.3	2.3	10.5	-	-	2.1	-	-	0.7	2.8	10.0
Ceramic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stone & Sand	-	-	88.4	-	-	-	-	-	-	-	7.3	-	-	17.2	-	2.2
Others < 5mm	-	-	-	-	-	-	-	-	2.6	28.3	-	-	0.1	-	0.7	-
Bones	-	-	-	-	-	0.3	-	8.0	-	-	-	-	5.7	-	-	-
Plant leaf	-	-	-	-	-	-	-	-	-	-	-	-	-	5.3	-	37.2
Others > 5mm	-	-	-	-	0.4	-	-	-	-	-	-	-	-	10.4	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 8.2.7 Results of Waste Composition at Generation Source in Lattakia and Jableh (Summary)

Waste Composition	High Lattakia	Middle Lattakia	Low Lattakia	Average Lattakia	Average Jableh	Shop	Private Office	Restaurant	Hotel	Public Office	School	Market	Road	Park
Food, vegetable	69.4	69.6	72.6	70.6	79.0	15.0	-	72.4	56.6	-	3.9	94.2	40.9	32.3
Paper	7.5	13.9	4.2	9.2	8.1	39.7	46.2	6.2	10.4	67.4	62.9	0.8	18.7	5.8
Plastic	9.7	8.2	6.6	8.0	6.5	28.4	9.6	5.1	5.8	17.2	10.5	1.2	16.9	10.8
Rubber & Leather	-	0.9	-	0.4	-	-	-	-	-	-	-	-	2.0	0.1
Wood	0.1	0.0	1.3	0.5	0.1	1.6	-	-	7.4	-	5.5	-	0.2	-
Textile	0.7	1.1	6.2	2.7	2.2	-	-	-	6.8	-	-	0.7	1.9	0.9
Metal	0.7	1.9	2.0	1.7	-	1.2	-	2.8	2.5	-	7.9	0.1	0.8	0.6
Glass	1.5	1.7	1.4	1.6	1.1	14.1	-	13.1	6.4	-	2.1	-	1.7	10.0
Ceramic	0.9	0.5	-	0.5	0.4	-	-	-	-	-	-	-	-	-
Stone & Sand	-	-	4.8	1.6	1.6	-	44.2	-	-	-	7.3	-	8.6	2.2
Others < 5mm	8.4	1.4	0.8	2.7	1.0	-	-	-	-	15.4	-	0.1	0.4	-
Bones	1.1	0.7	-	0.6	-	-	-	0.1	4.0	-	-	2.9	-	-
Plant leaf	-	-	-	-	-	-	-	-	-	-	-	-	2.6	37.2
Others > 5mm	-	-	-	-	-	-	-	0.2	-	-	-	-	5.2	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

APPENDIX 9

SOLID WASTE QUALITY ANALYSIS SURVEY (HOMS)

SECTION 9 SOLID WASTE QUALITY ANALYSIS SURVEY (HOMS)

9.1 INTRODUCTION

In response to the request of the government of the Syrian Arab Republic, the government of Japan decided to conduct the study on solid waste management at local cities in S.A.R. in close cooperation with the authorities concerned of the government of Syria.

The JICA study team will conduct a Solid Waste Analysis Survey in Homs to identify the quality of the different types waste generated in the study area. Which will provide basic information required for the feasibility study on a compost plant.

9.2 GENERAL

The waste collected from household and other sources for the unit generation rate survey conducted by JICA study team used for the samples for analysis.

Number of samples for analysis:

Household waste	9 Samples
Commercial waste	8 Samples
Public institution waste	3 Samples
Market waste	2 Samples

The details for sources are shown below.

Table 9.2.1

	Category	Generating place	Number of Samples
1	Household	High Income	3
		Medium Income	3
		Low Income	3
2	Commercial	Shopping street	2
		Office	2
		Restaurant	2
		Hotel	2
3	Public institution	Public office	2
		School	1
4	Market		2
	Total		22

9.3 REQUESTED ANALYSIS

The following analysis was conducted.

- Physical separation, Mass%, Moisture%, Combustion, Ahs%
- Chemical analysis: C, N, C/N

9.4 METHODOLOGY

The analysis was conducted as follows.

- Separate the waste collected from the households and other sources, which were carried out by JICA study team to: paper, glass, wood, metallic material, plastics and organic material by manual separation and calculate the weight in percentage.
- Determination of the total moisture content (based on ASTM testing method, ISO 589/1981)
  The testing procedures briefed as shown herein under:
  - Put the sample in the microwave (model FM 1215) for a certain time consistent with sample weight, but normally about 20 minutes.
  - Define the loss of the weight, by repeating the above procedure until the weight of the sample remains unchanged, after that the weight percentage can be calculated.
  - Put the sample in the drier (type : Kolet) for 24 hours at a temperature 105, then calculate the moisture content based on knowing the loss of the weight.
- Define the ignition temperature as below:
  - Putting the sample in the oven (type: Carbolin or SCON), or in the furnace.
  - Start rising the temperature till igbition starts, and temperature can be measured by simultaneously.
- Defining the percentage of the ash content (ASTM test method,ISO-1171/1997)
  - Put the homogenized sample, after being weighed accordingly, in the oven (type: Carbolin or SCON) at a temperature 450－500°C until the weight remains unchanged.
  - The sample should be weighed again, and the percentage of the ash content can be calculated.
- Determination of the organic material in the solid waste according to ASTM test method No. DIN-38414.

9.5 RESULTS

Table 9.5.1 shows the analysis results for the household waste.

The percentage of the organic matter and of non－organic matter are very high and same as for moisture content.

PH is very qualified for the fermentation.
The ratio C/N is lower than values needed for compost.

Table 9.5.1 Analysis Result of Household Waste

Organic matter Wt.(%)	Non-organic Matter Wt.(%)	Moisture Wt.(%)	pH	C/N
54.1	45.9	46	7.0	11.85
50.9	49.09	44	6.8	12.3
52.0	49.3	42	6.8	17.1
53.02	47.78	41.4	7.08	19.5
50.6	50.37	42.0	6.6	11.5
52.35	47.8	37.0	7.0	11.85
51.0	49.0	32.22	6.8	17.95
Average: 51.99%	Average: 48.46%	Average: 40.66%	Average: 6.87%	Average: 14.58%

Notes: 1) The figures show the average values of all samples for the household waste.

Table 9.5.2 and 9.5.3 show the summary of waste composition.

Table 9.5.2 Sample Waste Composition.

Sample No:	Cod No:	Date 2001	Sources	O.M. W. %	Humidity W.% In OM	NOM W.%	pH	C (Ash) W.%	N W. %	C/N	Waste composition, In non-organic matter, W.							
											Glass	Paper	Plastics	Iron	Textile	Wood	Stone	Bone
G1	1	5.6	L.i	53.0	83	47.0	7.5	26.3	1.9	13.8	8.28	22.0	8.94	1.78	5.96	-	-	-
G2	2	5.6	S.S	54.7	60	45.3	7.0	25.3	1.4	18.0	-	28.6	16.35	0.38	-	-	-	
G3	3	5.6	M.i.	54.6	75	45.4	6.5	25.4	2.4	10.6	5.00	16.5	16.01	0.77	4.40	2.7	-	-
G4	4	5.6	H.i	54.2	87	45.8	7.0	25.6	2.05	12.5	6.31	22.9	12.10	1.28	3.2	-	-	-
G5	5	5.6	C.P.O	53.0	46	47.0	6.3	26.3	2.3	11.4	-	32.8	14.20	-	-	-	-	-
G6	1	6.6	P.O.	55.0	51	45.0	6.6	25.2	2.2	11.4	-	41.6	0.82	2.84	-	-	-	-
G7	2	6.6	M	52.0	81	48.0	7.4	26.8	0.8	33.5	-	20.5	27.50	-	-	-	-	-
G8	3	6.6	L..i.	49.0	45	51.0	6.5	28.6	1.6	17.8	13.6	4.16	6.94	0.98	8.9	1.31	15.12	-
G9	4	6.6	H.i.	54.0	63	46.0	7.0	25.7	2.3	11.2	2.02	23.9	16.52	2.41	2.1	-	-	-
G10	5	6.6	M.i.	44.0	81	46.0	6.7	31.4	2.1	15.0	4.5	12.4	13.12	2.00	12.8	1.17	-	-
G11	6	6.6	P.O.	53.0	53	47.0	6.9	26.3	1.2	21.9	-	-	47.00	-	-	-	-	-
G12	7	6.6	M.i.	54.0	87	46.0	6.8	25.7	1.8	14.3	-	9.38	16.10	-	9.38	1.34	-	9.82
G13	8	6.6	S.S.	54.4	68	45.6	7.2	25.5	1.1	23.2	-	31.7	17.30	5.47	-	-	-	-
G14	1	7.6	L.i.	54.0	52	46.0	6.4	25.7	1.3	19.7	8.32	16.5	18.30	3.17	-	-	-	-
G15	2	7.6	H.S.	48.0	78	52.0	7.0	29.0	1.2	24.1	5.71	31.2	14.60	1.13	-	-	-	-
G16	3	7.6	P.O.	43.5	65	56.5	6.6	31.6	2.2	14.1	-	28.25	28.25	-	-	-	-	-
G17	4	7.6	M.i.	51.0	75	49.0	7.3	27.4	3.0	9.2	2.52	29.4	13.30	3.81	-	-	-	-
G18	5	7.6	M	52.0	65	48.0	6.8	28.8	2.9	9.1	-	2.34	45.89	-	-	-	-	-
G19	1	7.6	R.(1)	52.2	62	47.8	7.2	26.7	2.2	12.1	-	36.26	10.70	-	-	-	-	1.71
G20	2	8.6	H.	54.0	50	46.0	6.6	25.7	2.2	11.7	-	6.60	19.02	9.71	10.65	-	-	-
G21	3	8.6	M.	52.0	82	48.0	7.0	26.8	2.0	13.4	-	35.08	12.92	-	-	-	-	-
G22	4	8.6	R.(2)	52.5	79	47.5	6.8	26.6	2.3	11.6	3.38	34.56	7.35	-	2.2			

Table 9.5.3 The Sample Waste Composition

Sample No:	Cod No:	Date 2001	Sources	O.M. W. %	Humidity W.%	Glass	Paper	Plastics	Iron	Textiles	Wood	Stone	Bone	Total	pH	C	N Wt.%	C/N
G1	1	5.6	L.i	9.0	44.0	8.2	22.0	9.0	1.8	6.0	-	-	-	100	7.5	26.3	1.9	13.8
G2	2	5.6	S.S	21.9	32.7	-	28.6	16.4	0.4	-	-	-		100	7.0	25.3	1.4	18.0
G3	3	5.6	M.i.	13.7	41.0	5.0	16.4	16.0	0.8	4.4	2.7	-	-	100	6.5	25.4	2.4	10.6
G4	4	5.6	H.i.	7.1	47.2	6.3	22.9	12.2	1.3	3.2	-	-	-	100	7.0	25.6	2.05	12.5
G5	5	5.6	.P.O	28.6	24.4	-	32.8	14.2	-	-	-	-	-	100	6.3	26.3	2.3	11.4
G6	1	6.6	P.O.	27.0	28.1	-	41.6	0.8	2.8	-	-	-	-	100	6.6	25.2	2.2	11.4
G7	2	6.6	M	9.9	42.1	-	20.5	27.5	-	-	-	-	-	100	7.4	26.8	0.8	33.5
G8	3	6.6	L..i	27.0	22.1	13.6	4.2	6.9	1.0	8.9	1.3	15.1	-	100	6.5	28.6	1.6	17.8
G9	4	6.6	H..i.	20.0	34.0	2.0	23.9	16.5	2.4	2.1	-	-	-	100	7.0	25.7	2.3	11.2
G10	5	6.6	M.i.	8.4	35.6	4.5	12.4	13.1	2.0	12.8	1.2	-	-	100	6.7	31.4	2.1	15.0
G11	6	6.6	P.O.	24.9	28.1	-	-	47.0	-	-	-	-	-	100	6.9	26.3	1.2	21.9
G12	7	6.6	M.i.	7.0	47.0	-	9.4	16.1	-	9.4	1.3	-	9.8	100	6.8	25.7	1.8	14.3
G13	8	6.6	S.S.	17.4	37.0	-	31.7	17.3	5.5	-	-	-	-	100	7.2	25.5	1.1	23.2
G14	1	7.6	L.i.	25.9	28.1	8.32	16.5	18.3	3.2	-	-	-	-	100	6.4	25.7	1.3	19.7
G15	2	7.6	H.S.	10.6	37.4	5.7	31.2	14.6	1.1	-	-	-	-	100	7.0	29.0	1.2	24.1
G16	3	7.6	P.O.	15.2	28.3	-	28.2	28.3	-	-	-	-	-	100	6.6	31.6	2.2	14.1
G17	4	7.6	M.i.	12.8	28.3	2.50	29.4	13.3	3.8		-	-	-	100	7.3	27.4	3.0	9.2
G18	5	7.6	M	18.2	33.8	-	2.3	45.4	-		-	-	-	100	6.8	28.8	2.9	9.10
G19	1	7.6	R.(1)	19.8	32.4	-	36.3	10.7	-	-	-	-	1.7	100	7.2	26.7	2.2	12.1
G20	2	8.6	H.	27.0	27.0	-	6.6	19.0	9.7	10.7	-	-	-	100	6.6	25.7	2.2	11.7
G21	3	8.6	M.	9.4	42.6	-	35.1	12.9	-	-	-	-	-	100	7.0	26.8	2.0	13.4
G22	4	8.6	R.(2)	11.4	41.1	3.4	34.6	7.4	-	2.2				100	6.8	26.6	2.3	11.6

APPENDIX 10

WASTE AND COMPOST QUALITY ANALYSIS SURVEY (LATTAKIA)

SECTION 10 WASTE AND COMPOST QUALITY ANALYSIS SURVEY (LATTAKIA)

10.1 GENERAL

The Survey is required as a part of the Pilot Study on the Improvement of Compost Product. In the survey, the local consultant shall analyzes the quality of hauled-in wastes; i.e. market waste and separated household waste, and compost produced by the Pilot Study.

10.2 WORK ITEMS AND CONTENTS

The contents of the Work will be as follows:

(1) Number of Samples to be analyzed

Hauled-in Waste; 3 Samples x 2 type of waste = 6 Samples
Compost products; 3 Samples x 2 type of waste = 6 Samples
Total 12 Samples

Details of the samples are shown in the following Table 10.2.1.

