
PART IV

PILOT STUDY IN LATTAKIA

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CHAPTER 1 INTRODUCTION

1.1 PURPOSE OF THE PILOT STUDY

A pilot study has been carried out in the Second Work Period in Syria (between May to August 2001) with the close cooperation between JICA Study Team and Syrian Counterpart Team.

The pilot study is a small project aimed at improving sanitary conditions and the efficiency of solid waste management. It is intended to be a technical transfer through actual management of a small-scale project.

The pilot study has been implemented taking into account the following conditions.

- The pilot study can be implemented during the Second Work Period in Syria (approx. 3month)
- Although small, the pilot study will be effective for the improvement of sanitary conditions and efficiency of solid waste management
- The pilot study will be continued by the Syrian side after the Second Project in Syria
- The pilot study will be in line with the direction of the Master Plan
- Technical transfer through the pilot study activities

1.2 CONTENTS OF THE PILOT STUDY

The following three pilot studies have been carried out:

- Production of Better Quality Compost
- Public Awareness Campaign on Environment
- Rehabilitation and Operation Improvement of Al-Bassa Disposal Site

Contents of each pilot study are summarized in Table 1.2.1.

Table 1.2.1 Contents of the Pilot Study

No	Pilot Study	Contents
1	Production of Better Quality Compost	<ul style="list-style-type: none"> • Collection of compost convertible waste (market waste and source separated organic waste) • Manual production of compost • Analysis of received waste and compost product • Consumer's opinion survey
2	Public Awareness Campaign on Environment	<ul style="list-style-type: none"> • Source separation campaign • Demonstration campaign at sport city • TV campaign
3	Rehabilitation and Operation Improvement of Al-Bassa disposal site	<ul style="list-style-type: none"> • Installation of control facilities • Rehabilitation of Al-Bassa disposal site • Landfill operation improvement

CHAPTER 2 PRODUCTION OF BETTER QUALITY COMPOST

2.1 OBJECTIVE

The pilot study was planned in order to; (1)st examine the production feasibility of good quality compost made from two waste generation sources; food markets and source separated domestic waste (organic), (2)nd introduce continuous production of a better quality compost and (3)rd expand the market demand of compost by providing good quality compost.

In the case of domestic waste residents are expected to separate discharge waste into organic and non-organic substances.

The compost produced by the pilot study will be analyzed in terms of particle size, organic material composition, C/N ratio, pH, electrical conductivity, moisture, chemical components including heavy metal, and then distributed to farmers with the main analysis date for trial application to their farmlands.

2.2 GENERAL DESCRIPTION

(1) Study Location and Period

- Location: Premises in the existing compost plant
- Period: 16th June to end of August 2001 (Supervised by JICA study team)
After to be done by Syrian side only

(2) Sources of Waste to be treated

- Market Waste: Aphamia Souq
- Domestic Waste: Al Soleiba with 200 house holds

(3) Treatment Capacity

- Approximately 1 ton/day

(4) Layout

Layout of pilot study is shown in Figure 2.2.1.

2.3 DETAILED PRODUCTION METHOD

The detailed method is as follows and shown in Figure 2.2.2.

(1) Receiving of Waste

Approximately 1 ton of waste will be received daily and measured by truck-scale.

(2) Hand Sorting

The following process has been done by hand as pre-treatment.

- Breaking of plastic bags.
- Separating of non-compost material such as plastics, glass, and metals.
- Weighing of separated non-compostable material.

(3) Crushing

Organic waste has been crushed to less than 50 mm by the temporary shredder.

(4) Fermentation

The shredded waste has been piled in the fermentation yard and has been turned over daily for 2 weeks by wheel loader.

One (1) pile volume was approximately 6 m³ (=2 m³/day x 3 days).

During fermentation, temperature, moisture content and bulk density has been measured with controlling moisture content if necessary.

(5) Maturing

After 2 weeks of fermentation, the waste has been conveyed to the maturing yard. During the maturing period of 3 weeks the waste has been turned over twice a week.

The temperature, moisture content and bulk density have been measured with controlling moisture content.

(6) Screening

The matured compost is sieved by vibrating screens with 16 mm holes and temporary hand screens with 10 mm mesh.

2.4 IMPLEMENTATION OF STUDY

(1) Test Equipment

All equipment used for the pilot study are listed in Table 2.4.1.

Table 2.1.1 Equipment List of Compost Pilot Study

No.	Name of Equipment	Specification	Q'ty	Country origin
1	Crusher	2 shaft type, 5.5 HP	1	Syria
2	Plastic bucket	Plastics, 120 liters	5	Syria
3	Weighing scale	Mechanical balance type, 0.1-200kg	1	Syria
4	Vibrating screen	16 mm holes	1	Existing
5	Hand screen	500 x 1000mm, 2 #(mesh)	1	Syria
6	Spray nozzle and hose	Multi spraying type, 1/2' x 50m	1	Japan, Syria
7	Moisture meter	Infrared light type, 0.2%	1	Japan
8	Thermometer	Digital type, 0-150 °C	1	Japan