Table10.2.1

	Hauled-in waste	Compost product	Total
Market waste	3	3	6
Separated hh waste	3	3	6
Total	6	6	12

Note: hh: Household

(2) Items to be analyzed

Items to be analyzed for each sample are shown in the following Table 10.2.2.

Table10.2.2

Hauled-in Waste	Compost product
Physical Composition	Analysis Items
Foods	Grading Analysis
Papers	Organic composition (%)
Textiles	C/N ratio
Plants/Trees	Hydrogen (%)
Plastics	Moisture (%)
Rubbers/Leathers	Metals and Glasses (%)
Metals	
Bins	
Glasses	
Soil/Stones/Ceramics	
(toxic wastes like battery are surveyed separately)	

Hauled-in Waste	Compost product
Chemical Element (%)	Heavy Metals (ppm)
C	As
H	Pb
N	Cd
P	Hg
S	Cr
O	Ni
	Cu
	Zn

10.3 SURVEY RESULTS

The local consultant has carried out the above required work items as described in the following paragraphs.

10.3.1 Market Hauled-in Waste and Compost

(1) Hauled-in Waste

Three hauled-in market waste samples were collected by the local consultant from the compost plant at the city of Lattakia in 18th, 19th and 20th of June 2001. The samples were collected from a separated hauled-in waste pile at the site. The pile was collected and main non-organic material ware manually separated by the Study Team as part of their Pilot Study. The separated non-organic materials are shown in Table 10.3.1.

Table 10.3.1 Percentage of Materials Manually Separated by the Study Team from Market Hauled-in Waste Pile

Components Manually Separated		Collecting Date		
		18/6/2001	19/6/2001	20/6/2001
Organic Materials		87.9	93.7	94.5
Non-Organic Materials	Papers %	2.7	2.2	1.3
	Plastics %	6.2	3.0	1.6
	Glass %	0.3	0.2	0.1
	Metals %	0.7	0.1	0.2
	Others %	2.2	0.8	2.3
Total %		100.0	100.0	100.0

Three samples from the remaining materials were handled to the local consultant for quality analysis. The quality analysis included physical and chemical analysis for the components of the samples as specified in the specifications.

The analysis results for the remaining composition together with the organic chemical elements could be seen in Table 10.3.2.

Table 10.3.2 Physical Components and Chemical Organic Materials in Market Hauled-in Waste

Sample No.	1	2	3
Sampling Date	18/6/2001	19/6/2001	20/6/2001
Moisture	71.20	60.10	62.40
Physical Components %			
Foods	90.97	90.11	91.75
Papers	T	T	T
Textiles	-	-	-
Plastics	T	T	T
Plants/trees	4.95	7.34	4.85
Rubbers/leathers	-	-	-
Metals	1.2	T	T
Glass	T	T	T
Stones/Ceramics	2.88	2.55	3.40
Total	100.00	100.00	100.00
Chemical Elements %			
Carbon	42.24	38.02	42.63
Hydrogen	6.30	6.72	6.21
Nitrogen	1.03	0.92	1.01
Phosphor	0.60	0.50	0.31
Sulfur	0.06	0.11	0.11
Oxygen	49.77	53.72	49.73
Total	100.00	100.00	100.00

N.B: Oxygen in the above results was measured by calculation; hence it includes oxygen and other unrecognized elements.

It could be seen from Table 10.3.2 that the most dominant component in the three samples, hence in the market hauled-in waste, is food and plants, hence the organic materials which comprises some 95% of the total wet weight. This was because of the improvement of manual separation at hauled-in site, which was carried out by the Study Team.

(2) Compost

Three compost samples were collected from market origin. The three samples were dried and grinded in order to become suitable for analysis. The analysis comprises compost grading, physical criteria and components, chemical elements and the components of heavy metals in the samples. The analysis output results are listed in Table 10.3.3 and Table 10.3.4.

Table 10.3.3 Physical and Chemical Analysis for Market Waste Compost

Sample No.	1	2	3
Grading Results %			
> 12 mm	0.58	0.70	0.94
5 – 12 mm	25.50	25.66	27.22
2 – 5 mm	27.21	24.73	22.55
< 2 mm	46.71	48.91	49.29
Total	100.00	100.00	100.00
Physical Components			
PH	8.32	8.32	8.31
Conductivity 1:10	7.5 dS/m	7.0 dS/m	7.5 dS/m
Debris %			
Plastics	0.05	0.013	0.07
Rubbers & Leathers	0.01	0.013	-
Metals	-	-	0.01
Glass	0.96	0.61	0.17
Stones/Ceramics	1.00	2.42	1.16
Organic Components	43.20	42.15	40.12
Chemical Elements %			
Carbon (C)	19.83	20.87	20.20
Nitrogen (N)	0.89	0.78	0.86
Phosphor (P)	0.24	0.26	0.23
Potassium (K)	0.98	0.96	1.01
Hydrogen (H)	7.84	7.56	7.92
Oxygen (O)	66.14	65.42	65.51
Sulfur (S)	0.04	0.05	0.04
Chlorate (Cl)	3.45	3.49	3.45
Magnesium (Mg)	0.59	0.61	0.78
Total	100.00	100.00	100.00
C/N Ratio	22.28	26.75	23.48

N.B: These results were listed taking into considerations that oxygen value include the oxygen and other materials which were not requested by the specifications. And that the pure Oxygen could be found as follows;
Oxygen % = Organic Composition % - (Carbon % + Nitrogen % + Hydrogen %)

Table 10.3.4 Heavy Metal Analysis for Market Waste Compost (mg/kg)

Sample No.	1	2	3	4
Pb	97.11	101.43	117.27	115.32
Cu	417.91	494.39	372.95	362.49
Ni	53.80	44.89	55.71	49.07
Cr	66.52	54.25	73.41	69.63
Cd	0.269	0.144	0.461	0.246
Zn	433.92	399.09	340.83	367.71
Hg	5.132	5.220	3.305	2.959
As	-	-	-	-

(3) Discussions and Further Recommendations

In order to achieve a better idea and a better control over the quality production of compost three additional samples were analyzed at after fermentation as pre-maturing

compost for the main affecting components, i.e. for Carbon, Nitrogen, C/N Ratio and Organic composition. The resulting outputs can be seen in Table 10.3.5.

Table 10.3.5 Chemical Elements for Pre-maturing Compost Market Generated

Sample No.	1	2	3
Carbon (C) %	14.12	15.24	16.23
Nitrogen (N) %	0.73	0.59	0.65
C/N Ratio	19.34	25.83	24.98
Organic Composition %	45.62	46.01	46.28

Although there was an increase in the value of both carbon and nitrogen, however, the indicator C/N ratio remained within the acceptable range for good compost. Though was the organic composition according to Syrian Specifications 2014/1998 (The Organic Mixture Produced from Solid Waste Resulted from Cities).

In another hand, the hydrogen number of the samples (pH) was a bit higher than the limit given in the above specifications.

Most of the heavy metals in the samples appear to be totally within the limit of first class compost according to specification 2014/1998 or at least within the limit of second class for some of them.

10.3.2 Domestic Hauled-in Waste and Compost

(1) Hauled-in Waste

Three hauled-in domestic waste samples were handled to the local consultant by the Study Team on 12th of July 2001. The samples were collected five days before and dried and grinded. The samples were manually separated taking non-organic items out of the waste. The separation was carried out by the Study Team before submission as part of their Pilot Study.

The three samples were handled in order to be analyzed for quality. The quality analysis for these samples included only the chemical analysis as specified in the specifications with additional analysis for chlorate. The analysis results for the main chemical elements could be seen in Table 10.3.6.

Table 10.3.6 Chemical Organic Materials in Hauled-in Domestic Waste

Sample No.	1	2	3
Moisture of the sample at receive %	3.57	3.67	3.67
Chemical Elements %			
Carbon	31.88	30.61	30.47
Hydrogen	8.16	8.30	8.31
Nitrogen	0.86	0.80	0.77
Phosphor	0.24	0.29	0.28
Sulfur	0.07	0.10	0.12
Oxygen	57.10	58.07	58.19
Chlorate	1.69	1.83	1.86
Total	100.00	100.00	100.00

N.B: Oxygen was achieved by calculation, and it includes oxygen and other unnoticed elements, i.e. oxygen and others.

(2) Compost

Four compost samples were collected from domestic origin. Three samples were dried and screened before handling to the local consultant, whereas the forth one was dried but not screened in order to get a wider representing view. The analysis comprise compost grading, physical components, chemical elements for the three samples and the components of heavy metals for the four samples, in addition to some physical indicators for the forth one as seen in Table 10.3.7. The analysis output results are all listed in Table 10.3.7.

Table 10.3.7 Physical and Chemical Analysis for Domestic Waste Compost

Sample No.	1	2	3	4
Grading Results %				
> 12 mm	0.00	0.00	0.00	Not Required
5 – 12 mm	26.46	35.74	41.85	
2 – 5 mm	29.84	33.02	18.42	
< 2 mm	43.70	31.24	39.73	
Total	100.00	100.00	100.00	
Physical Components				
pH	8.4	8.4	8.3	8.4
Conductivity 1:10	5.5 dS/m	5.0 dS/m	5.0 dS/m	4.5 dS/m
Debris %				
Plastics	0.91	0.84	0.80	Not Required
Rubbers & Leathers	-	-	-	
Metals	-	-	-	
Glass	0.62	0.83	0.63	
Stones/Ceramics	1.71	1.85	2.60	
Organic Components %	52.85	54.40	51.65	
Chemical Elements %				
Carbon (C)	25.71	22.96	22.50	Not Required
Nitrogen (N)	0.99	0.94	0.92	
Phosphor (P)	0.27	0.20	0.22	
Potassium (K)	0.35	0.28	0.33	
Hydrogen (H)	6.42	6.80	6.60	
Oxygen (O)	63.02	65.74	66.42	
Sulfur (S)	0.35	0.33	0.33	
Chlorate (Cl)	1.70	1.69	1.73	1.45
Magnesium (Mg)	1.19	1.06	0.95	Not Required
Total	100.00	100.00	100.00	
C/N Ratio	25.97	24.42	24.45	
Heavy Metals (mg/kg)				
Pb	45.02	68.28	1820.78	71.69
Cu	160.16	156.35	7183.74	117.23
Ni	46.28	45.43	117.23	136.06
Cr	67.16	61.13	139.31	70.42
Cd	0.94	1.26	0.55	0.183
Zn	375.78	366.51	405.32	407.88
Hg	7.88	6.92	10.20	3.92
As	-	-	-	

N.B: These results were listed taking into considerations that Oxygen value include the oxygen and other materials which were not requested by the specifications, and that the pure Oxygen could be found as follows;
Oxygen % = Organic Composition % - (Carbon % + Nitrogen % + Hydrogen %)

(3) Discussions and further recommendations

In order to achieve a better control over the quality production of compost, three additional samples were analyzed at after fermentation as pre-maturing compost for the main affecting components, i.e. for Carbon, Nitrogen, C/N Ratio, Chloride and Organic composition. The resulting outputs can be seen in Table 10.3.8.

Table 10.3.8 Chemical Elements for Pre-maturing Compost Domestic Generated

Sample No.	1	2	3
Carbon (C) %	19.82	20.21	20.81
Nitrogen (N) %	0.98	0.90	0.98
C/N Ratio	20.10	22.04	21.20
Organic Composition %	41.60	42.22	42.16
Chloride (Cl) %	1.77	1.73	1.53

Although there was an increase in the value of the carbon but the nitrogen values almost remain constant. This in turn led to an increase in the C/N indicator, which remained within the acceptable range for good compost. Though was the organic composition according to the Syrian Specifications 2014/1998 (The Organic Mixture Produced from Solid Waste Resulted from Cities).

Heavy metals in the samples appear to be totally within the limit of first class compost according to specification 2014/1988 or at least within the limit of second class for some of them.

However, higher values of mercury were noticed in the samples.

Sample No. 3 might be assumed as an odd sample, where most of the results appear to be out of the range. The cause for such results might be a concentration of an odd subject in the one-gram sample. This might lead to a recommendation that the analysis for each sample should be repeated four times for four sub-samples, i.e. increase number of samples and sub-samples in order to achieve more represented results.

APPENDIX 12

TOPOGRAPHIC AND GEOLOGICAL SURVEY AT THE PROPOSED SITE FOR NEW COMPOST PLANT IN HOMS

APPENDIX 12 TOPOGRAPHIC AND GEOLOGICAL SURVEY AT THE PROPOSED SITE FOR NEW COMPOST PLANT IN HOMS

12.1 INTRODUCTION

This Geological Survey at the area of new compost plant in Homs (Dear Baalbeh Site) aims to obtain the information about the nature of the site soil, its layers, its mechanical and physical characteristics according to the following items:

Drilling a set of geotechnical bores using a rotary drilling depth equal to 90 m to obtain the information about the nature of the soil in the site.

Obtaining soil samples during sub-surface exploration (Disturbed and undisturbed samples)

Performing the standard penetration test during the drilling of the bores at each one meter in depth with total test number equal to 90 test samples.

Observation of ground water table by means of the drilled bores.

Performing the laboratory experiments on the obtained soil samples from different depths, using the following table.

Table 12.1.1 shows the summary of the number conducted in the survey.

Table 12.1.1 Number of Site Tests and Laboratory Experiments

Test Item	Test No.
In - situ testing (SPT test)	90
Moisture Content	6
Liquid Limit	6
Plastic Limit	6
Consolidation Test	6
Unit gravity	6
Grain size analysis	6
Permeability test	6

12.2 SITE DESCRIPTION

The studied site is a land consists of three parcels with numbers (1615-1616-1617).

The land has slight slopes, its area is about 8.6 hectares.

The site locates at the north of Homs City and about 5 Km far from it, near the existing dump site.

The north border of the studied site is the existing dump site., the east border is the city cemetery, the west border is a seasonal irrigation canal, and at the south border there is an oil pipeline followed by private farms and small factories.

12.3 BOREHOLES

Figure 12.3.1 shows the location of the boreholes and Table 12.3.1 shows the depth of boring for each borehole.

6 boreholes were drilled using rotary drilling machine.

The locations of these bores had been distributed on the whole area of the site as shown in the attached figure.

Table 12.3.1 shows the number and the depth of each bore.

Table 12.3.1 Depth of Boreholes

Boring No.	Depth of Boring (m)
B1	22
B2	12
B3	22
B4	12
B5	12
B6	12

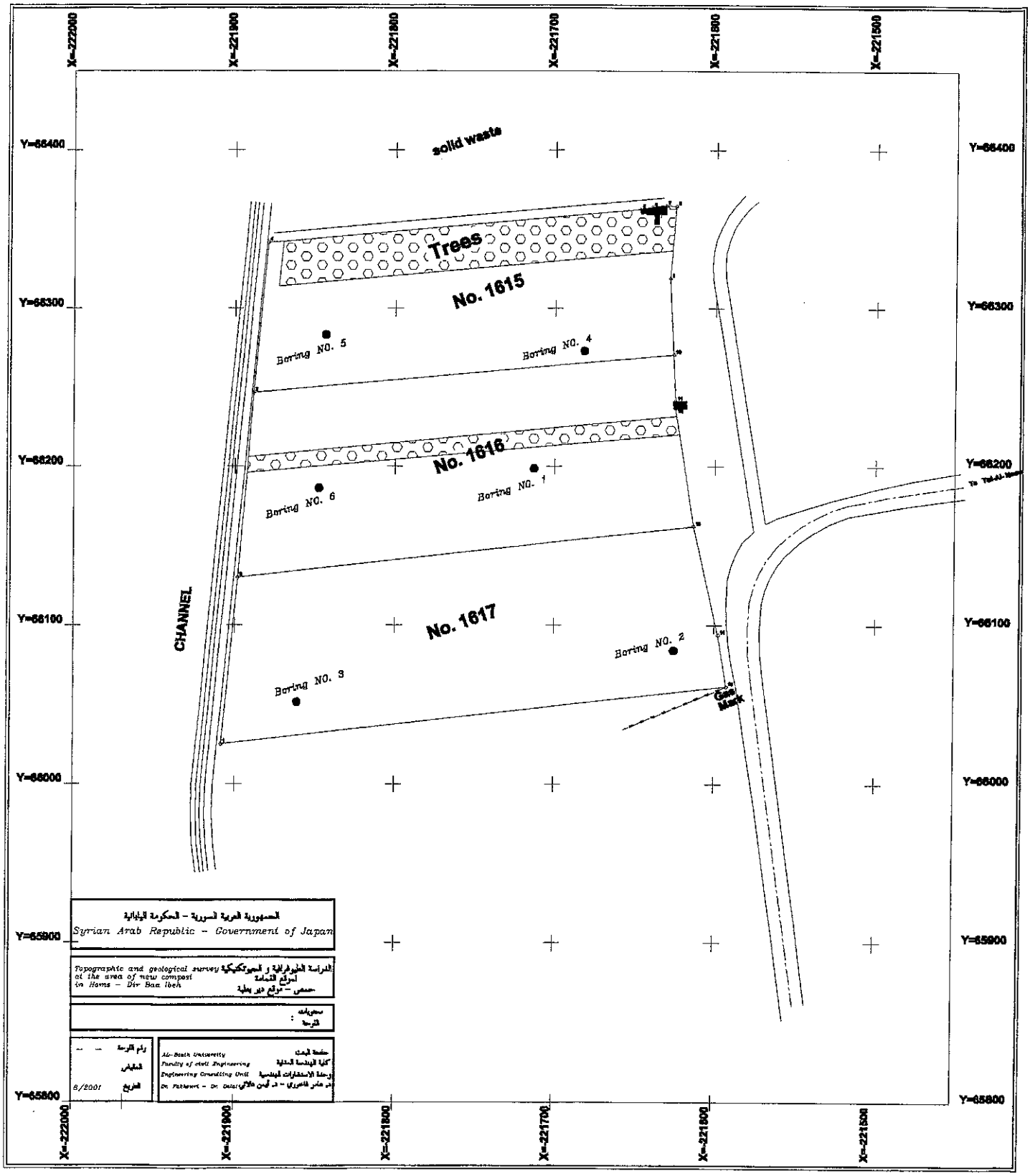

Figure 12.3.1 Location Map of Boreholes

12.4 SURVEY RESULTS

12.4.1 Ground Water

The Soil was Drilled to Maximum Depth equal to 22 m and a pezieometer was installed in the bore number 1 to observe the ground water table level.

The observation Shows that there is not ground water till this depth.

12.4.2 Soil Profile

(1) Soil Layers

The boring results show that the soil consists of the following layers:

(2) First Layer

Red agricultural soil with some gravel, the thickness of this layer is varying between 120 - 250 cm depending on the bore location.

(3) Second Layer

Lime marl soil, this soil is defined as a fine grained soil with sand and some gravel.

The soil is penetrated by seams of the red soil.

In the dry case, this soil shows good rigidity and at some locations it becomes rocky.

This soil continues in homogenous form till the depth 900 cm

(4) Third Layer

Conglomerate rock, this rock is defined as an assembly of the sand, fine materials, and gravel, interconnected by means of lime mortar.

This layer has a high rigidity and continues till a depth varies between 15-16 m.

(5) Fourth Layer

Rigid lime rock, this layer continues till a depth varies between 19-21 m.

(6) Fifth Layer

Basalt rock with dark color.

The attached figures, Figure 12.4.1 (1) to 12.4.1 (6), detailed description of the soil and its layers thicknesses.

12.4.3 In-situ Tests

The Standard Penetration Tests were performed in a successive way following the drilling works and for each 100 cm in depth.

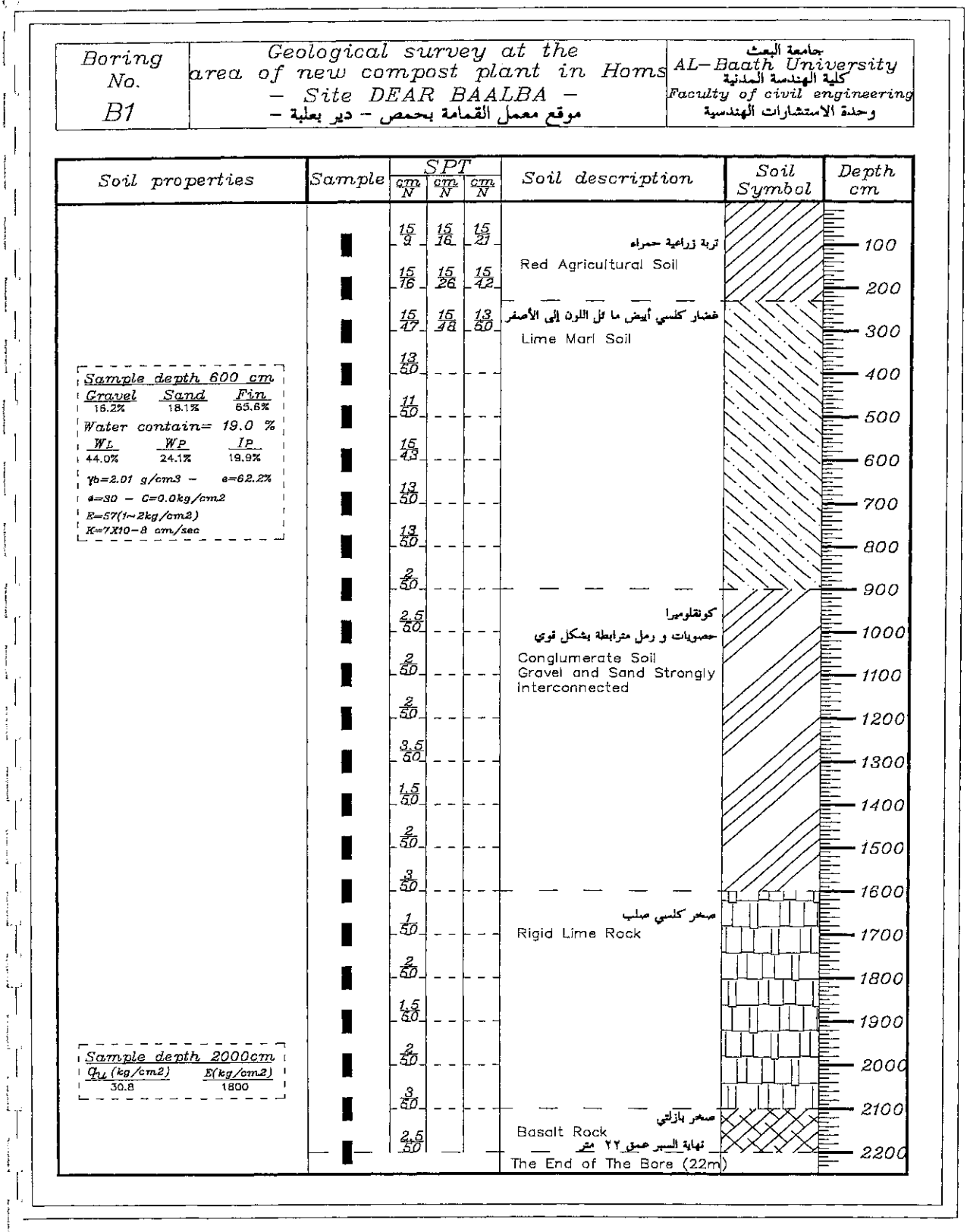

Figure 12.4.1 Soil Profile at New Compost Plant in Homs (1)

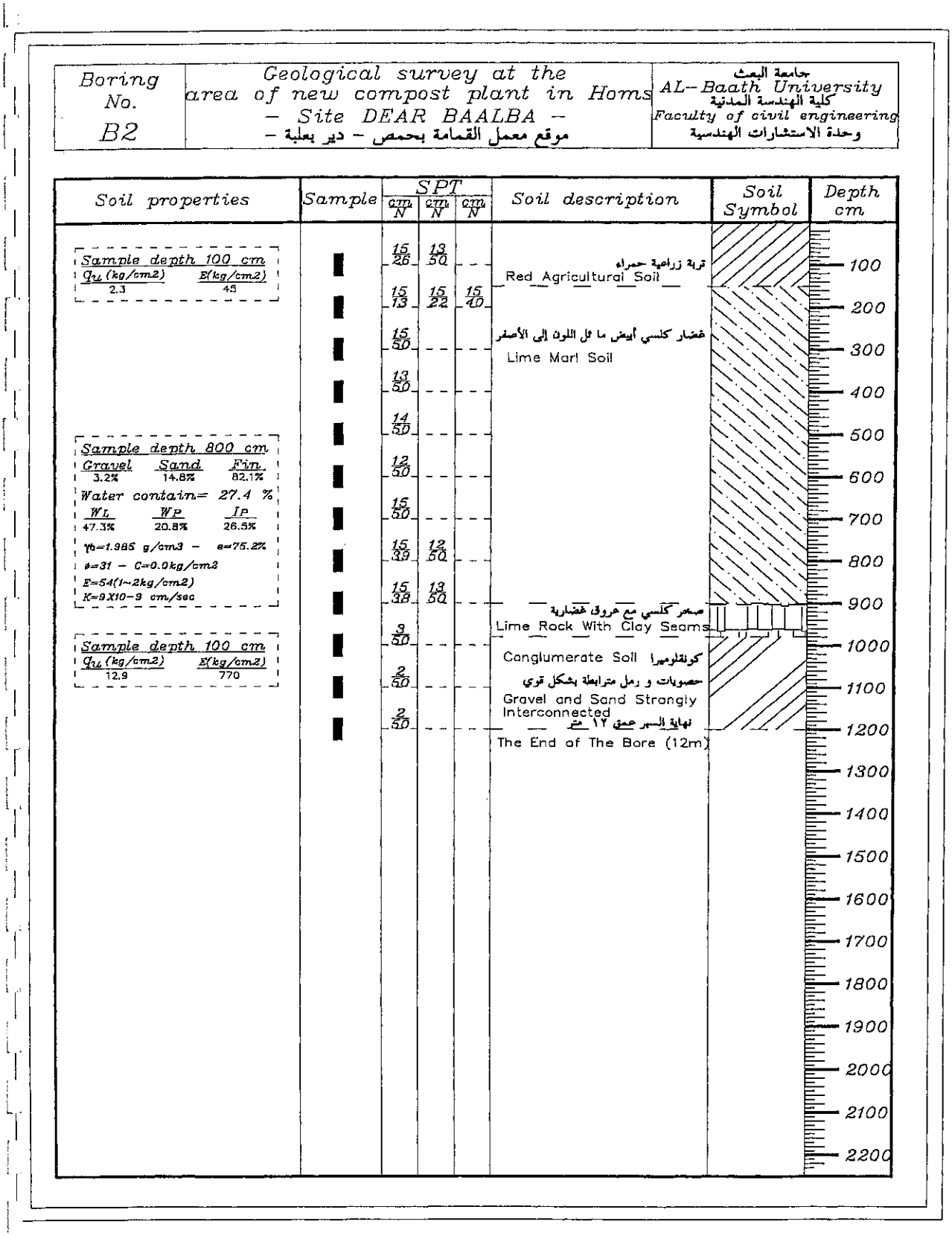

Figure 12.4.1 Soil Profile at New Compost Plant in Homs (2)