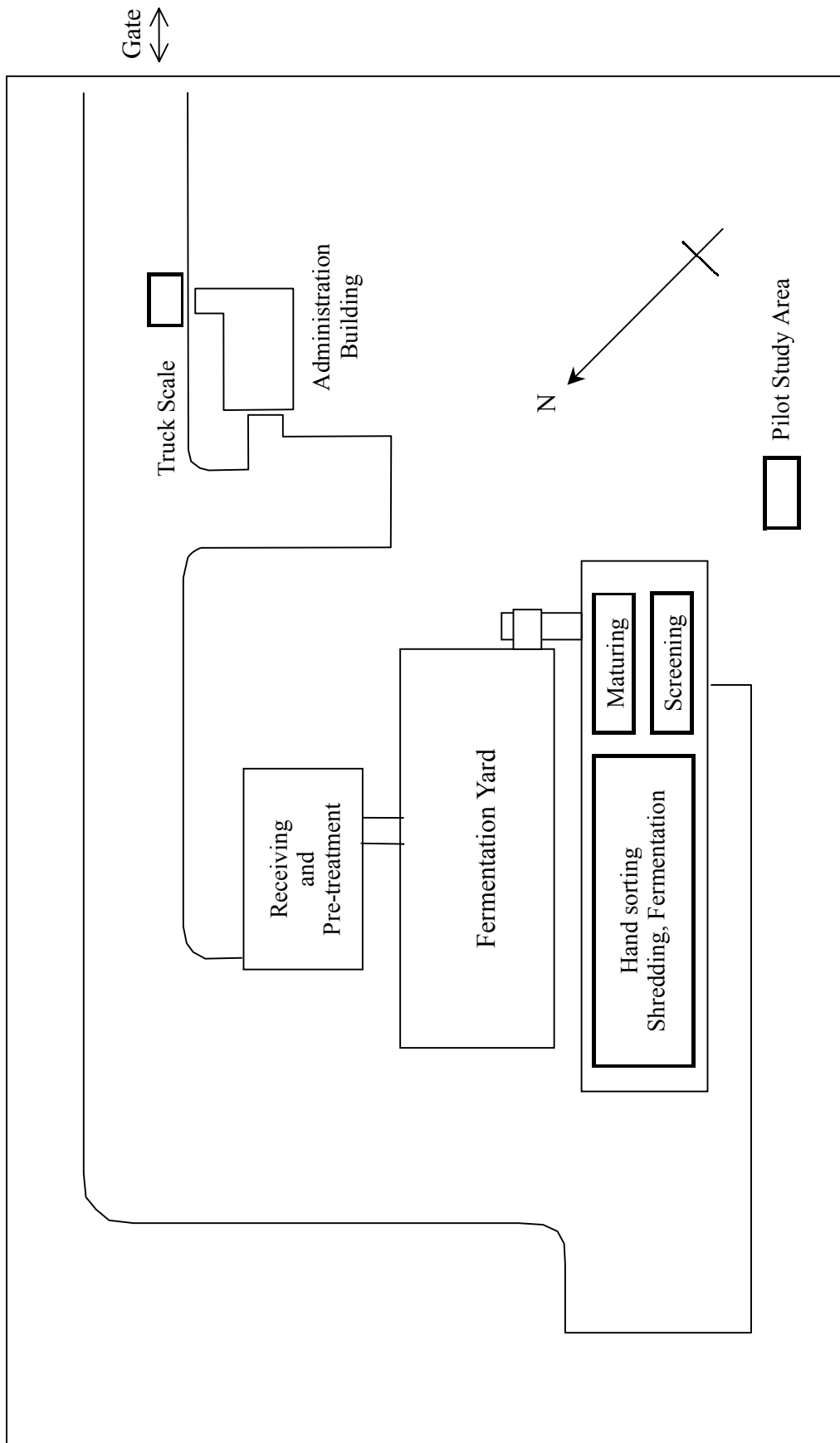


Figure 2.2.1 Layout of Compost Pilot Study

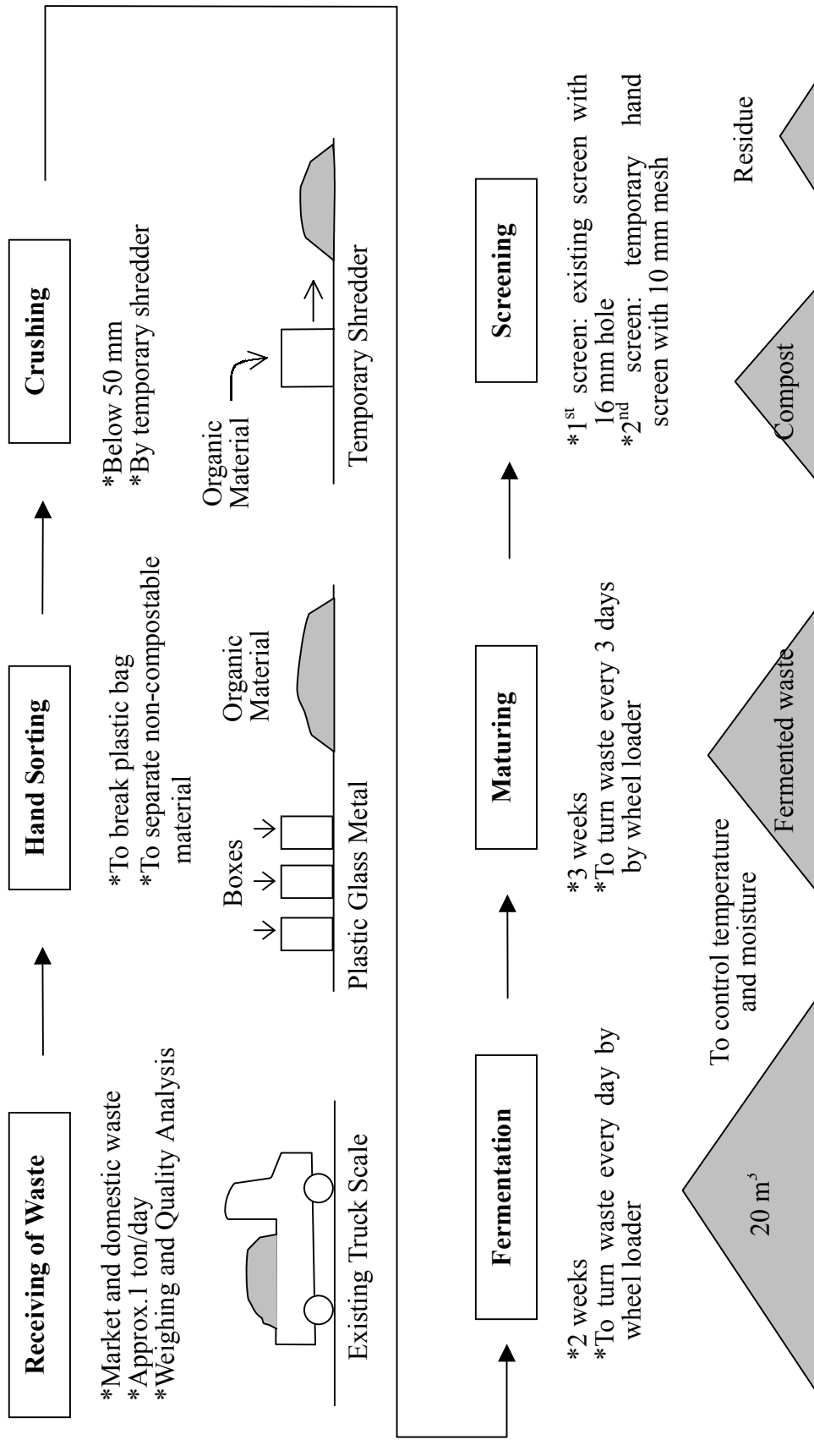


Figure 2.2.2 Process Flow Diagram of Compost Pilot Study

(2) Implementation Schedule

Implementation schedule of the pilot study is shown in Table 2.4.2.

Table 2.1.2 Implementation Schedule of the Pilot Study

	May	June	July	August	September -
Preparation		██████████	With JICA Study Team		
Market Waste		██████████	With JICA Study Team	██████████	██████████
Domestic Waste			██████████	██████████	██████████
Opinion Survey				██	
Report					██████████

(3) Working Situation

Actual working situation is shown in Figure 2.4.1.

2.5 RESULT OF THE STUDY

(1) Amount of Treated Waste

During a pilot study from 16th June to 30th August 2001, 103 ton market waste and 11 ton separated organic domestic waste were treated as shown in Figure 2.5.1.

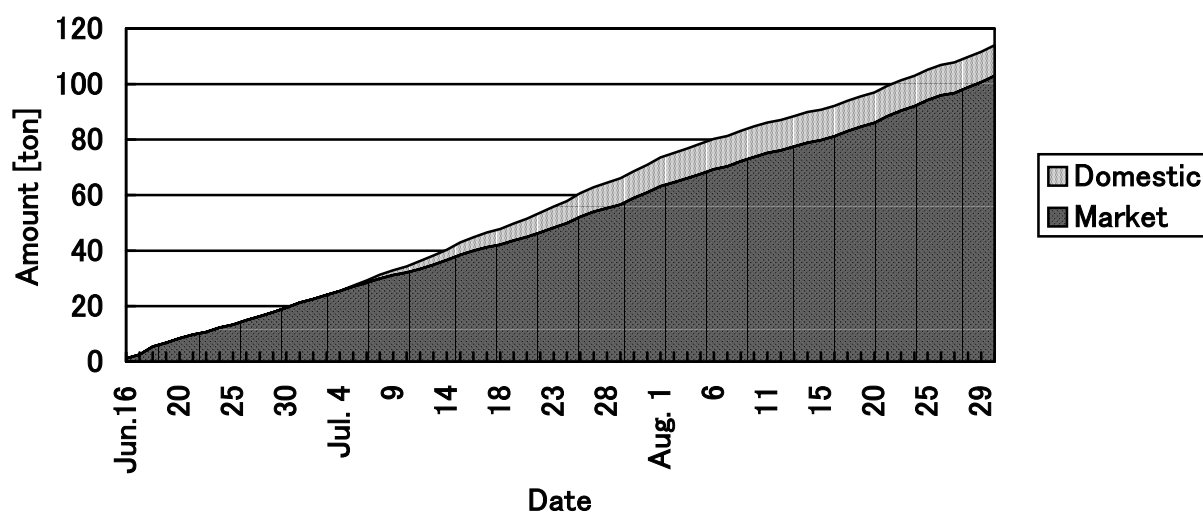


Figure 2.5.1 Total Amount of Waste Treated

(2) Waste Composition

1) Market Waste

Market waste of the study included approximately 72 % organic matter as shown Table 2.5.1.

Table 2.5.1 Market Waste Composition

(% in wet basis)						
Organic	Paper	Plastic	Metal	Glass	Others	Total
72.4	6.0	11.6	1.2	0.9	7.9	100.0

Survey period: 16 to 22 June 2001

2) Separated Domestic Waste

a. Source Separation Ratio

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

b. Separated Domestic Waste Composition

Separated organic domestic waste has contained approximately 84 % of organic material as shown in Table 2.5.2.