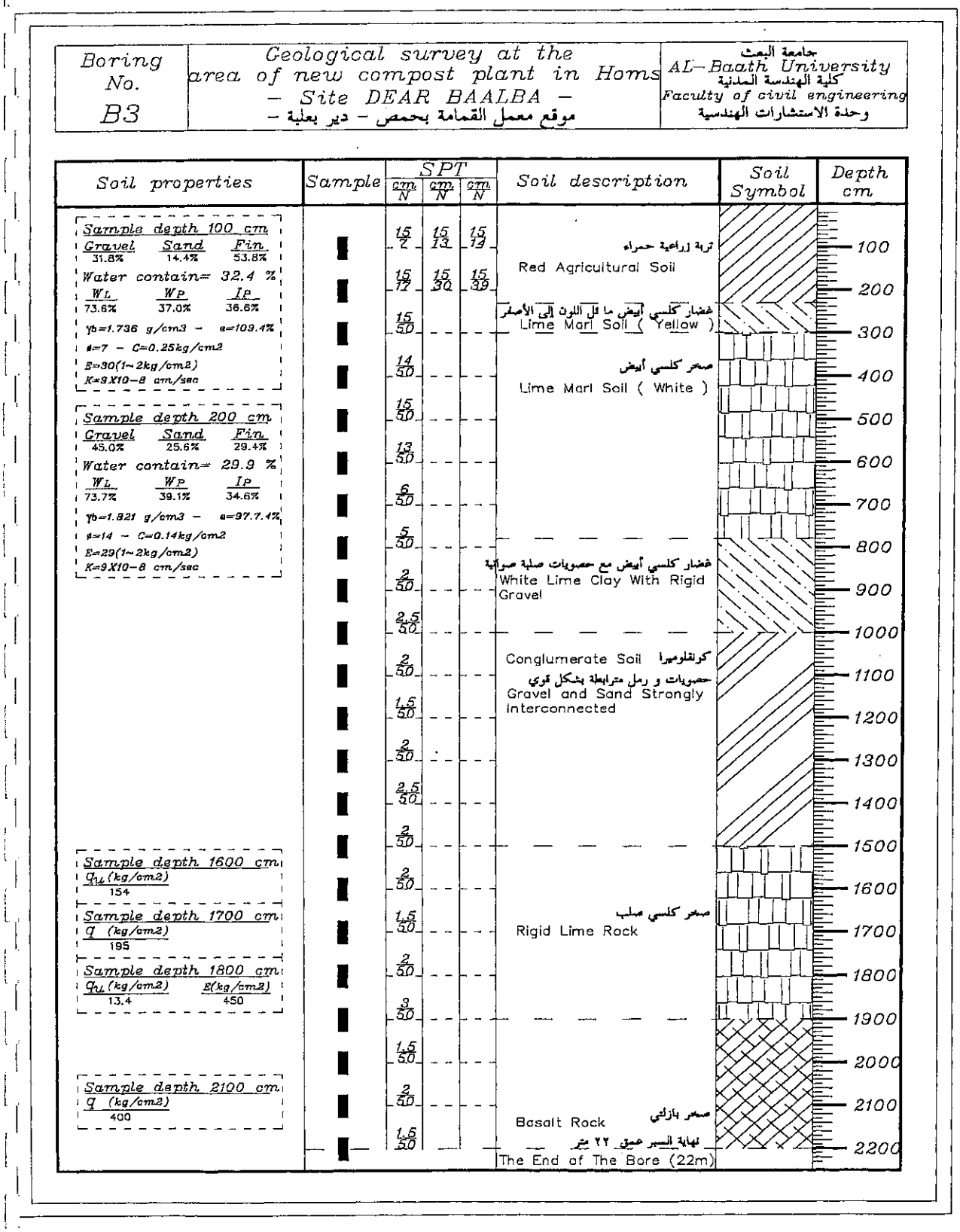

Figure 12.4.1 Soil Profile at New Compost Plant in Homs (3)

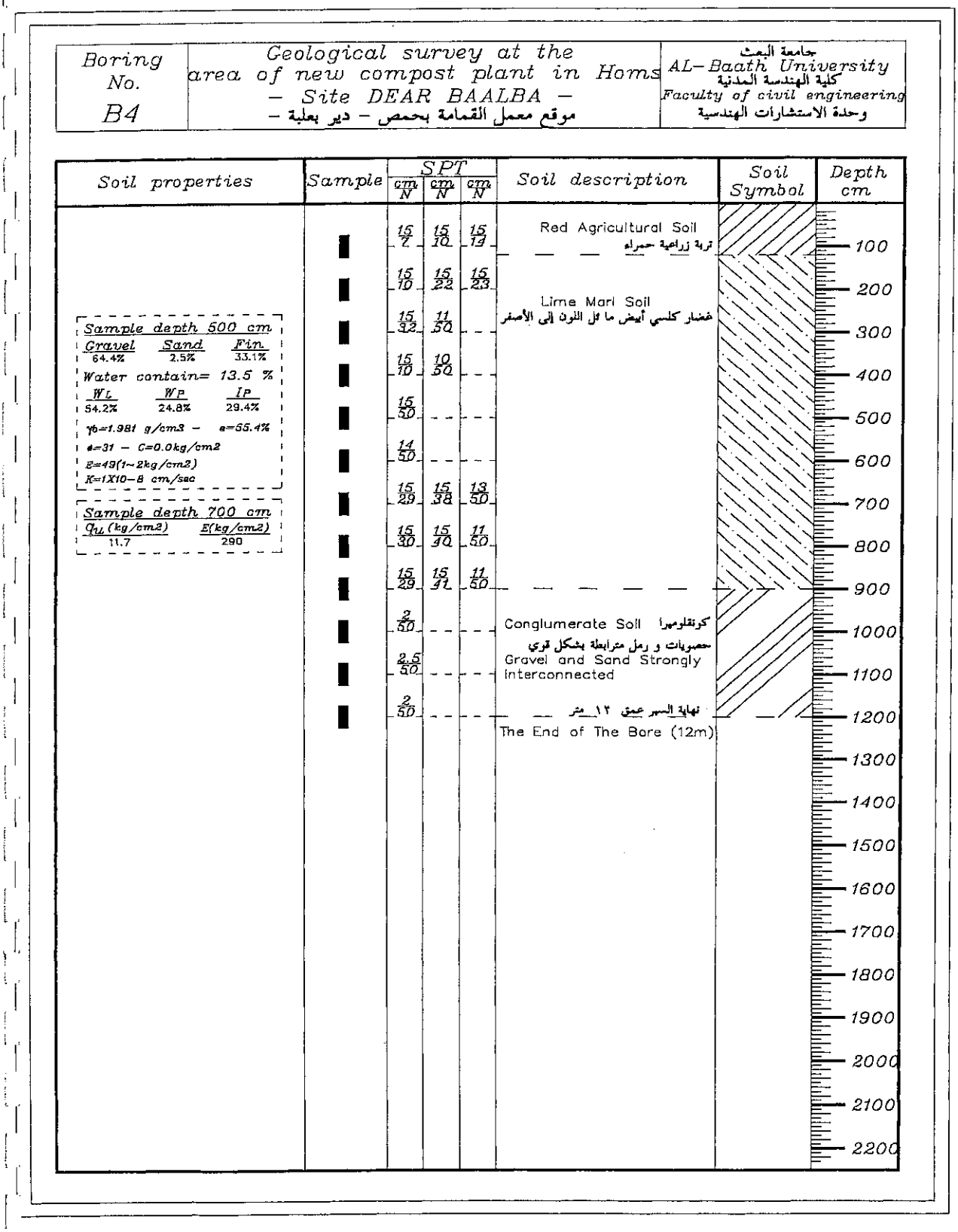

Figure 12.4.1 Soil Profile at New Compost Plant in Homs (4)

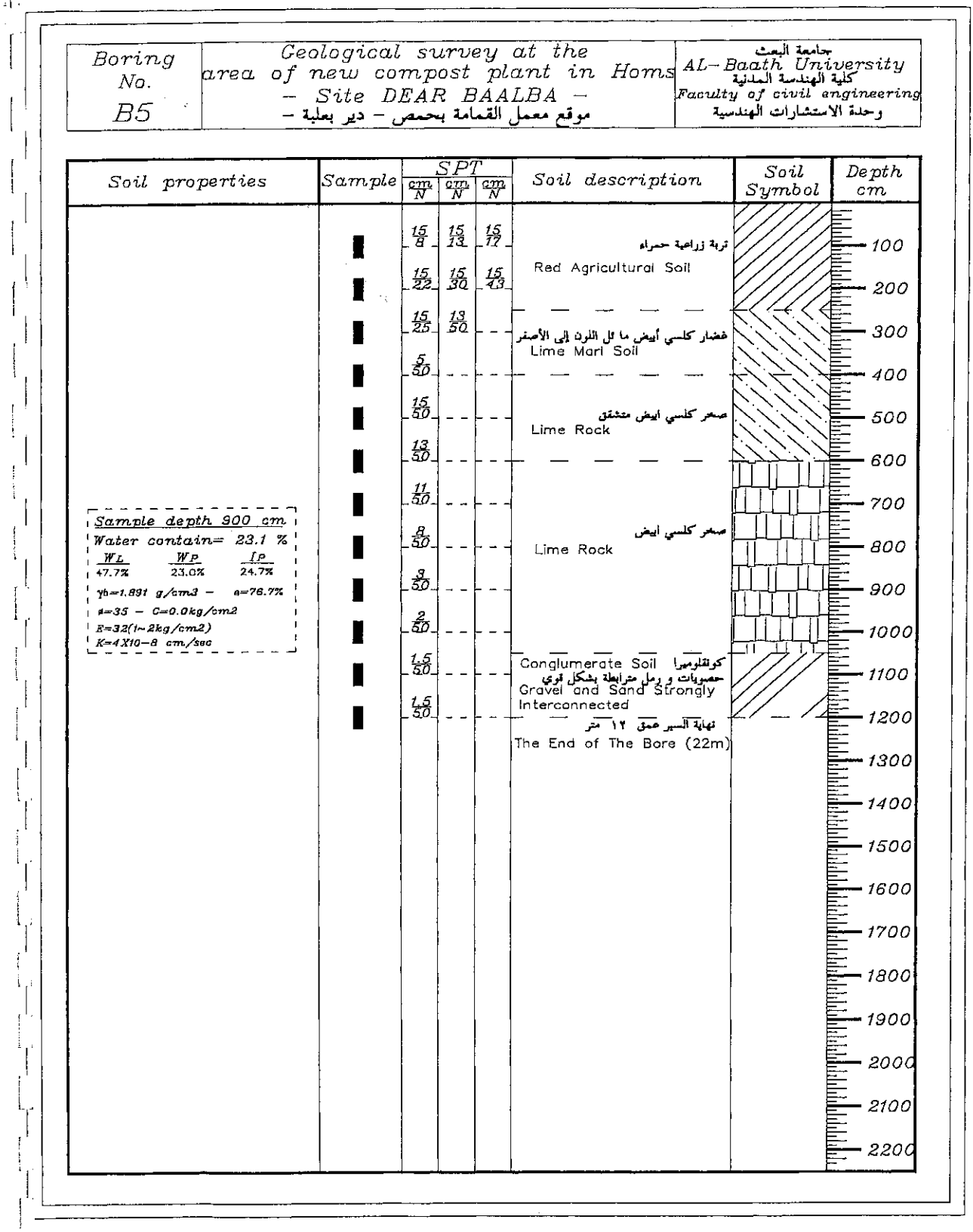

Figure 12.4.1 Soil Profile at New Compost Plant in Homs (5)

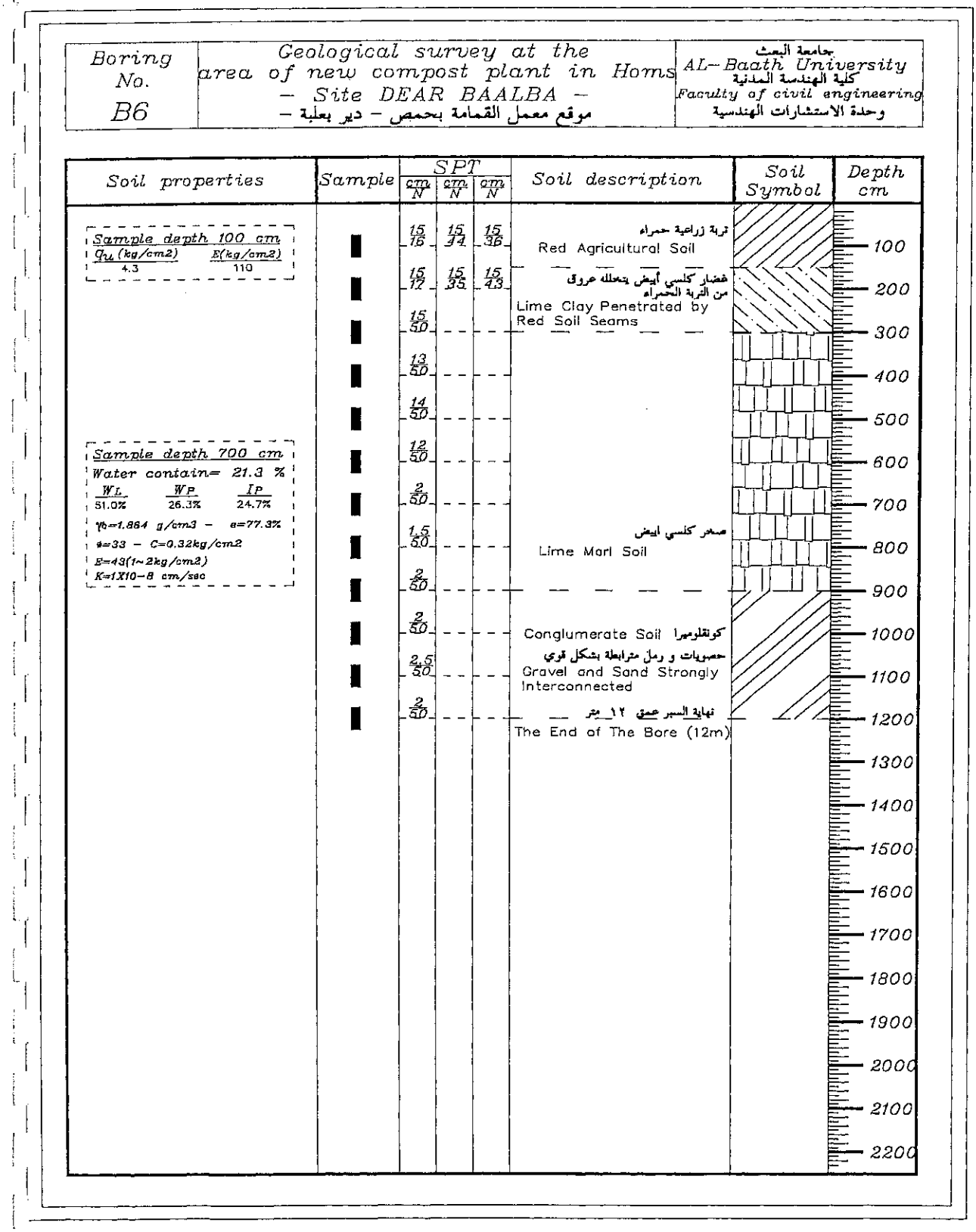

Figure 12.4.1 Soil Profile at New Compost Plant in Homs (6)

12.4.4 Laboratory Experiments

(1) Grain Size Distribution Tests

The grain size distribution tests were performed using the wet method by sieving the samples through 0.075 mm sieve by means of water current.

Table 12.4.1 shows the results.

Table 12.4.1 Grain Size Distribution

Boring No	Depth of Sample	Passing (%)		
	cm	< 0.075 mm	0.075~4.75 mm	> 4.75 mm
B1	600	65.6	18.1	16.2
B2	800	82.1	14.8	3.2
B3	100	53.8	14.4	31.8
B3	200	29.4	25.6	45.0
B4	500	33.1	2.5	64.4
B4	900	59.1	40.0	0.9

(2) Atterberg Limits

The Atterberg limits tests were performed to determine the plasticity characteristics of the sieved soil through 0.425 mm sieve according to the ASTM system.

Table 12.4.2 shows the results.

Table 12.4.2 Atterberg Limits Determination

Boring No.	Depth of Sample (cm)	Plasticity Index (IP %)	Plastic Limit Determination (W_P %)	Liquid Limit Test (W_L %)
B1	600	19.9	24.1	44.0
B1	800	26.5	20.8	47.3
B3	100	36.6	37.0	73.6
B3	200	34.6	39.1	73.7
B4	500	29.4	24.8	54.2
B5	900	24.7	23.0	47.7
B6	700	24.7	26.3	51.0

(3) Physical Characteristics

To define the physical characteristics of the soil, the following tests were performed:

- Water - displacement test using paraffin wax to determine the dry density of the soil
- Specific gravity test.
- Water continent test

The rest of the physical characteristics were calculated depending on the results of the previous tests.

Table 12.4.3 shows above results.

Table 12.4.3 Physical Characteristics of Soil

Boring No.	Depth of Sample (cm)	DEGREE OF SATURATION (S_r)	VOID RATIO (e)	SPECIFIC GRAVITY (γ_s)	WATER CONTENT (ω)	DRY U.W (γ_d)	BULK U.W (γ_b)
		%	%	-	%	g/cm^3	Gr/cm^3
B1	600	83.8	62.2	2.738	19.0	1.688	2.01
B2	800	99.4	75.2	2.730	27.4	1.559	1.985
B3	100	81.3	109.4	2.745	32.4	1.311	1.736
B3	200	84.8	97.7	2.772	29.9	1.402	1.821
B4	500	65.9	55.4	2.712	13.5	1.746	1.981
B5	900	81.6	76.7	2.716	23.1	1.527	1.891
B6	700	75.2	77.3	2.723	21.3	1.536	1.864

(4) Direct shear tests

The direct shear tests were performed using the obtained samples from the bores and the soil samples were saturated.

The used shear velocity was 0.5 mm/min.

The shear began directly after the applying of the normal stresses on the samples.

The following table illustrates the soil cohesion value and the internal friction angle value.

Table 12.4.4 shows the direct shear tests results.

Table 12.4.4 Box Shear Test

Boring No.	Depth of Sample	Cohesion (C)	Angle of internal friction (Φ)
	Cm	kg/cm^2	DEG.
B1	600	0.00	30
B2	800	0.00	31
B3	100	0.25	7.0
B3	200	0.14	14
B4	500	0.00	31
B5	900	0.00	35
B6	700	0.32	33

(5) Consolidation Test

The consolidation tests were performed to define he soil compressibility, the soil elasticity modules as a function to the value of the applied normal stresses, the free relative swelling stain and swelling pressure value.

Table 12.4.5 illustrates above results, and Table 12.4.6 shows the swelling pressure and strains.

Table 12.4.5 Consolidation Test

Boring No.	Depth of Sample	Module of Elasticity E (kg/cm^2)			
	cm	4.0 ~ 8.0	2.0 ~ 4.0	1.0 ~ 2.0	0.50 ~ 1.0
B1	600	182	87	57	53
B2	800	104	80	54	43
B3	100	86	52	30	31
B3	200	93	56	29	30
B4	500	211	93	49	50
B5	900	123	60	32	31
B6	700	138	71	43	40

Table 12.4.6 Swelling Pressures and Free Swelling Strains

Boring No.	Depth of Sample (cm)	Free swelling strain (%)	Swelling Pressure (Kg/cm^2)
B1	600	0.10	0.20
B2	800	0.30	0.10
B3	100	1.50	0.70
B3	200	2.00	0.60
B4	500	0.10	0.65
B5	900	1.60	0.60
B6	700	0.60	0.10

(6) Unconfined Compression Test

The unconfined compression tests were performed using undisturbed cylindrical samples which were token from different depths.

By these tests, we determine the soil elasticity module and the unconfined compressive strength of the soil.

Table 12.4.7 shows the test results.

Table 12.4.7 Results of Unconfined Compression Test

Boring No.	Depth of Sample (cm)	Unconfined Compressive Strength (Kg/cm^2)	Modules of Elasticity (Kg/cm^2)
B1	2000	30.8	1800
B2	100	2.3	45
B2	1000	12.9	770
B3	1600	154	-
B3	1700	195	-
B3	2100	400	-
B3	1800	13.4	450
B4	700	11.7	290
B6	100	4.3	110

(7) Permeability Coefficient Determination Test

As a result of the low value of the soil permeability, we calculate the value of the permeability coefficient using the time-compression relation which was determined by the consolidation tests.

Table 12.4.8 illustrates the results.

Table 12.4.8 Coefficient of Permeability (Time-Compression relation)

Boring No.	Depth of Sample (cm)	Coefficient of Consolidation (C_v) (cm^2/sec)	Coefficient of Permeability (K) (cm/sec)
B1	600	0.0066	7×10^{-8}
B2	800	0.001	9×10^{-9}
B3	200	0.005	9×10^{-8}
B4	500	0.002	1×10^{-8}
B5	900	0.0028	4×10^{-8}
B6	700	00022	1×10^{-8}

APPENDIX 13

RELEVANT DATA RELATED TO COMPOST

APPENDIX 13 RELEVANT DATA RELATED TO COMPOST

13.1 ORIGINAL TEST DATA OF COMPOST PILOT STUDY IN LATTAKIA

The composting temperature for market and domestic waste are shown in Table 13.1.1 and 13.1.2.

The bulk density for market and domestic waste are shown in Table 13.1.3 and 13.1.4.

The moisture for market and domestic waste are shown in Table 13.1.5, 13.1.6 and 13.1.7.

Table 13.1.1 Composting Temperature (Market Waste)

Waste No.	Date		June-01															July-01																							
			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
1	2001/6/16	Sat	27	57	57	67	70	62		60	64	58	52	48																										
2	2001/6/17	Sun	31	58	60	63	70		68	59	63	63	62	60			53	53	45	66	62		54	53	53	50	55	57		61	47	55	57	54	54		47	41		
3	2001/6/18	Mon	27	48	60	68		71	65		64	60	60		58																									
4	2001/6/19	Tue	30	49	53		56	64	68	70	65	61		50																										
5	2001/6/20	Wed	32	50		58	63	64	66	65	63		55	43		46	63	61		61	51	51	56	55	54		52	46	48	50	51	51		49	41	42	47	42	37	
6	2001/6/21	Thu	30		55	70	73	68	67	67		60	53	49	62																									
	2001/6/22	Fri																																						
7	2001/6/23	Sat	29	52	53	59	60	68		63	70	60	47	47																										
8	2001/6/24	Sun	28	49	53	55	63		62	60	58	60				54	54	45	49	50	52		53	46	49	51	50	50		51	44	43	46	46	42		41	42	38	
9	2001/6/25	Mon	28	42	50	50		65	63	50	60	60	61																											
10	2001/6/26	Tue	28	48	49		65	68	65	59	54	62																												
11	2001/6/27	Wed	28	49		53	58	65	62	53	63		65	57	49	46	56	57		52	50	48	48	57	54		53	46	45	45	45	43		40	41	41	42	44	40	
12	2001/6/28	Thu	29		44	45	52	50	52	62																														
	2001/6/29	Fri																																						
13	2001/6/30	Sat	30	48	50	59	55	60																																
14	2001/7/1	Sun	29	43	48	50	55		55	55	50	52	59	61		62	50	54	50	60	56		55	45	48	53	51	49		46	46	47	43	46	46		45	41		
15	2001/7/2	Mon	28	44	44	45																																		
16	2001/7/3	Tue	29	47	49																																			
17	2001/7/4	Wed	30	43		49	59	61	55	65	58		63	60	57	56	62	56		57	50	47	56	53	50		48	50	46	48	47	47		42	50	54	52	40	41	
18	2001/7/5	Thu	29																																					
	2001/7/6	Fri																																						
19	2001/7/7	Sat	28	40																																				
20	2001/7/8	Sun	30	44	45	58	54		58	59	60	60	60	55		57	58	56	50	50	45		50	50	51	50	47	47		43	47	50	53	50	51		50	45	38	
21	2001/7/9	Mon																																						
22	2001/7/10	Tue	28	45																																				
23	2001/7/11	Wed	29	44		43	57	61	62	53	56		58	56	55	55	57	53		53	55	55	54	50	49		50	46	49	50	51	53		52	54	50	44	40	40	
24	2001/7/12	Thu	30																																					
	2001/7/13	Fri																																						
25	2001/7/14	Sat	29	40																																				
26	2001/7/15	Sun	30	46	46	50	54		59	55	54	54	60	57		56	47	47	50	54	52		52	47	46	49	57	57		56	55	55	49	48	46		34	38	32	
27	2001/7/16	Mon	29																																					
28	2001/7/17	Tue	28	47																																				
29	2001/7/18	Wed	30	48		50	44	45	52	53	56		57	50	50	60	55	55		57	55	40	48	60	59		58	56	54	49	46	51		44	42	43	43	35		
30	2001/7/19	Thu	29																																					
	2001/7/20	Fri																																						
31	2001/7/21	Sat	30	41																																				
32	2001/7/22	Sun	29	45	51	51	57		55	52	52	62	60	59		61	50	60	53	61	58		55	55	56	50	50	55		42	50	45	42	47	40		39	38	38	
33	2001/7/23	Mon	30																																					
34	2001/7/24	Tue	29	40																																				
35	2001/7/25	Wed	30	48		43	50	50	54	54	61		58	60	61	57	61	53		58	51	57	50	52	53		50	51	43	45	46	42		39	37	38	37			
36	2001/7/26	Tru																																						
	2001/7/27	Fri																																						
37	2001/7/28	Sat	30																																					
38	2001/7/29	Sun		40	44	50	53		56	60	58	52	60	60		58	56	58	58	60	56		53	61	52	50	50	46		38	43	42	40	39					
39	2001/7/30	Mon																																						
40	2001/7/31	Tue	30																																					
41	2001/8/1	Wed	39	43		50	49	55	54	61	54		61	57	60	56	57	60		55	53	50	48	50	49		48	49	46	45	39									
42	2001/8/2	Thu																																						
	2001/8/3	Fri																																						

Table 13.1.2 Composting Temperature (Domestic Waste)

Waste No.	Date		July-01																										August-01								
			5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9
			Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	2001/7/5	Thu	29		37	42																																
	2001/7/6	Fri																																				
2	2001/7/7	Sat	29	42																																		
3	2001/7/8	Sun	29	40																																		
4	2001/7/9	Mon	29	39	38	37		37	36	34	34	40	42		45	45	50	50	53	57		59	55	56	54	57	50		48	52	50	55	51	45		42	41	41
5	2001/7/10	Tue	30																																			
6	2001/7/11	Wed	29																																			
7	2001/7/12	Thu	30																																			
	2001/7/13	Fri																																				
8	2001/7/14	Sat	29	33																																		
9	2001/7/15	Sun	30	36																																		
10	2001/7/16	Mon	30	35																																		
11	2001/7/17	Tue	29	36	39		40	40	40	40	42	49		58	51	50	51	55	52		53	41	43	44	42	40		38	38	40	38	39	37		31	34	37	
12	2001/7/18	Wed	30																																			
13	2001/7/19	Thu																																				
	2001/7/20	Fri																																				
14	2001/7/21	Sat																																				
15	2001/7/22	Sun	32	39	44	51	53		58	55	55	55	55	53		52																						
16	2001/7/23	Mon		38	45	50		60	56	52	54	47	55		49	61	48	51	47	40		40																
17	2001/7/24	Tue	30	40	45		59	53	55	51	46	52		47																								
18	2001/7/25	Wed	29	41		56	51	54	50	52	51		58								40	45	39	39	37		33	34	36	35	36	38		40	39	42		
19	2001/7/26	Thu	29		53	50	57	58	54	54		49	60	46	56	50	45		46																			
	2001/7/27	Fri																																				
20	2001/7/28	Sat		42	49	50	51	55		52																												
21	2001/7/29	Sun		42	44	46	56		52																													
22	2001/7/30	Mon		40	40	50		51	60	56	59	55	54		52																							
23	2001/7/31	Tue		37	49		50																															
24	2001/8/1	Wed		40		49								57	50	50	50	43		38	39	39	33	35	45		38	43	45	45	35							
25	2001/8/2	Thu			48	44	50	61	60	60		55																										
	2001/8/3	Fri																																				
26	2001/8/4	Sat																																				
27	2001/8/5	Sun		40	44																																	

Table 13.1.3 Bulk Density (Market Waste)