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

Table 2.5.2 Domestic Waste Composition

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

Survey period: 5 to 16 July 2001

(3) Compost production Ratio

In the study, approximately 23 to 35 % of organic material changed to coarse compost. Coarse compost is screened with a 2-stage screen to eliminate foreign mater. The first screen is a vibrating screen with 16 mm holes and the second, a hand operated screen with 10 mm wire mesh, therefore fine compost was approximately 30 to 40 % of coarse compost. Consequently the compost production ratio became as shown in Table 2.5.3.

Table 2.5.3 Compost Production Ratio

(% in wet basis)					
Waste	Organic Mater	Coarse Compost	1st Screen Reject	2nd Screen Reject	Fine Compost
Market Waste	100	34.2	16.0	7.8	10.4
Domestic Waste	100	23.5	4.4	8.9	10.2



Hand Sorting



Shredding



Fermentation



Turning



Maturing



Screening

Figure 2.4.1 Actual Working Situation

(4) Compost Quality

Compost quality of pilot study satisfies the standard in Syria as shown in Table 2.5.4.

Table 2.5.4 Compost Quality of Pilot Study

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

(5) Heavy Metal contained in the Compost Product

Analysis of the compost product, made from market waste, showed that the copper content was between 362 to 494 ppm. In order to confirm this result, another sample was taken and analyzed, and the result was between 146 to 681 ppm.

The standard of copper content in Japan is 600 ppm (recommended standard by the Ministry of Agriculture, Forestry and Fisheries) and in Denmark it is 1,000 ppm respectively. The above figures are below these standards.

While, in case of the compost product made of domestic waste, mercury content was higher than the Syrian standard of 3 ppm. It was checked in another laboratory and the result was below the standard.

Considering the above items, it is recommended to continue monitoring the quality of compost products and produce compost that contains lower levels of heavy metals, and to promote the investigation and research on an accumulation of heavy metal at farm land where compost applied.

CHAPTER 3 PUBLIC AWARENESS CAMPAIGN ON ENVIRONMENT

3.1 INTRODUCTION

In order for a city to create an environmentally-friendly society, there are lots of actions to be taken including conservation of ecosystem, protection of global environment, improvement of environmental sanitation including SWM and so on. In the field of SWM, it is generally pointed out that the following activities are extremely important to attain such a society with fundamental actions.

- To keep a city clean
- .To promote recycling of reusable materials in domestic waste

To sufficiently implement these activities, residents' cooperation is indispensable in addition to a sound public service of SWM. Therefore, it is absolutely necessary for SWM to heighten public awareness concerning these issues. Public awareness campaigns on environment and other actives concerned shall be stepwise launched to clean a city up and promote recycling of reusable materials as tests and trials. In the JICA study, pilot studies including public awareness campaigns on environment were conducted as a primary step of such tests and trials to accomplish the targets as shown in Figure 3.1.1.

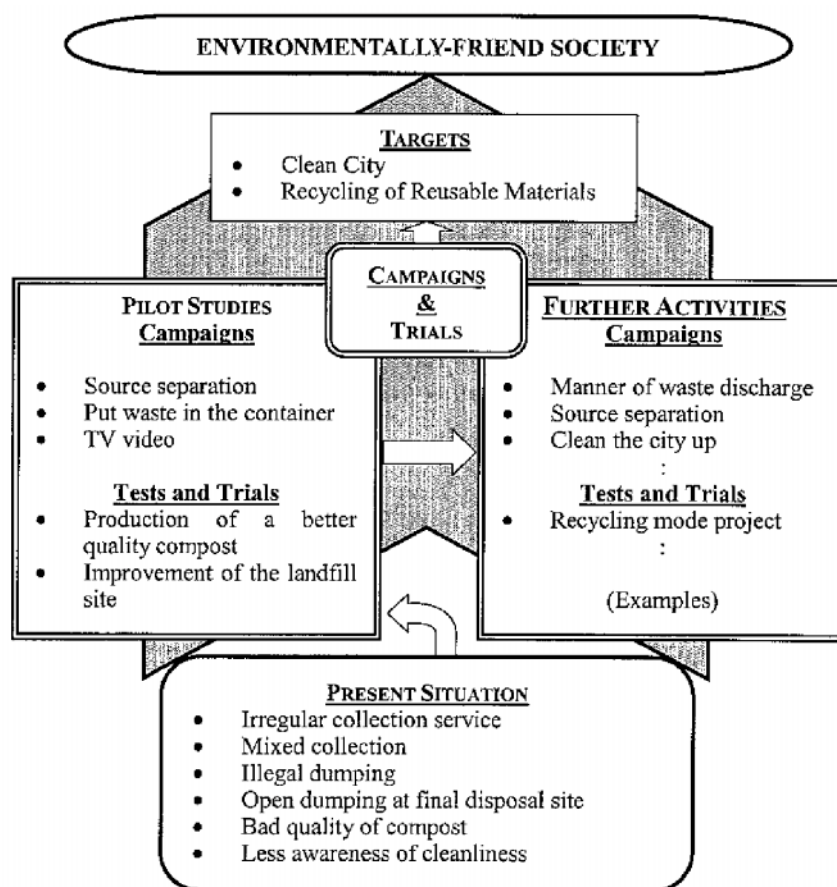


Figure: The JICA Study Team

Figure 3.1.1 Public Awareness Campaign and Pilot Studies

3.2 OUTLINE OF THE CAMPAIGNS

Based on the results of the public awareness survey and discussions between the JICA Study Team and the Counterpart Team, the public awareness campaigns on environment and SWM were planned and executed as follows.

3.2.1 Purposes

The principal purposes of the campaigns are summarized as follows:

- To heighten public awareness on environment and on SWM
- To introduce campaign know how to all participants involved
- To introduce know how of a community participation approach to all participants involved
- To promote good relation between the private sector (including the community) and the public sector

3.2.2 Framework for the Campaign

To fully achieve the purposes of the campaign, the JICA Study Team in cooperation with the counterpart team prepared the framework for the campaigns from the point of view of the expertise of public awareness on environment and SWM, as well as in accordance with the results of the public awareness survey as follows.

(1) Approach

Only a positive response to the campaigns by the citizens of *Lattakia* (communities, civil societies and individuals) and a complete “community participation” can guarantee sustainable improvement of public awareness on environment and SWM. As public opinion in the study area in this matter, the public awareness survey shows:

- 57% of the respondents have answered their willingness to participate in campaigns such as a cleansing day.
- Nearly half of the respondents (43%) have answered their willingness to contribute to source separation.

Based on these survey results, it is reasonable to suppose that a positive cooperation of the population and the communities could be expected to implement the related campaigns. Therefore, “community participatory approach” was employed for the campaigns in this study to expect a possible community involvement in, and their positive cooperation on the campaigns. The following shows one of the basic ideas on the approach, which is suitable for the campaigns in the fields.

First of all, to build a cooperative relationship among participants involved, the following conditions are necessary.

- A sound relationship of mutual trust between the communities and the public sector involved.
- Good communications among the participants involved.

- An active community involvement in every stage from planning to implementation on related campaigns as well as solid waste management campaigns

Next, to attain each condition above, the following activities are required as well:

- To recognize problems on environment and solid waste management
- To create communication channels among the participants involved
- To hold regular meetings and dialogues among the participants involved
- To exchange information about how they can improve environment and SWM

(2) Step by Step Comprehension of Participatory Approach

The participatory approach has several steps and processes to execute as mentioned above. Therefore, it is reasonable to suppose that the approach should be introduced in steps to the participants to allow smooth comprehension of it. The following three steps were employed to introduce the basic idea of the approach to the participants involved including both the private sector and the public sector.