Waste No.	Date	June-01														July-01																					
		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	2001/6/16 Sat									0.45																												
2	2001/6/17 Sun								0.39							0.32	0.30		0.26			0.34	0.43	0.40			0.31		0.38	0.35	0.32	0.37	0.37	0.38		0.39		
3	2001/6/18 Mon							0.36						0.324																								
4	2001/6/19 Tue						0.34																															
5	2001/6/20 Wed					0.32						0.35	0.38			0.31			0.43	0.40	0.47			0.38		0.44	0.34	0.37	0.38	0.45	0.46		0.40		0.44	0.45	0.36	
6	2001/6/21 Thu				0.49							0.45	0.34																									
	2001/6/22 Fri																																					
7	2001/6/23 Sat		0.44							0.57	0.45																											
8	2001/6/24 Sun	0.54	0.58	0.55	0.52	0.57		0.55	0.54	0.47					0.43	0.43	0.47			0.26		0.43	0.40	0.40	0.43	0.44	0.51		0.43		0.45	0.45		0.43				
9	2001/6/25 Mon	0.39						0.31	0.36		0.33																											
10	2001/6/26 Tue	0.54					0.43	0.34																														
11	2001/6/27 Wed	0.50				0.45	0.45					0.42		0.47			0.31		0.40	0.40	0.45	0.47	0.54	0.52		0.48		0.49	0.50		0.43				0.47	0.57		
12	2001/6/28 Thu	0.60			0.64	0.47																															
	2001/6/29 Fri																																					
13	2001/6/30 Sat	0.52	0.41	0.41																																		
14	2001/7/1 Sun	0.68	0.51					0.39								0.37	0.39	0.40	0.50	0.52		0.47		0.42	0.52		0.48				0.44	0.50		0.50				
15	2001/7/2 Mon	0.29																																				
16	2001/7/3 Tue																																					
17	2001/7/4 Wed														0.30	0.42	0.37		0.40		0.45	0.38		0.50				0.45	0.50		0.42					0.53	
18	2001/7/5 Thu																																					
	2001/7/6 Fri																																					
19	2001/7/7 Sat																																					
20	2001/7/8 Sun																	0.49		0.53				0.45	0.61		0.44					0.45	0.44				
21	2001/7/9 Mon																																					
22	2001/7/10 Tue																																					
23	2001/7/11 Wed																				0.40	0.52		0.40						0.46	0.49				0.45	0.55		
24	2001/7/12 Thu																																					
	2001/7/13 Fri																																					
25	2001/7/14 Sat																																					
26	2001/7/15 Sun																	0.57		0.51						0.50	0.53				0.52	0.55		0.47				
27	2001/7/16 Mon																																					
28	2001/7/17 Tue																																					
29	2001/7/18 Wed														0.51								0.48	0.50				0.45	0.45		0.48				0.54			
30	2001/7/19 Thu																																					
	2001/7/20 Fri																																					
31	2001/7/21 Sat																																					
32	2001/7/22 Sun										0.59								0.60	0.55				0.51	0.57		0.55				0.47							
33	2001/7/23 Mon																																					
34	2001/7/24 Tue																																					
35	2001/7/25 Wed							0.61								0.61	0.44				0.40	0.40		0.45				0.52			0.52				0.44			
36	2001/7/26 Thu																																					
	2001/7/27 Fri																																					
37	2001/7/28 Sat																																					
38	2001/7/29 Sun			0.52								0.57	0.43				0.55	0.45		0.45				0.40			0.42			0.47							
39	2001/7/30 Mon																																					
40	2001/7/31 Tue																																					
41	2001/8/1 Wed								0.62	0.54				0.54	0.54		0.55				0.51			0.45				0.43										
42	2001/8/2 Thu																																					
	2001/8/3 Fri																																					
43	2001/8/4 Sat																																					
44	2001/8/5 Sun				0.59	0.52				0.56	0.47		0.52				0.62			0.46				0.43														
45	2001/8/6 Mon																																					
46	2001/8/7 Tue																																					
47	2001/8/8 Wed	0.54	0.56				0.53	0.45		0.53				0.52																								
48	2001/8/9 Thu																																					
	2001/8/10 Fri																																					
49	2001/8/11 Sat																																					
50	2001/8/12 Sun		0.56	0.57		0.54				0.64																												
51	2001/8/13 Mon																																					
52	2001/8/14 Tue																																					
53	2001/8/15 Wed		0.58				0.56																															
54	2001/8/16 Thu																																					
	2001/8/21 Fri																																					
55	2001/8/23 Sat																																					
56	2001/8/24 Sun		0.53																																			
57	2001/8/25 Mon																																					
62	2001/8/26 Tue																																					

Table 13.1.4 Bulk Density (Domestic Waste)

Waste No.	Date		July-01																											August-01									
			5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10
			Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	2001/7/5	Thu			0.63																																		
	2001/7/6	Fri																																					
2	2001/7/7	Sat																																					
3	2001/7/8	Sun																																					
4	2001/7/9	Mon						0.58			0.50	0.55			0.46		0.46	0.45		0.36			0.44	0.44	0.32	0.38	0.29		0.40	0.33	0.36	0.33	0.32	0.30		0.31	0.32		
5	2001/7/10	Tue																																					
6	2001/7/11	Wed																																					
7	2001/7/12	Thu																																					
	2001/7/13	Fri																																					
8	2001/7/14	Sat	0.66																																				
9	2001/7/15	Sun																																					
10	2001/7/16	Mon																																					
11	2001/7/17	Tue	0.62	0.62			0.61		0.55	0.53		0.49			0.47	0.48	0.46	0.40	0.40		0.40	0.36	0.40	0.31	0.30	0.30		0.32	0.32	0.38	0.38	0.34	0.31		0.32	0.31			
12	2001/7/18	Wed																																					
13	2001/7/19	Thu																																					
	2001/7/20	Fri																																					
14	2001/7/21	Sat																																					
15	2001/7/22	Sun		0.53	0.52		0.49			0.45	0.48	0.45	0.40	0.4		0.40																							
16	2001/7/23	Mon	0.65	0.61		0.46			0.50	0.48	0.45	0.44	0.45		0.44	0.43	0.40	0.40	0.38	0.39																			
17	2001/7/24	Tue	0.60		0.55			0.52	0.53	0.5	0.42	0.46		0.45																									
18	2001/7/25	Wed		0.56			0.63	0.59	0.47	0.45	0.47		0.45							0.38	0.40	0.43	0.40	0.36	0.43		0.41	0.38	0.43	0.43	0.41	0.39				0.33			
19	2001/7/26	Thu	0.53			0.52	0.45	0.49	0.49	0.47		0.46	0.46	0.44	0.41	0.43	0.42																						
	2001/7/27	Fri																																					
20	2001/7/28	Sat		0.64	0.65	0.5	0.44	0.43		0.46																													
21	2001/7/29	Sun	0.59	0.63	0.68	0.54	0.54		0.55																														
22	2001/7/30	Mon	0.65	0.68	0.52	0.52		0.55	0.54	0.54	0.44	0.47	0.45		0.45																							
23	2001/7/31	Tue	0.68	0.58	0.58		0.59																																
24	2001/8/1	Wed	0.6	0.61		0.64								0.40	0.44	0.49	0.43	0.46		0.46	0.45	0.51	0.50	0.45	0.48				0.43	0.40									
25	2001/8/2	Thu	0.56		0.64	0.63	0.63	0.53	0.51	0.50		0.48																											
	2001/8/3	Fri																																					
26	2001/8/4	Sat	0.62																																				
27	2001/8/5	Sun		0.57	0.48	0.47	0.47		0.51																														

Table 13.1.5 Moisture (Market Waste)

Waste No.	Date		June-01															July-01																				
			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
			Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	2001/6/16	Sat									61																											
2	2001/6/17	Sun								70						48							33	34						39							28	
3	2001/6/18	Mon							66																													
4	2001/6/19	Tue						66																														
5	2001/6/20	Wed					67						54							40							32							36				
6	2001/6/21	Thu				70																																
	2001/6/22	Fri																																				
7	2001/6/23	Sat		69																																		
8	2001/6/24	Sun	84						63							40							45							37								36
9	2001/6/25	Mon																																				
10	2001/6/26	Tue																																				
11	2001/6/27	Wed											58							45							45								33			
12	2001/6/28	Thu																																				
	2001/6/29	Fri																																				
13	2001/6/30	Sat	72																																			
14	2001/7/1	Sun							64														47														41	
15	2001/7/2	Mon																																				
16	2001/7/3	Tue																																				
17	2001/7/4	Wed																		52																		
18	2001/7/5	Thu																																				
	2001/7/6	Fri																																				
19	2001/7/7	Sat																																				
20	2001/7/8	Sun																																			26	
21	2001/7/9	Mon																																				
22	2001/7/10	Tue																																				
23	2001/7/11	Wed																									32							20				
24	2001/7/12	Thu																																				
	2001/7/13	Fri																																				
25	2001/7/14	Sat																																				
26	2001/7/15	Sun																												34							30	
27	2001/7/16	Mon																																				
28	2001/7/17	Tue																																				
29	2001/7/18	Wed																									45							22				
30	2001/7/19	Thu																																				
	2001/7/20	Fri																																				
31	2001/7/21	Sat																																				
32	2001/7/22	Sun																					44							34								
33	2001/7/23	Mon																																				
34	2001/7/24	Tue																																				
35	2001/7/25	Wed																		51							38											
36	2001/7/26	Thu																																				
	2001/7/27	Fri																																				
37	2001/7/28	Sat																																				
38	2001/7/29	Sun																					57															
39	2001/7/30	Mon																																				
40	2001/7/31	Tue																																				
41	2001/8/2	Wed																		42																		
42	2001/8/3	Thu																																				
44	2001/8/4	Fri																																				

Table 13.1.6 Moisture (Domestic Waste)

Waste No.	Date		July-01																											August-01									
			5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10
			Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	2001/7/5	Thu			**0.67**																																		
	2001/7/6	Fri																																					
2	2001/7/7	Sat																																					
3	2001/7/8	Sun																																					
4	2001/7/9	Mon						**0.78**							**0.70**							**0.50**					**0.38**		**0.30**							**0.32**			
5	2001/7/10	Tue																																					
6	2001/7/11	Wed																																					
7	2001/7/12	Thu																																					
	2001/7/13	Fri																																					
8	2001/7/14	Sat																																					
9	2001/7/15	Sun																																					
10	2001/7/16	Mon																																					
11	2001/7/17	Tue	**0.82**				**0.75**							**0.57**							**0.42**							**0.37**						**0.23**					
12	2001/7/18	Wed																																					
13	2001/7/19	Thu																																					
	2001/7/20	Fri																																					
14	2001/7/21	Sat																																					
15	2001/7/22	Sun							**0.6**																														
16	2001/7/23	Mon						**0.5**							**0.65**																								
17	2001/7/24	Tue					**0.6**																																
18	2001/7/25	Wed				**0.6**														**0.37**							**0.25**											
19	2001/7/26	Thu			**0.5**							**0.52**																											
	2001/7/27	Fri																																					
20	28/7/2001	Sat	**0.7**																																				
21	29/7/2001	Sun																																					
22	30/7/2001	Mon						**0.54**																															
23	31/7/2001	Tue																																					
24	2001/1/8	Wed											**0.48**							**0.31**																		
25	2001/2/8	Thu			**0.70**																																		
	2001/3/8	Fri																																					
29	2001/4/8	Sat																																					
30	2001/5/8	Sun																																					

Table 13.1.7 Detailed Data of Moisture

Waste	Passing Days	No	Sampling Date	Initial Weight(kg)			Dried Weight(kg)			Moisture (%)	
				Total	Plate	Net	Total	Plate	Net	Original	Average
Market	0	8	2001/6/24	2.10	0.80	1.30	1.00	0.80	0.20	85%	84.5%
				3.40	0.80	2.60	1.23	0.80	0.43	83%	
				3.20	0.80	2.40	1.15	0.80	0.35	85%	
	0	13	2001/6/30	2.6	0.80	1.8	1.26	0.80	0.46	74%	72.4%
				2.65	0.80	1.85	1.32	0.80	0.52	72%	
				2.92	0.80	2.12	1.42	0.80	0.62	71%	
	1	7	2001/6/24	3.00	0.80	2.20	1.49	0.80	0.69	69%	
	3	6	2001/6/24	3.10	0.80	2.30	1.50	0.80	0.70	70%	
	4	5	2001/6/24	3.10	0.80	2.30	1.56	0.80	0.76	67%	
	5	4	2001/6/24	2.40	0.80	1.60	1.35	0.80	0.55	66%	
	6	3	2001/6/24	3.00	0.80	2.20	1.58	0.80	0.78	65%	
	6	8	2001/6/30	2.75	0.80	1.95	1.5	0.80	0.70	64%	62.7%
				2.64	0.80	1.84	1.49	0.80	0.69	63%	
				2.78	0.80	1.98	1.56	0.80	0.76	62%	
	6	14	2001/7/7	2.86	0.80	2.06	1.54	0.80	0.74	64%	
	7	2	2001/6/24	3.10	0.80	2.30	1.50	0.80	0.70	70%	
	8	1	2001/6/24	3.00	0.80	2.20	1.65	0.80	0.85	61%	
	10	5	2001/6/30	2.32	0.80	1.52	1.50	0.80	0.70	54%	
	11	11	2001/7/7	2.87	0.80	2.07	1.67	0.80	0.87	58%	
	13	2	2001/6/30	2.16	0.80	1.36	1.55	0.80	0.75	45%	48.0%
				2.38	0.80	1.58	1.56	0.80	0.76	52%	
				2.05	0.80	1.25	1.46	0.80	0.66	47%	
	13	8	2001/7/7	2.90	0.80	2.1	2.09	0.80	1.29	39%	40.3%
				2.60	0.80	1.8	1.86	0.80	1.06	41%	
				2.50	0.80	1.7	1.8	0.80	1.00	41%	
	17	5	2001/7/7	3.06	0.80	2.26	2.15	0.80	1.35	40%	
	17	11	2001/7/14	2.50	0.80	1.7	1.74	0.80	0.94	45%	
	17	14	2001/7/21	2.16	0.80	1.36	1.45	0.80	0.65	52%	
	20	2	2001/7/7	2.00	0.80	1.2	1.6	0.80	0.80	33%	
	20	8	2001/7/14	2.20	0.80	1.4	1.61	0.80	0.81	42%	44.5%
				2.40	0.80	1.6	1.69	0.80	0.89	44%	
				2.50	0.80	1.7	1.70	0.80	0.90	47%	
	20	14	2001/7/21	2.30	0.80	1.5	1.60	0.80	0.80	47%	
	24	5	2001/7/14	1.91	0.80	1.11	1.55	0.80	0.75	32%	
	24	11	2001/7/21	2.25	0.80	1.45	1.60	0.80	0.80	45%	
	27	2	2001/7/14	2.00	0.80	1.2	1.53	0.80	0.73	39%	
	27	8	2001/7/21	2.00	0.80	1.2	1.56	0.80	0.76	37%	
	31	5	2001/7/21	1.75	0.80	0.95	1.41	0.80	0.61	36%	
	31	11	2001/7/28	2.20	0.80	1.4	1.74	0.80	0.94	33%	
	33	2	2001/7/21	2.05	0.80	1.25	1.70	0.80	0.90	28%	
	35	8	2001/7/28	2.10	0.80	1.3	1.63	0.80	0.83	36%	
	36	8	2001/7/30	1.71	0.80	0.91	1.47	0.80	0.67	26%	29.0%
				2.35	0.80	1.55	1.80	0.80	1.00	35%	
				2.00	0.80	1.2	1.70	0.80	0.90	25%	
Domestic	0	8	2001/7/14	2.95	0.80	2.15	1.20	0.80	0.40	81%	82.2%
				3.20	0.80	2.4	1.21	0.80	0.41	83%	
				3.40	0.80	2.6	1.26	0.80	0.46	82%	
	0	20	2001/7/28	3.55	0.80	2.75	1.59	0.80	0.79	71%	
	2	19	2001/7/28	2.60	0.80	1.8	1.71	0.80	0.91	49%	
	3	18	2001/7/28	3.10	0.80	2.3	1.66	0.80	0.86	63%	
	4	11	2001/7/21	2.28	0.80	1.48	1.10	0.80	0.30	80%	75.2%
				2.50	0.80	1.7	1.30	0.80	0.50	71%	
	4	17	2001/7/28	3.00	0.80	2.2	1.72	0.80	0.92	58%	
	5	16	2001/7/28	2.60	0.80	1.8	1.75	0.80	0.95	47%	
	6	15	2001/7/28	2.80	0.80	2	1.65	0.80	0.85	58%	
	8	4	2001/7/14	2.80	0.80	2	1.25	0.80	0.45	78%	
	11	11	2001/7/28	2.30	0.80	1.5	1.45	0.80	0.65	57%	
	12	4	2001/7/21	2.00	0.80	1.2	1.16	0.80	0.36	70%	70.5%
				2.35	0.80	1.55	1.25	0.80	0.45	71%	
	19	4	2001/7/28	2.20	0.80	1.4	1.50	0.80	0.70	50%	

13.2 COMPOST PRODUCTION RECORD OF DAMASCUS COMPOST PLANT

The compost production records are shown in Table 13.2.1 and 13.2.2.