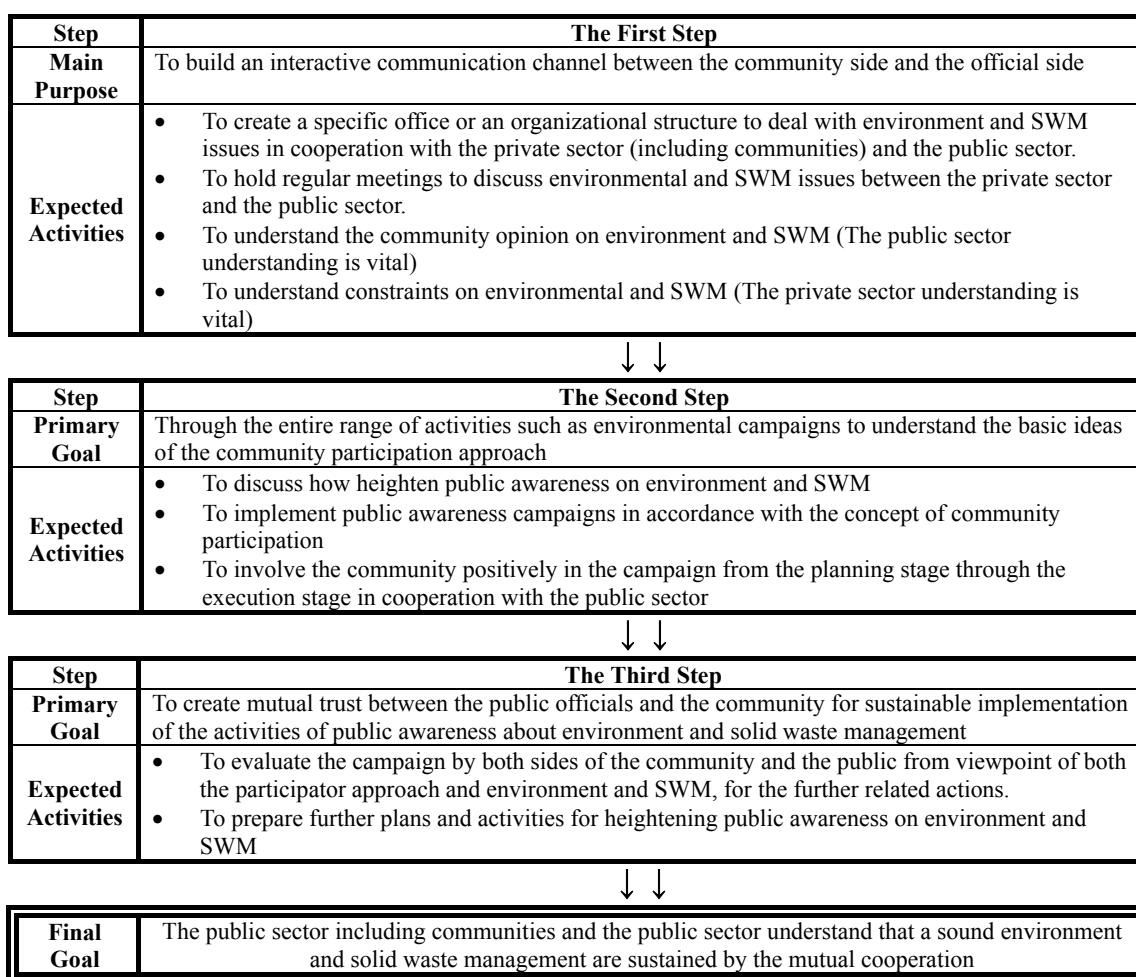


Figure: The JICA Study Team

Figure 3.2.1 Step by Step Comprehension of Participatory Approach

(3) Executive Structure

Base on the following basic ideas in line with participatory approach, the JICA Study Team played a role as a facilitator for preparing and implementing the campaigns.

- The campaigns shall be the *Lattakia* side initiative
- The study team shall transfer a know-how of participatory approach to the *Lattakia* side
- Interactive channels shall be created between the private sector and the public sector

Consequently, an executive structure for the campaign was organized as shown in Figure 3.2.3.

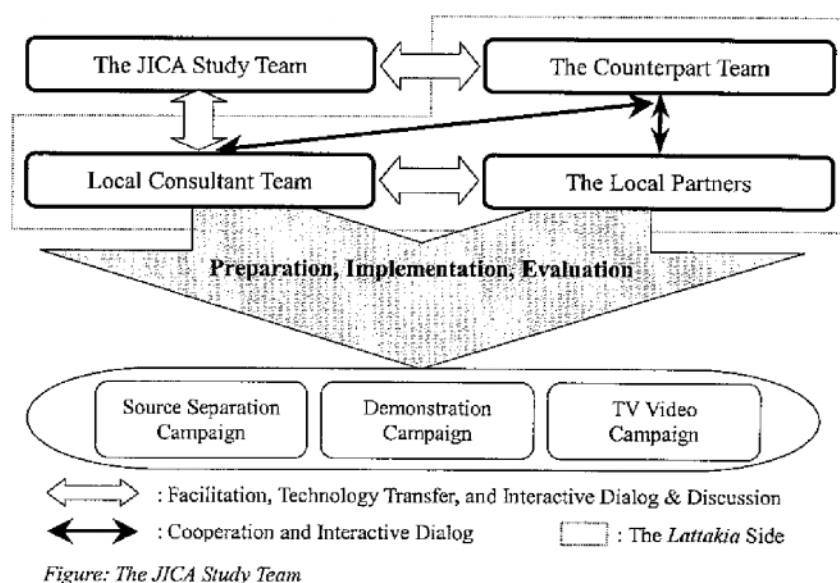


Figure 3.2.3 Executive Structure

(4) Local Partners

The “local partners” to be involved in the executive structure were selected by the JICA study team and Counterpart team based on the following criteria, as summarized in Table 3.2.4.

- Leading entities which may represent the private sector including the communities
- Leading entities which may represent the public-service organizations concerned
- Leading entities which may represent the central and local government concerned

Table 3.2.1 Local Partners

The Private Sector	Public-Service Organizations	Governmental Entities
<ul style="list-style-type: none"> Community Representatives <ul style="list-style-type: none"> - Lattakia City - Jableh City - Qurdaha City - Al-Haffeh City 	<ul style="list-style-type: none"> Public Unions and Entities <ul style="list-style-type: none"> - The Lattakia Women's Union - The Lattakia Sport Union - The Lattakia Farmer's Union - The Sport City 	<ul style="list-style-type: none"> City Council <ul style="list-style-type: none"> - The Lattakia City Council - The Jableh City Council - Qurdaha City Council - Al-Haffeh City Council
<ul style="list-style-type: none"> Business Establishment <ul style="list-style-type: none"> - An association of business establishment in Lattakia - A Local Consultant 	<ul style="list-style-type: none"> The Mass Media <ul style="list-style-type: none"> - The Lattakia Radio & TV Center - A Local News Paper Agency 	<ul style="list-style-type: none"> Directorates in Lattakia <ul style="list-style-type: none"> - The Environmental Directorate - The Health Directorate - The Lattakia Culture Center

(5) Community Explanatory Meetings

Community Explanatory Meetings on the campaigns were held with three steps as the initial action of the community participation approach. Each step of the meetings is consistent with “the basic idea of the step-by-step comprehension of community participation approach” mentioned in Figure 3.2.1, as summarized in Table 3.2.2.

Table 3.2.2 Community Explanatory Meetings

	Meeting 1 (27 th May 2001) The First Step	Meeting 2 (18 th June 2001) The Second Step	Meeting 3 (19 th August 2001) The Third Step
Main Theme	Explanation of the JICA Study, the campaigns and the approach	Presentation and finalization of all results discussed in Meeting 1 to have a consensus and cooperation of the participants	Evaluation of the campaigns and consideration of the future actions
Main Topics	<ul style="list-style-type: none"> To explain the JICA study and the team To explain the campaigns To explain a basic idea of community participation To build a cooperative partnership among the <i>Lattakia</i> side to implement sound companies To hear problems and issues on SWM from the local partners To invite suggestions for a campaign slogan & colors of waste containers using the demonstration campaign from the local partners To consider a suitable site for the source separation campaign 	<ul style="list-style-type: none"> To show specific interests of the Meeting 1 and the objectives of Meeting 2 To present results of the Meeting 1 To finalize the best slogan and the colors of the containers, those presented by the <i>Lattakia</i> side To finalize the location of for the source separation campaign To ask for further cooperation among the local partners for the implementation of the campaigns To introduce local partners to be involved in the campaigns 	<ul style="list-style-type: none"> To explain all results of the campaign to the local partners To show the evaluation of the campaign to the local partners To discuss further action on a sustainable implementation of the campaign to heighten public awareness of environment and solid waste management in the <i>Lattakia</i> area, among the <i>Lattakia</i> side
Primary Goal	To build an interactive communication channel between the community side and the public officials	To understand basic ideas of community participatory approach	To create mutual trust between the community and public officials side for a sustainable implementation of the activities on public awareness on environment and SWM

1) Purpose

The main purpose of the meetings was for the JICA study team and the Counterparts to explain the plans and ideas of the campaigns to the *Lattakia* side, and to share opinions about the campaigns and to evaluate the campaigns among them.