Table 13.2.1 Compost Production Record of Damascus Compost Plant (1)

Year	Month	Fine Compost m3	Value SP	Second Compost m3	Value SP	Mix Compost m3	Value SP	Coarse Compost m3	Value SP	Per Month Total SP	Per Year Total of Sales SP	Per Year Total Sales m3
1991	Oct.	39	11,700	1,455	291,000					302,700		
	Nov.	282	84,600	6,453	1,290,600					1,375,200		
	Dec.	995	298,500	54	10,800					309,300		
	Total	**1,316**	**394,800**	**7,962**	**1,592,400**					**1,987,200**	**1,987,200**	**9,278**
1992	Jan.	651	195,300	3,288	657,600					852,900		
	Feb.	576	172,800	978	195,600					368,400		
	March	363	108,900	732	146,400	895	210,325	5,454	681,750	1,147,375		
	April					390	91,650	6,546	818,250	909,900		
	May					894	210,090	4,206	525,750	735,840		
	June					336	87,960	735	91,875	170,835		
	July					663	155,805	57	7,125	162,930		
	Aug.					231	54,285	378	47,250	101,535		
	Sep.					354	83,190	405	50,625	133,815		
	Oct.					1,398	328,530	1,764	220,500	549,030		
	Nov.					1,710	401,850	2,493	311,625	713,475		
	Dec.					603	141,705	651	81,375	223,080		
	Total	**1,590**	**477,000**	**4,998**	**999,600**	**7,474**	**1,765,390**	**22,689**	**2,836,125**	**4,847,815**	**6,069,115**	**36,751**
1993	Jan.					672	157,920	564	70,500	228,420		
	Feb.					912	214,320	1,686	210,750	425,070		
	March					1,452	341,220	3,510	438,750	779,970		
	April					1,134	266,490	4,326	540,750	807,240		
	May					45	10,575	2,379	297,375	307,950		
	June					766	180,010	1,068	133,500	313,510		
	July					474	111,390	1,059	132,375	243,765		
	Aug.					504	118,440	948	118,500	236,940		
	Sep.					980	230,300	1,083	135,375	365,675		
	Oct.					1,269	298,215	3,498	437,250	735,465		
	Nov.					2,475	581,625	4,194	524,250	1,105,875		
	Dec.					2,962	696,070	4,206	525,750	1,221,820		
	Total					**13,645**	**3,206,575**	**28,521**	**3,565,125**	**6,771,700**	**6,771,700**	**42,272**
1994	Jan.					1,251	293,985	2,520	315,000	608,985		
	Feb.					1,203	282,705	3,708	463,500	746,205		
	March					2,649	622,515	11,577	1,447,125	2,069,640		
	April					1,662	390,570	8,187	1,023,375	1,413,945		
	May					822	193,170	1,708	213,500	406,670		
	June					927	217,845	966	120,750	338,595		
	July					786	184,710	396	49,500	234,210		
	Aug.					792	186,120	807	100,875	286,995		
	Sep.					936	219,960	2,382	297,750	517,710		
	Oct.	12	3,600			1,980	465,300	5,175	646,875	1,115,775		
	Nov.	9	2,700			2,544	597,840	3,699	462,375	1,062,915		
	Dec.					1,302	305,970	1,764	220,500	526,470		
	Total	**21**	**6,300**			**16,854**	**3,960,690**	**42,889**	**5,361,125**	**9,328,115**	**9,328,115**	**59,746**
1995	Jan.	12	3,600			1,536	360,960	3,045	380,625	745,185		
	Feb.					993	233,760	2,739	345,000	578,760		
	March	21	7,350	66	16,500	618	165,615	5,685	905,715	1,095,180		
	April					660	184,800	3,831	612,225	797,025		
	May	30	10,500			273	76,440	1,035	165,600	252,540		
	June					177	49,560	1,167	186,720	236,280		
	July					392	109,600	600	96,000	205,900		
	Aug.	99	34,650			429	120,120	591	94,560	249,330		
	Sep.					558	156,240	516	82,560	238,800		
	Oct.					1,600	448,000	1,464	234,240	682,240		
	Nov.					1,821	509,880	3,711	593,760	1,103,640		
	Dec.					1,791	501,480	2,403	384,480	885,960		
	Total	**162**	**56,100**	**66**	**16,500**	**10,848**	**2,916,455**	**26,787**	**4,081,485**	**7,070,840**	**7,070,840**	**37,863**
1996	Jan.					678	189,840	366	58,560	248,400		
	Feb.					840	225,120	1,266	202,560	427,680		
	March					1,326	371,280	4,591	734,560	1,105,840		
	April					1,112	311,360	2,438	390,080	701,440		
	May					679	190,120	936	149,760	339,880		
	June					423	118,440	909	145,440	263,880		
	July					633	177,240	246	39,360	216,600		
	Aug.					322	90,160	191	30,560	120,720		
	Sep.					331	92,680	210	33,600	126,280		
	Oct.					515	144,200	721	115,360	259,560		
	Nov.					726	203,280	785	125,600	328,880		
	Dec.					540	151,200	354	56,640	207,840		
	Total					**8,125**	**2,264,920**	**13,013**	**2,082,080**	**4,347,000**	**4,347,000**	**20,871**

Table 13.2.2 Compost Production Record of Damascus Compost Plant (2)

Year	Month	Fine Compost m3	Value SP	Second Compost m3	Value SP	Mix Compost m3	Value SP	Coarse Compost m3	Value SP	Per Month Total SP	Per Year Total of Sales SP	Per Year Total Sales m3
1997	Jan.					281	78,680	539	86,240	164,920		
	Feb.					586	164,080	816	130,560	294,640		
	March					969	253,725	2,646	405,920	659,645		
	April					1,527	358,845	3,036	425,040	783,885		
	May					1,405	330,175	1,308	183,120	513,295		
	June					1,226	288,110	631	88,340	376,450		
	July					488	114,680	234	32,760	147,440		
	Aug.					433	101,755	8	1,120	102,885		
	Sep.					236	55,460	581	81,340	136,800		
	Oct.					667	156,745	320	44,800	201,545		
	Nov.					941	221,135	191	26,740	247,875		
	Dec.					605	142,175	345	48,300	190,475		
	Total					**9,364**	**2,265,565**	**10,655**	**1,554,280**	**3,819,855**	**3,819,855**	**20,019**
1998	Jan.					473	111,155	815	114,100	225,255		
	Feb.					836	196,460	627	87,780	284,240		
	March					2,117	497,495	2,250	315,000	812,495		
	April					1,986	466,710	2,020	282,800	749,510		
	May					2,152	505,720	1,113	155,820	661,540		
	June					843	198,105	381	53,340	251,445		
	July					688	161,680	246	34,440	196,120		
	Aug.					1,093	256,855	87	12,180	269,035		
	Sep.					1,885	438,900	156	21,840	460,740		
	Oct.					1,478	347,330	477	66,780	414,110		
	Nov.					3,111	731,085	408	57,120	788,205		
	Dec.	30	9,000			1,416	332,760	248	34,720	376,480		
	Total	**30**	**9,000**			**18,078**	**4,244,255**	**8,828**	**1,235,920**	**5,489,175**	**5,489,175**	**26,906**
1999	Jan.					783	184,005	330	46,200	230,205		
	Feb.					1,041	244,635	510	71,400	316,035		
	March					1,983	466,005	968	135,520	601,525		
	April					1,731	406,785	1,794	251,160	657,945		
	May					1,398	328,530	1,089	152,460	480,990		
	June					1,091	256,385	297	41,580	297,965		
	July					525	123,375	54	7,560	130,935		
	Aug.					454	106,690	15	2,100	108,790		
	Sep.					555	128,425	213	29,820	158,245		
	Oct.					1,132.50	266,138	249	34,860	300,998		
	Nov.					2,374	557,890	354	49,560	607,450		
	Dec.					689	149,135	249	31,980	181,115		
	Total					**13,757**	**3,217,998**	**6,122**	**854,200**	**4,072,198**	**4,072,198**	**19,878**
2000	Jan.					422	73,850	747	74,700	148,550		
	Feb.					1,395	244,125	906	90,600	334,725		
	March					3,651	638,925	1,998	199,800	838,725		
	April					4,972	870,100	402	40,200	910,300		
	May					4,722	826,350	18	1,800	828,150		
	June					2,074	362,950			362,950		
	July					960	168,000	18	1,800	169,800		
	Aug.					426	74,550			74,550		
	Sep.					852	149,100			149,100		
	Oct.					1,106	193,550	Stamps		193,550		
	Nov.					3,056	534,800	1,089		535,889		
	Dec.					1,003	175,525	586		176,111		
	Total					**24,639**	**4,311,825**	**5,764**	**408,900**	**4,722,400**	**4,723,975**	**28,728**
2001	Jan.					2,056	359,800	1,187		360,987		
	Feb.					1,531	267,925	879		268,804		
	March					3,610	631,750	2,086		633,836		
	April					2,919	510,825	1,722		512,547		
	May					2,961	518,175	1,746		519,921		
	Total					**13,077**	**2,288,475**	**7,620**	**0**	**2,296,095**	-	-
Ground Total											**53,679,173**	**302,312**

Unit price **177.6 SP/m3**
355.1 SP/ton
(Bulk density 0.5 ton/m3)

13.3 SYRIAN STANDARD FOR COMPOST

1998 2014	**Subject :** **Organic Mixture** **(Produced) Made** **of Solid Waste Resulted** **from The Cities**	**Syrian Arab Republic** **Ministry of Industry** **Syrian Arab Organization for** **Standardization and Metrology**
ICS 13.030.10		
S.N.S: 2014 .1998		
Municipal Solid Waste Composting		

1. The Range

This standard specification determines the requirements that should be found in the fermented organic mixture that made from organic solid waste obtained from city waste, as an improver for the soil and it includes three kinds of products which is : product of green vegetable, product of mixed solid waste and product of residues of sewer.

2. Definitions

2.1 The product

The subject that produced from the dissolution of organic materials partially by the help of some microscopic creatures with the existence of heat and air, it is controlled carefully and also it includes the product of non-air fermentation. The product should be exposed during the dissolution process to a temperature not less than 55C and for one week.

2.2 Agents Cause Toxicity

Agents cause the destruction of growing plants or frustration of seeds germination because of its toxicity.

2.3 Primary Material

The raw material that used in producing the production.

2.4 Damaging Level

It is the level of any material in nature which causes the destruction of environment or causes a health diseases.

Number of Approval Decision 244	Approval Date 31 . 8 . 1998	Non - Application Obligation

Syrian Arab Organization for Standardization and metrology

3. Classification

This product is classified according to its primary material to these types:

3.1 Product of Green Waste

It is the product that its raw material is almost formed out of organic materials that capable for biological dissolution like scraps of gardens, green waste of gardens, fruits, restaurants and manufacturing food center.

3.2 Product of Mixed Solid Waste

It is the product that its raw material is formed out of known city waste which is normally a mixture of an organic materials that dissolute and others like iron, glass, and plastic materials.

3.3 Product of Residues of Sewer

It is the product that its raw material is formed out of a fine dough that collected from sewer treatment places which came from the residential districts.

4. Requirements and Fineness Ranks

Three of the mentioned requirements should be available in the product, also fineness ranks should be granted according to this:

4.1 The green product

4.1.1 The green product could be spread on all the agricultural lands without any limit and 1st rank is granted to the product which fulfilled these requirements.

4.1.1.1 The radioactive power average that diffuses from the product should not exceed the maximum limit that allowed internationally.

4.1.1.2 The product should be streamlined and its color should be brown and also at least a 95% of this product should pass through a screen, the screen hole diameter should be 12 mm.

4.1.1.3 It has no hateful smell.

4.1.1.4 There should not be an agents for poisoning the plants.

4.1.1.5 Must not contain grass seeds or plant parts that might grow.

4.1.1.6 The content of organic material should not be less than 35 % of its mass and carbon. Azote should not be more than 25:1.

4.1.1.7 Its hydrogen number should not be less than 5.0 and more than 8.0.

4.1.1.8 The announcement about the contents of food elements in the product is not obligatory but in the case of announcement, the figure it is forming should be mentioned (Organic or Mineral), also this announced content will surely be analyzed periodically.

4.1.1.9 The moisture in this product should not be more than (35%) in the mass.

4.1.1.10 Polluted heavy elements should not be more than the levels that are shown in table No. (1).

4.1.1.11 The electric connection of the saturated pasta from the product should not be more than (1) (m Simm. C.m) (d Simm . m).

Table No. (1)
The Maximum Limits for the Heavy Elements
That Polluting the Product of Degree (1) and Degree (2)

Element	The Maximum Limit (part of million)		Element	The Maximum Limit (part of million)	
	Degree (1)	Degree (2)		Degree (1)	Degree (2)
Arsenic	15	25	Lead	120	150
Cadmium	3	5	Mercury	1.5	3
Chrome	100	150	Nickel	50	70
Copper	150	250	Zinc	350	500

4.1.2 Green waste product which does not fulfill the requirements of Degree (1) will be classified on Degree (2) but with these conditions:

4.1.2.1 It should fulfill the articles 4.1.1.1 (radioactive power) and 4.1.1.4 (toxicity).

4.1.2.2 It should fulfill the maximum limit of the polluted heavy elements and which are mentioned in table No. (1)

4.1.3 If any heavy element in the content of the product increase above the maximum limit of the product of degree (2) and similar to the requirements of the other degree (2) will be classified on the degree (3), so we can use it only on agricultural lands just in the case of detailed observation to the capability of elements accumulation to a very harming level.

4.2 The Product of Mixed Solid Waste

4.2.1 The product of mixed solid waste could be spread on all the agricultural lands without limit and the rank No. (1) is granted to the product that fulfill these requirements:

4.2.1.1 All the requirements that are mentioned to the green waste product in the articles (4.1.1.1 to 4.1.1.10).

4.2.1.2 Besides, the content of the product of mineral pieces and glass (dull materials) should not increase more than 1% of the mass.

4.2.2 The product which does not fulfill the requirements of degree (1) will be classified in degree (2) but with a condition : to fulfill the requirements which has been mentioned in the articles (4.1.2.1 & 4.1.2.2).

4.2.3 The content of the product which increases more than of any of the heavy elements maximum limits which are shown in the degree (2) and similar to the requirements of degree (2) will be classified in the degree (3), so it can be used on plants just as it is explained in the article (5.1.3).

Note: The limit showed in the table does not apply to the sewer product.

4.3 Sewer Residues Product

4.3.1 It is not allowed to spread the product of sewer residues on the agricultural plants which we are eating usually without cocking (like the green salad components), the product of degree (1) should fulfill these requirements:

4.3.1.1 The requirements which has been mentioned for the green waste product in the articles (4.1.1.1 to 4.1.1.9).

4.3.1.2 Besides , it should contain less than (1,000) cells of Koliform Bacteria or (3) cells of Salemonia Bacteria for each Gram of dry material.

4.3.1.3 The content of the product of heavy polluting elements should not increase because of the lack of basic amounts that specified in the table No. (2) for each element. There must be a maximum limit for the produced amount (Ton of dry material) that could be added to one Hectare in the lands during a period of (10 years). The way that calculates this amount is explained in the article (4.3.1.4).

Table No. (2)
The Basic Amounts (Part of Million) for the Polluted Heavy Elements In The Product of Sewer Residues

Element	Basic Amount	Element	Basic Amount
Cadmium	20	Lead	800
Chrome	1,000	Cilinium	100
Copper	1,000	Zinc	3,000
Mercury	10	Chrome + Copper + Nickel +Zinc	400
Nickel	200		

4.3.1.4 To calculate the maximum amount of the product of sewer residues that can be added to agricultural lands, this way is done:

4.3.1.4.1 The percent for each experienced heavy element is calculated as following:

$$\text{Percents (K)} = \frac{\text{The basic amount (Table No. 2)}}{\text{The experimental amount}}$$

4.3.1.4.2 If the amount of (K) less than (0.5), that means that the product is under experiment and not identical to the range of this specification (out the limits of measurements) and the content of heavy elements in it (The experimental amount) more than the double of basic amount (Table No. 2)

4.3.1.4.3 If the amount of (K) less than (0.5), so the maximum amount of the product that can be added to lands is should be calculated like this:
30 X (K) ton . hectare of dry material during (10) years.

4.3.1.4.4 It is not allowed to add the sewer residues product in which any of the heavy elements or more might be more than the amounts that shown in the table No. (3) to the lands.

Table No. (3)
The Amount of Heavy Elements in Lands (One Part of Million)
In Which No Sewer Residues Product is Allowed to be Added

Element	Its Amount in Soil	Element	Its Amount in Soil
Nickel	50	Cadmium	2
Lead	100	Chromium	150
Selenium	10	Copper	100
Zinc	300	Mercury	1

4.3.2 Sewer residues which does not fulfill the degree (1) requirements including the content of heavy elements and microbes that cause diseases, it should classified by the phrase “out the limits of measurements” and this degree of the product is not allowed at anyway to be added to the agricultural lands including pastures and parks that used for entertainment purposes.

APPENDIX 14

QUESTIONNAIRE SHEET FOR MEDICAL WASTE MANAGEMENT

APPENDIX 14 QUESTIONNAIRE SHEET FOR MEDICAL WASTE MANAGEMENT

Describe the following questions relating to the medical waste.

A. General Information

1. Name of hospital: _____
_____
_____

2. Address: _____

3. Type of hospital (tick one):
   - ☐ National hospital
   - ☐ Private hospital
   - ☐ Health center
   - ☐ Clinic (Describe specialty)
   - ☐ Others (Describe details:)
   - ☐

4. Number of inpatient per day: _____ / day

5. Number of outpatient per day: _____ / day

6. Number of beds (total): _____ / day
   Including: _____ / _____ ward
   (no.) (type of ward)
   _____ / _____ ward
   (no.) (type of ward)
   _____ / _____ ward
   (no.) (type of ward)
   _____ / _____ ward
   (no.) (type of ward)

B. Type of solid waste generated and estimated quantity

Consult classification, mark X where waste is generated and fill the estimated quantity.

Sources	Waste Category								
	General	Pathological	Radioactive	Chemical	Infectious	Sharps	Pharmaceutical	Pressurized Containers	Estimated Quantity (kg/day)
Patient Services									
Medical									
Surgical									
Operating Theatre									
Recovery / Intensive Care									
Isolation Ward									
Dialysis Unit									
Oncology Unit									
Emergency									
Outpatient clinic									
Autopsy room									
Radiology									
Laboratories									
Biochemistry									
Microbiology									
Haematology									
Research									
Pathology									
Nuclear Medicine									
Support Services									
Blood Bank									
Pharmacy									
Central Sterile Supply									
Laundry									
Kitchen									
Engineering									
Administration									
Public Areas									
Long-term Health Care									

C. Waste Segregation, Collection, Storage and Handling

Describe briefly what happens between segregation (If any) and final disposal of:

Sharps: _____

_____

_____

Pathological Waste: _____

_____

_____

Infectious Waste: _____

_____

_____

Radioactive Waste: _____

_____

_____

Chemical Waste: _____

_____

_____

Pharmaceutical Waste: _____

_____

_____

Pressurized Containers: _____

_____

_____

D. Waste Segregation, Collection, Labeling, Transport and Disposal

Handling of Segregate Waste	Sharps	Pathological Waste	Infectious Waste	Radioactive Waste	Chemical Waste	Pharmaceutical Waste	Pressurized Containers
Indicate by X the type of waste (if any) that is segregated from general waste stream.							
Where is the segregation taking place (i.e. operating room, laboratory, etc.)?							
What type of containers bags (primary containment vessels) are used to segregate waste (bags, cardboard boxes, plastic containers, metal containers, etc.)? Describe accurately.							
What type of labeling, color-coding (if any) is used for marking segregated waste? Describe.							
1. Who handles (removes) the segregated waste (designation of the hospital staff member)? 2. Is the waste handler using any protective clothing (gloves, etc.) during waste handling? Yes / No.							
What type of containers (plastic bins, bags, cardboard boxes, trolleys, wheelbarrows, etc.) are used for collection and internal transport of the waste? Describe.							
Where is the segregated waste stored while awaiting removal from the hospital or disposal? Describe.							
Describe briefly the final disposal of segregated waste (taken to municipal landfill, buried on hospital grounds, incinerated, open burned, etc.).							

E. Personnel involved in the management of hospital solid waste

1. The management of hospital solid waste

(a) Designation of person(s) responsible for organization and management of waste collection, handling, storage and disposal at the hospital administration level.

_____

_____

(b) General qualification and level of education of designated person.

_____

_____

(c) Has he / she received any training on hospital waste management? ☐Yes ☐No

If yes, what type of training and of what duration?

_____

_____

2. Indicate the number of persons involved in the collection, handling, and storage of hospital waste, their designation, their training in solid waste handling and management, and the number of years of experience of this type of work.

Number	Designation	Training	Experience

3. Do the waste management staffs have job descriptions detailing their tasks? ☐Yes ☐No

4. Are instructions / training given to newly hired waste management staff? ☐Yes ☐No

F. Hospital Waste Management Policy

1. Are you aware of any legislation application to hospital waste management? Yes ☐No

_____

_____

2. Are you aware of a document outlining the hospital waste management policy? Yes ☐No
   If yes, give title of document (and attach a copy if possible):

_____

3. Is there a manual or guideline document on management of hospital wastes available:
   (a) In the Ministry of Health? ☐Yes ☐No
   If yes, give title of document:

_____

   (b) In your hospital? ☐Yes ☐No
   If yes, give title of document:

_____

4. Waste Management of Hospital
   (a) Does your hospital have a Waste Management Plan? ☐Yes ☐No
   If yes, please attach a copy.

   (b) Does your hospital have a Waste Management Team (or Teams)? ☐Yes ☐No
   If yes, please list the members by designation:

	Designation	No.
Team Leader:	_____	_____
Team Members:	_____	_____
Waste Handling Staff:	_____	_____

5. Are there clearly defined procedures for collection and handling of wastes from specified units in the hospital? ☐Yes ☐No

6. Are there waste management responsibilities included in the job descriptions of hospital supervisory staff (Head of Hospital, Department Heads, Matron / Senior Nursing Officer, Hospital Engineer, Infection Control Officer, Pharmacist, Laboratory Supervisor, etc.)? ☐Yes ☐No
   If yes, provide sample copies.

7. How are the present waste collection, handling, and disposal responsibilities defined in the job descriptions of the staff involved? (Cite appropriate statement or provide copies.)

APPENDIX 15

QUESTIONNAIRE SHEET FOR INDUSTRIAL WASTE MANAGEMENT

APPENDIX 15 QUESTIONNAIRE SHEET FOR INDUSTRIAL WASTE MANAGEMENT

Questionnaire for Industrial Enterprises

The following questions should be answered. All the questions should be answered as much as possible.
Borrow reference materials for photocopy.

1. Profile

1) Name of factory:
2) Ownership of the factory (private / state-owned):
3) Type of product:
4) Number of worker:
5) Annual sales:
6) Major manufacturing process

(Please describe a major manufacturing process. Foe example, electroplating, surface treatment, material synthesizing, electric furnace, assembly of machines, production of paper, metal work, canning, waste water treatment equipment, emission gas treatment equipment)

2. Type of waste generated at the factory

1) Solid waste generated from manufacturing process:

a. Metal sludge: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

b. Organic sludge: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

c. Non-organic sludge: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

d. Mud: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

e. Soot and dust: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

f. Slag: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

g. Plastics: Yes:_____ton/year / No
- method of treatment, if yes
- Is this waste recycled?
  Yes/No

To Interviewer

a. Ask for reasons of no comment but avoid being pressive
b. Obtain printed data
c. Ask for description of the recycling system
d. Check if the factory does the following activities
   - Hauling solid waste to local government's disposal
   Yes / No

   - Treating solid waste at factory's site
   Yes / No

   - Hauling solid waste to privately operated disposal
   Yes / No

   - Incinerating solid waste
   Yes / No

   - Other measures

2) Liquid waste generated from manufacturing process

a. Acid liquid waste: Yes:_____ton/year / No
- method of treatment, if yes
- Lists name of chemicals contained

b. Alkali liquid waste: Yes:_____ton/year / No
- method of treatment, if yes
- Lists name of chemicals contained

c. Waste solvent: Yes:_____ton/year / No
- Method of treatment, if yes
- Lists name of chemicals contained

- Hydrogen chloride waste: Yes:_____ton/year / No
  - Method of treatment, if yes
  - Lists name of chemicals contained

- Other waste: Yes:_____ton/year / No
  - Method of treatment, if yes
  - Lists name of chemicals contained

d. Lubricating oil: Yes:_____ton/year / No
- Method of treatment, if yes
- Lists name of chemicals contained

e. Other waste oil: Yes:_____ton/year / No
- Method of treatment, if yes
- Lists name of chemicals contained

f. Organic waste oil: Yes:_____ton/year / No
- Method of treatment, if yes
- Lists name of chemicals contained

g. Dry waste: Yes:_____ton/year / No
- Method of treatment, if yes
- Lists name of chemicals contained

To Interviewer

a. Ask for reasons of no comment but avoid being pressive
b. Obtain printed data
c. Obtain the names of chemicals contained in the waste
d. Check if the factory does the following activities
    - Discharging to the river without any treatment: Yes / No
    - Discharging to the river after neutralizing the liquid waste: Yes / No
    - Discharging to the river after separating oil and water: Yes / No
    - Incinerating liquid waste: Yes / No
    - Use by private contractor for treatment: Yes / No

3. Institutional arrangements for waste treatment

1) House command (company's instruction) concerning waste treatment

a. Do president and other managers give special commands and tasks for waste management?

Yes / No

b. Describe commands and tasks

c. Are there any written rules concerning tasks of waste management?

Yes / No

d. If yes, describe the contents of rules

2) Section responsible for waste treatment

a. Is there any section designed for management of waste treatment?

Yes / No

b. Describe the section responsibility

c. Is there any section designed for operation of treatment?

Yes / No

d. Is an engineer assigned to work for the section?

Yes / No

If yes, how many engineers are assigned?

3) Description of management

a. Are there any norms of factory's own waste treatment?

Yes / No

b. Describe the norms.

c. Is data of the amount of the waste treated recovered?

Yes / No

d. Has the factory ever analyzed the waste quality?

Yes / No

e. Does the factory give the private waste treatment company information on the waste composition and instruction concerning treatment process?

Yes / No

f. Do you know where the factory waste is treated outside?

Yes / No

3) Ask the following questions if the factory conduct waste treatment with its own facility.

a. In what year did the facility begin its operation?

b. Is the equipment of the facility imported or made in Syria?

Yes / No

c. Does the facility perform as designed?

Yes / No

4) Training for industrial waste management

a. Are there any workers who received training for industrial waste management?

Yes / No

If yes, how many workers have received the training?

b. Are there any workers who received training for treatment technology?

Yes / No

If yes, how many workers have received the training?

6) Are you informed of the following topics?

a. Obligatory environmental auditing by ISO 14000

Yes / No

b. Regulation by Basel convention for import and export of hazardous waste

Yes / No

c. Do you know the term “Ecotechnology”?

Yes / No

7) List any efforts made by the factory for waste management.

8) List problems that the factory is facing concerning waste management.

9) Provide interviews’ comments.