2) Explanatory Meeting 1 and 2

Two community explanatory meetings (the Meeting 1 and 2) were held in the preparation stage for the campaigns. As a result of two meetings, the proposed campaigns' plans were finalized based on the consensus of the *Lattakia* side as shown in Table 3.2.3 below. In addition, required preparations for the campaigns including the campaign slogan, containers' colors and a location of the source separation campaign were decided based on the consensus of the *Lattakia* side as follows. The minutes of the meetings appear in Appendix 1 and 2.

- Campaign slogan : “Let’s keep our city clean and beautiful”
- Container colors : “Blue” for non-organic and “Violet” for organic waste
- Location of source separation : Al-Slaibah, Zone A of Lattakia City

3) The Explanatory Meeting 3

After completion of the campaigns, the Explanatory Meeting 3 was hold to evaluate all activities of the campaigns and to discuss further actions on a sustainable implementation of the campaign. The main topics of the meeting are summarized in Table 3.2.3. As a result of the meeting, the *Lattakia* side made a recommendation for further activities related to the campaign. For the full details, see Section 3.4 as well as the minuets of the meeting attached as Appendix 3.

(6) Campaigns

Based on the expertise of the public awareness and the basic concept of community participation, the JICA Study Team and the Counterpart team planed a campaign proposal containing three different types of the campaigns. The proposed campaigns were accepted at the explanatory meetings as summarized in Table 3.2.3.

Table 3.2.3 List of the Campaigns

	Target Groups	Main Activities	Remarks
Source Separation Campaign	The Primary Target: Housewives in selected households in the Study Area (200 households)	- An experimental practice of source separation. - The Separated organic waste is used as raw materiel for the compost pilot study. - Interview surveys (before and after the implementation of the separation) - An observation tour for the target group to inspect the pilot compost plant and compost as the final product made from the separated waste.	Compost Pilot Project
	The Secondary Target: Other family member in the households (3,000 households)	- A practical demonstration with printed materials	
Demonstration Campaign on “Put Waste in a Container”	The Primary Target: Spectators at the <i>Al Mahaba</i> Festival (Approximately 10,000 spectators)	- To set dust bins or containers (30) at the entrances to major stadiums of Sport City (the venue of the <i>Al Mahaba</i> Festival) - To set signboards at the major entrances (10) to the stadiums - To exhibit a brief explanation of the process of compost production - To exhibit a sample of compost produced from waste - To prepare a leaflet about the importance of separated collections - To distribute the leaflet (2,000) - To conduct a questionnaire survey to identify public opinion about the campaign	<i>Al Mahaba</i> Sport Festival (August 2 - 12)

	Target Groups	Main Activities	Remarks
	The Secondary Target: The Family members of the spectators (Approximately 50,000 households)	- An instructional information on SWM and compost with printed materials	
TV Video Campaign	The Target Entire population in the study area	- To prepare a video program on the above campaigns to disseminate information related to the campaigns and activities of the JICA Study Team - To prepare a video program on a sound SWM, the importance of the separated collection and composting	Lattakia TV Station of Syrian TV



Photo [1] Meeting 1
(The Governorate Hall)



Photo [2] Meeting 2
(The Cultural Center)

(7) Timing and Schedules

Taking into account schedules of the compost pilot study and the sport festival in Lattakia, each campaign was scheduled from July to August 2001, and was prepared and implemented as shown in Table 3.2.4.

Table 3.2.4 Timing and Schedules

	May	June	July	August
1. Source Separation				
a. Preparation		▨		
b. Questionnaire surveys			■	■
c. Source separation			■	
d. Observation tour			▲	
e. Data analysis/ Reporting				▨
2. Put Waste in the Container				
a. Preparation		▨		
b. Manufacturing the containers		■	■	■
c. Prep. Signboards/leaflets etc.		■	■	■
d. Prep. of compost exhibition			▨	
e. Campaign at Sport City				■
f. Questionnaire survey				■
g. Data analysis/ Reporting				▨
3. TV Campaign				
a. Preparation		▨		
b. Produce a TV program		■	■	■
c. Showing (at Sport City)				■
<Meetings>				
Meeting 1,2 and 3 (Evaluation)	▨ M1	▨ M2		▨ M3

Note:

▨ : Preparation
▨ : Data Analysis/Reporting
■ : Questionnaire Surveys
■ : Manufacturing, Printing and Producing
■ : Implementation of Campaigns
▲ : Observation Tour
M : Explanatory Meetings

Table: The JICA Study Team

3.3 IMPLEMENTATION OF THE CAMPAIGNS

3.3.1 Source Separation Campaign

(1) Selection of Households

In accordance with the discussions and the results at the community explanatory meetings, the campaign location was decided in *Sleibah* area of *Lattakia* City as shown in Figure 3.3.1.



Figure 3.3.1 Location of Source Separation

As for target households for the campaign, taking account of the characteristics of waste amount and composition in *Lattakia*, 200 households were selected based on the income levels as shown in the Table 3.3.1.

Table 3.3.1 Target Households

Income Level	Number of Households
Low Income	70
Medium Income	100
High Income	30
Total	200

The selection of households was made in cooperation with the Women's Union, Branch of *Lattakia*, as well as the Counterpart Team in the following procedure:

- An approximate selection of blocks in *Sleiba* area was made in coordination with the counterpart team and the Women's Union in *Lattakia*.
- The survey team composed of members of the Women's Union in *Lattakia* was organized for implementing the campaign.
- In the third week of June, the survey team made a first visit to more than 250 households in these blocks with a short questionnaire indicating address, family name, income level and the availability of the family during the campaign period.

- By the end of the third week of the June, the samples of 200 households were selected on the basis of the information collected in the short-questionnaire survey.

(2) The 1st Questionnaire Survey (Before the implementation)

An opinion survey was carried out on the selected households aimed to identify the level of awareness of housewives about environment and solid waste considerations before the implementation of the campaign.

- A survey team was composed of 14 women belonging to the Women's Union.
- A preliminary survey was carried out on 20 households with a draft questionnaire.
- Based on the results of the preliminary survey as well as advice of the JICA Study Team, the draft questionnaire was modified to suite the present situation of the households.
- The survey team carried out the full-scale survey with the modified questionnaire before the implementation of the campaign. (See Appendix 4 for questionnaire,)

(3) Explanatory Leaflet and Demonstration of Source Separation

In order to explain the source separation procedure to the housewives of the selected households, an explanatory leaflet was prepared and distributed to them before the campaign. At the end a questionnaire survey with a demonstration about the source separation using two different types of nylon bags was given, namely;

- Black color nylon bag for organic waste
- White color nylon bag for non-organic waste

A sufficient number of leaflets were provided to each household with the instruction to distribute them to the family members, neighbors and the friends of the family members. (The leaflet, see Appendix 5)

(4) Implementation of the Source Separation Campaign

The campaign was implemented for four weeks in August 2001. During the implementation stage, the collection workers of the cleansing department of the *Lattakia* City collected the households' waste every morning (between 9 and 10 am). At the same time the workers distributed new nylon bags for the next day.

Most of the operation was carried out without direct contacts between the workers and the housewives. Because that the wastes were put out doors by the housewives every early morning, then the workers collected wastes and hanged the new bags on the doors.

Black color bags containing organic waste were delivered to the compost pilot study site at *Al-Bassa*, and used as law materials for composting there, other wastes were disposed at the *Al-Bassa* disposal site.

(5) Observation Tour

An observation bus-tour to the *Al-Bassa* site was organized on July 19th for the housewives to inspect the present final disposal site and the pilot compost plant for exhibiting the plant and compost as the final product from the waste separated. The survey team and the members of the Women's Union participated in the tour. Due to social reasons (non-approval of the husbands on the visit) and others, total 45 housewives were participated in the tour.

The participants visited the composting pilot study site and the pilot study for the rehabilitation of the present disposal site as shown in the following photos. The JICA Study Team and the local consultant presented explanations about the rehabilitation and the compost process from waste to them during the observation.



Photo [3] Separated Waste



Photo [4] Compost from Waste



Photo [5] Disposal Site



Photo [6] On-site Explanation

(6) The 2nd Questionnaire Survey (After the implementation)

The 2nd questionnaire survey was carried out after the implementation of the separation campaign. The purpose of this survey were to identify raise in awareness about the importance of solid waste separation at source and to evaluate the campaign and to determine the possibility for housewives' participation in a "wide scale" source separation process in the future. The questionnaire was prepared in a manner enabling a connection with the "1st questionnaire survey", which was conducted before the campaign, in almost same procedure of the 1st survey. (The questionnaire, see Appendix 6)

3.3.2 Demonstration Campaign on “Put Waste in a Container”

A demonstration campaign on “put waste in a container” took place during *Al Mahaba* festival 13th (2nd –12th August 2001) at *Al-Assad Sport City of Lattakia* to heighten public awareness on environment and SWM, especially on separate collection of waste.

(1) Preparation

1) Installation

- Installation of the exhibition booth at the festival venue as shown in Figure 3.3.2.

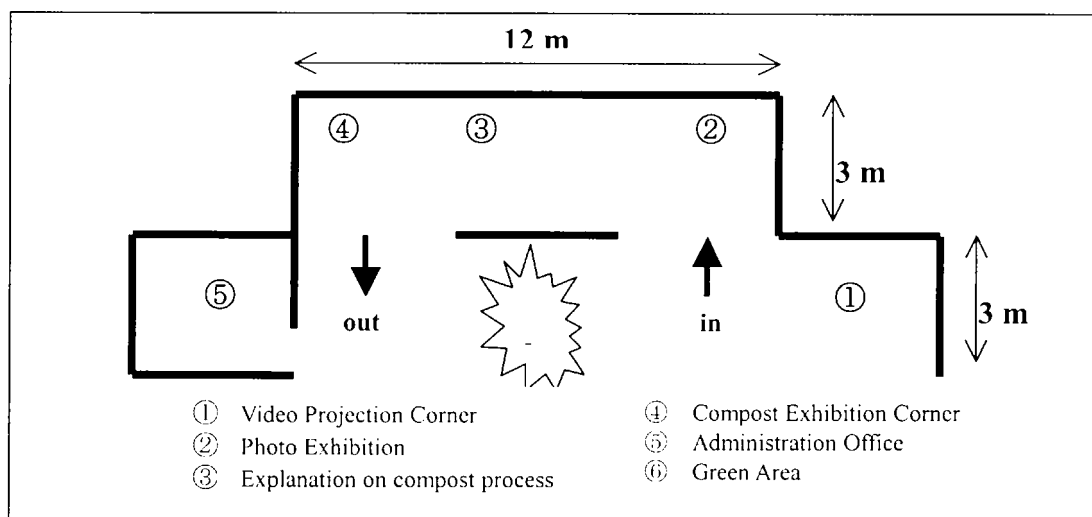


Figure 3.3.2 Layout of the Exhibition Booth

- Installation of 15 sets of waste containers in the sport city as the venue of the campaign. The colors of containers were selected in the explanatory meeting 2 with consensus of the *Lattakia* side as shown in Table 3.3.2. (The containers, see Photo 3.3.7, 3.3.8 and see Appendix 7)
- Installation of 15 signboards (of which 5 were provided by the administration of the sport city) at the locations selected for the distribution of the 15 sets of waste containers. (The signboards, Photo 3.3.6 and see Appendix 8)
- Installation of 50 sets of small wastebaskets with the same color arrangements shown in Table 3.3.2, by the sport city. (The baskets, see Photo 3.3.10)

Table 3.3.2 Colors of Containers

Color of Container	Purpose	The origin of the color selected	Number
Blue	Non-organic waste	Blue is inspired from the sea, as <i>Lattakia</i> is a coastal city	15
Violate	Organic waste	Violate is the color of flowers of a tree planted on the streets of <i>Lattakia</i>	15



Photo [7] The Exhibition Booth



Photo [8] The Signboard



Photo [9] Container (Non-organic)



Photo [10] Container (Organic)



Photo [11] Signboard & Containers



Photo [12] Wastebaskets

2) Photos and Explanation

- The following preparation of the photos and explanations for the exhibition: (See Appendix 9)
 - Present situation of SWM in *Lattakia*, with the focus on the activities and efforts of the cleansing workers to collect and discharge waste as well as to clean the city up.
 - Present situation of *Al-Bassa* disposal site, with presentation of the activities of the scavengers on the site.
 - The use of organic waste to produce compost and its process

- Efforts of the JICA Study team for the rehabilitation of *Al-Bassa* disposal site.
- The activities of the JICA Study team in the compost pilot project.
- Photos from the campaign on source separation, focusing on the interests of such operation to obtain better quality compost.

3) Printed Materials

- A special page of the campaign with the logo on the brochure of *Al-Mahaba* festival. (As for the logo, see Figure 3.3.3)
- 10,000 leaflets explaining a source separation process and its interests.
- (Printed Materials, See Appendix 10)



Figure 3.3.3 The Campaign Logo

4) Related Tools

- 5,000 key-holders containing the logo and slogan of the campaign.
- 500 T-shirts with the logo and slogan.
- A video film on SWM (See section 3.4 TV video campaign).



Photo [13] T-shirt



Photo [14] Key-holder

5) Questionnaire

- A questionnaire form of an interview survey of public opinion on the Campaign. (Questionnaire, See Appendix 11)

(2) Implementation of the Demonstration Campaign

The campaign was started in the evening from 8 p.m. to 10 p.m. every day in accordance with the festival schedule, which was executed in the evening during 2nd - 12th August 2001. The principal activities of the campaign are summarized as follows;

- The photo exhibition
- The exhibition of compost sample produced from organic waste and its process.
- The interview survey to identify public opinion on the campaign.
- The video show related to environment, SWM, the JICA Study Team and others.

1) Activities and Manpower

In and around the exhibition booth, three teams of local staff implemented the following activities as summarized in Table 3.3.3.

- Team A: explained the details of the exhibitions to each visitor
- Team B: distributed the leaflets and the key-holders to the visitors
- Team C: carried out the interview survey with the questionnaire

Table 3.3.3 Manpower for the Campaign

Date (August)	2	3	4	5	6	7	8	9	10	11	12
Team A (persons)	2	6	8	8	8	8	8	6	6	5	2
Team B (persons)	4	13	15	13	14	15	13	13	10	10	4
Team C (persons)	-	-	-	-	2	4	5	5	5	5	-

2) Tools

The tools for the campaign were distributed as shown Table 3.3.4.

Table 3.3.4 Tools Distributed

Date (August)	2	3	4	5	6	7	8	9	10	11	12	Total
Leaflet (nos.)	-	200	2,000	2,000	1,000	1,000	1,000	1,000	1,000	500	300	10,000
Key holder (nos.)	-	500	800	700	600	500	500	400	400	400	200	5,000
T-shirt (nos.)	20	50	70	60	40	30	30	70	60	20	-	450

3) A video show

A video on SWM was shown at the booth several times in each day as summarized in Table 3.3.5. The video film was produced in the TV video campaign of this study. The detail information about the video appears in section 3.4.

Table 3.3.5 Video Show

Date (August)	2	3	4	5	6	7	8	9	10	11	12	Total
Show (times)	-	-	5	5	6	3	5	6	6	5	-	41
Audience (persons)	-	-	91	60	95	43	79	97	110	73	-	648

4) Number of Visitors

The total number of visitors can be estimated as shown in Table 3.3.6. The estimation is calculated as the probable number of the visitors based on the number of leaflets and key holders distributed.

Table 3.3.6 Visitors

Date (August)	2	3	4	5	6	7	8	9	10	11	12	Total
Visitors (persons)	40	100	1,000	800	700	600	600	600	400	300	60	5,200



Photo 3.3. [15] The Explanation Scene



Photo [16] Interview Survey

3.3.3 TV Video Campaign

As has mentioned already, the TV video campaign is to produce a short video program that may be used for a TV broadcast in *Lattakia*. The video covers the following points.

- Issues and problems of solid waste in four local cities in Lattakia
- Ideas on SWM
- Importance of waste separate collection and composting
- Activities of the JICA as well as the JICA study team
- The related campaigns

The video film was produced in the following procedure;

- A tentative scenario for the video was considered by the *Lattakia* side based on suggestions and comments of the JICA Study Team
- The tentative scenario was submitted to the 2nd Explanatory Meeting to discuss the contents.

- At the meeting the tentative scenario was modified based on the discussion and obtained a consensus of the *Lattakia* side.
- Then a team of the Syrian TV shot the scenes in accordance with the scenario.
- The video produced was about 25 minutes in length and based on the scenario.
- The video was shown during the demonstration campaign, August 2nd to 12th 2001, at the exhibition booth in the Sport City in *Lattakia* for *Al-Mahabba* Festival. (The scenario, See Appendix 12).



Photo [17] A Video Show



Photo [18] Barker for Exhibition

3.3.4 Results of Questionnaire Surveys

(1) Results of the Questionnaire Surveys in the Source Separation Campaign

The results of the two surveys of “before” and “after” of the demonstration campaign are summarized as follows.

1) General Attributes

a. Level of Income:

- The distribution of the level of income was determined by the selection conditions: 15 % high income, 35% low income and 50% medium income.

b. Age of Housewives:

- 56% of the housewives belong to the age group of 31-50 years old.
- Only 1% is less than 20 years old and 6% are older than 60.

c. Number of household members:

- 29% of the households have 5 members and a total percentage of 64% of the households have between 4 and 6 members.

d. Profession of Housewives:

- 77% of the housewives do not have any profession, whereas only 17% are public employees.
- A insignificant percent of the housewives are working in the private sector and do not have a privately owned business.

e. Level of Education:

- 30% of housewives have a school degree, 31% have a higher degree (Institute and University), while 12% don't have any education.

f. Monthly Income and Expenditure:

- 46% of the housewives did not report the monthly household income, 52% did not even report the expenditure. This result may say the degree of sensitivity of this topic for most of the people.
- However, 27% answered a monthly income between 4,000-7,000 SP and 10% reported that the income is between 7,000-10,000 SP.
- While for the expenditure, 16% reported a monthly expenditure between 4,000-7,000 SP and 11% replied that the expenditure between 7,000-10,000 SP.

g. State of Residence:

- 85% of the households live in their own homes, and 12% live in rental houses.

2) Solid Waste Handling Practices

a. Waste Collection and Discharge:

- Most of the housewives collect domestic waste at home (85%), often by the use of a nylon bag (89%).
- A member of the family (87%) often undertakes waste discharge. The discharge is undertaken daily in 77% of the cases, and 16% is done every second day. 53% of the households do not check their waste before discharge but 43% do this check.
- Most of the housewives estimate that food constitutes the biggest amount in the waste. As for the second biggest amount, 39% of housewives think that it is composed of paper while 34% estimate that it is composed of plastic.
- Most of the interviewees replied they dispose food waste (72%). A few give it to other people. 81% of households dispose plastic and glass (81%). Whereas 33% of households keep old magazines and newspapers.

b. Solid Waste Sorting and Recycling:

- 49% of housewives seem to have an idea about waste sorting.
- Nevertheless, 59% of the housewives don't sort their domestic waste.
- 71% of the housewives seem to know the benefits from recycling and 78% of the housewives mention these benefits in terms of "Economic Benefits".
- Meanwhile, most of the housewives don't know any group doing recycling in *Lattakia* (74%).
- For 91% of the housewives, burning wastes can increase air pollution and 84% think that recycling can decrease scavenging.
- Most of the housewives accept that sorting is to be done in the houses (65%), and by the family members themselves (62%).

- People are satisfied with the present condition of waste collection, but most of the housewives answered they were not paying any kind of yearly municipal tax for cleaning (65%).
- Few housewives know the exact amount of this tax.

3) Opinions about the Campaign (The 2nd Questionnaire Survey)

a. Period and Timing

- Most of the housewives perceived that the implementation of the campaign during July was suitable (79%), but too short (74%).
- 95% of the housewives replied that the daily schedule to the discharge of the waste (between 9 and 10 am) by the workers of the Cleansing Department of the Municipality was suitable.

b. Explanation and Implementation:

- 92% of the housewives report the explanations of the campaign were enough.
- They gave positive opinions about the leaflets and the colors of the nylon bags.
- The necessity of the cooperation of family members in the separation process is outlined by almost all the housewives. 88% of the housewives estimated that this cooperation was good during the campaign.

c. The Source Separation Practices:

- 31% of the housewives mentioned the lack of understanding of source separation process by children.
- 81% of the Housewives answered that the separation was successful.
- Most of the housewives seems to find benefits in waste separation, 71% made mention of health benefits whereas 10% rely these benefits to the environment.
- 95% of the housewives reported that the source separation campaign was useful.

4) Future Source Separation Perspective

a. Willingness to Source Separation:

- 83% of the housewives answered that it is necessary to be provided with nylon bags in order to practice source separation.
- 59% of the housewives report they would to continue source separation without being provided with these bags.

b. Public Containers:

- 94% of the housewives perceived they would to go on separating their domestic waste in the future under conditions of the existence of sets of public containers (one for organic, another for non-organic) in streets.

(2) Results of the Questionnaire Surveys in the Demonstration Campaign

The results of the questionnaire survey in the demonstration campaign are summarized as follows.

1) Samples

The samples were selected randomly among the visitors in the exhibition booth. Table 3.3.7 shows educational backgrounds of the samples, visitors interviewed, for the survey.

Table 3.3.7 Samples

Education	Persons	%
Schools (Primary & Secondary)	69	43
University Degree	51	32
Institute Degree (2 years after the secondary school)	27	17
A post graduate	6	4
Non	2	1
Others	5	3
Total	160	100

2) Containers, Wastebaskets and Signboards

- Most of the visitors answer the number of the containers were acceptable
- 77% of the visitors report that the design of the containers was good
- 79% of the visitors replied with the same opinion for the small wastebaskets
- 82% of the visitors found that the design of the signboard was good.

3) Impression of the Exhibition

- 96% of the visitors expressed a good impression on the exhibition title "Put Waste in containers"
- 86% of the visitors expressed the exhibition was good in general.
- 93% of the visitors gave a positive impression on the compost sample presented at the exhibition booth.

4) Separation and Recycling

- 65% of the visitors perceive that the advantage of waste sorting is economical.
- 31% of the visitors perceive that the advantage of waste sorting is environmental improvement.
- 4% of the visitors report these advantages in terms of recycling activities.

5) Ideas about the Cleanness

- 75% of the visitors were not satisfied with cleanness of their city of residence.
- 45% of the visitors thought the percentage of people who discharge waste in the container is about 30%.

3.4 EVALUATION OF THE CAMPAIGNS

3.4.1 The Initiative in the Campaigns

As has mentioned above, the JICA Study Team played as a facilitator for the preparation and implementation of the campaign in line with participatory approach. Therefore, the initiative in implementing the campaigns was gradually transferred from the JICA study team to the *Lattakia* side in accordance with the progress of the activities concerned and the campaigns as follows and shown in Figure 3.4.1.

- In order for the JICA study team to concentrate on the team's role as the facilitator, the levels of the study team's initiative in the campaigns gradually decreased in accordance with the progress of the activities of the campaigns.
- On the other hand, in order for the *Lattakia* side to learn and experience the approach, the levels of the *Lattakia* side's initiative and commitment to the campaigns gradually increased in accordance with the progress of the activities of the campaigns.

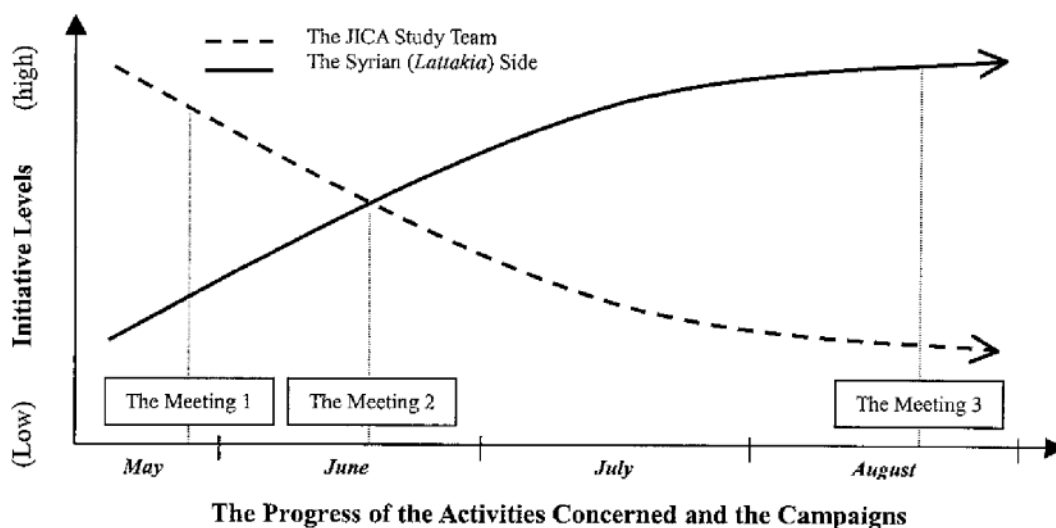


Figure 3.4.1 Initiative in the Campaigns

3.4.2 The Evaluation Meeting (The Meeting 3)

To evaluate the campaigns among the local partners, the explanatory meeting 3 was hold after the termination of the campaigns as summarized in the following. The details of the meeting appear in the minutes of the meeting attached in Appendix 16.

(1) Contents of the Evaluation

The evaluation meeting was conducted as shown in the following description.

- Acknowledgements to the local partners, reviews of the roles of the JICA study team and the future expectation of *Lattakia* side were presented by the JICA study team.

- All results of the campaigns were presented by the local consultant
- Comments and expression on the participation of the *Lattakia* side in the campaigns
- Q&A and a discussion on the campaigns among the *Lattakia* side were conducted
- Conclusions were made by the Mayor of *Lattakia* City on behalf of the *Lattakia* side

(2) Main Evaluations, Opinions and Questions on the Campaigns

Main evaluations, opinions and questions on the campaigns expressed and asked by the local partners are summarized as follows;

1) Evaluations

- The campaign was very successful; but what is the next?
- There was no adequate introduction of the campaigns in the city, particularly to the schools and kindergartens.
- Thanks to all people contributing to the success of these campaigns, which were truly useful and important to the region.

2) Opinions

- The further possibility of applying the demonstration campaign at *Al- Mahaba* festival for other festivals.
- What are next actions after the JICA Study?
- Importance of using the containers found in *Al-Mahaba* Festival, in other places.
- Hopes that this demonstration campaign will be a start towards further campaigns.
- The necessity to establish regulations to control the solid waste disposal.
- The necessity of permanent municipal watchers in the streets.

3) Questions

- Has there been any analysis of the solid waste components and amounts in the containers in the demonstration campaign?
- What were the results of the campaign in regards to the commitment of the people to the matter of the containers at the demonstration campaign and the separation of the solid wastes (organic – non organic)?

As for the questions, the local consultants adequately replied to the questions based on technical and scientific explanations as well as the results of the questionnaire surveys executed in the campaigns.

The details of the meeting appear in the minutes of the meeting attached in Appendix 16.

(3) Conclusions

The meeting ended with the Mayor of *Lattakia* City on behalf of the *Lattakia* side, who explained the positive reflection and effect of the campaigns on the prospective solid waste management in *Lattakia* region. The Mayor confirmed the importance of the public awareness on solid waste separation at source.

At the end of the meeting, the Mayor developed official points of views and future expectations as follows:

- To focus on public awareness oriented to children (in schools, summer camps and kindergardens).
- To organize the further similar exhibitions and to implement the same campaigns in the next *Al-Mahaba* Festival of the sport city.
- To continue efforts on waste separation by making use of available local facilities.
- To request necessary equipment and machinery to improve the present landfill site and waste collection.

3.4.3 Public Awareness Campaign in *Jableh* City

As one of positive effects derived from the implementation of the campaigns of the JICA study, *Jableh* City conducted a public awareness campaign on SWM and separate collection from 15th to 18th August 2001, after the completion of the campaigns of the JICA study in *Lattakia* as follows.

- The Mayor of *Jableh* City independently planed a public awareness campaign in accordance with the same arrangements of the demonstration campaign at the Sport City in *Lattakia*.
- The JICA Study Team, the Counterpart team and the Local Consultants were officially requested by the Mayor to cooperate and facilitate the proposed campaign in *Jabla* City.
- The JICA Study Team, the Counterpart team and the Local Consultants accepted to cooperate and facilitate to launch the campaign in *Jableh* City as much as possible.
- *Jableh* City allocated necessary budgets and manpower for launching the campaign in *Jableh*.
- *Jableh* City prepared several sets of the wastebaskets (organic & non-organic set), and put the baskets around the exhibition booth, which was set up in a public area along with a seacoast in *Jableh*, for promoting separate collection of waste.
- *Jalbe* City prepared printed materials to instruct separate collection and SWM based on the leaflet produced for the demonstration campaign at the Sport City in *Lattakia*.
- The following tools produced for the demonstration campaign at the Sport City in *Lattakia* were accommodated for the campaign period (from 15th to 18th August 2001) in *Jableh* City.

- Photos
- Compost sample and the explanation papers
- Utensils and furniture of the exhibition booth
- Video film and the projector

Accordingly, the fact of the implementation of the campaign in *Jableh* indicates that the know-how on the public awareness campaigns prepared in the JICA study is positively evaluated and effectively accepted by the Syrian side.

CHAPTER 4 REHABILITATION AND OPERATION IMPROVEMENT OF AL-BASSA DISPOSAL SITE

4.1 OUTLINE OF THE PILOT STUDY

The existing Al-Bassa disposal site has become one of the urban public nuisances in Lattakia Govenorate. In order to overcome and minimize the environmental impacts created at Al-Bassa disposal site, it is urgently required to introduce “controlled landfill” as a waste disposal system equipped with proper facilities for the environmental counter-measures and proper landfill operation.

Based on this understanding, the pilot study to rehabilitate and improve the operation of Al-Bassa disposal site has started in 10th June 2001 by the Syrian side and supervised by JICA Study Team. Outline of the pilot study is described in the following articles.

4.1.1 Purpose

The purpose of the pilot study is described as follows.

- Minimize the environmental impacts to the surrounding residents and environs.
- Rehabilitation of Al-Bassa disposal site by re-arrangement of existing disorderly accumulated waste.
- Introduction of proper landfill operation by waste push-up/cell method and covering with soil.
- Implement control of incoming vehicles and scavenging activities.
- Providing concrete example of controlled landfill operation for the proposed new disposal site. (In the master plan of this study, new inter-municipal disposal site is proposed in Qasia, and the operation system of it should be the controlled/sanitary landfill.)
- Technical transfer to the Syrian side for the above items.

4.1.2 Basic Conditions of the Pilot Study Area

Basic conditions of the pilot study area are summarized in Table 4.1.1. Figure 4.1.1 shows the location of the pilot study area.

Table 4.1.1 Basic Conditions of the Pilot Study Area

No	Item	Conditions
1	Location	Al-Bassa disposal site (Zone-I)
2	Area in total for the pilot study	2.5 hectare (part of Zone-I of Al-Bassa disposal site)
3	Area for the rehabilitation	1.5 hectare
4	Topographic feature	Basin at sandy hill (GL+5.0 – GL+12.0)
5	Existing accumulated waste amount	Approx. 7,400 m ³ (for only pilot study area)
6	Incoming waste amount	Approx. 240 ton/day (43 trips in average)

4.1.3 Control Facilities Installed

Control facilities, which have been installed/ constructed at the pilot study area under the supervision of *JICA Study Team* are described in Table 4.1.2. Location and photo of each facility are shown Figure 4.1.2 and Figure 4.1.3, respectively.

Table 4.1.2 Control Facilities Installed for the Pilot Study

Facilities	Quantity/ Dimension	Environmental Countermeasures etc.
1. Fence	L=150m, H=1.8m	Prevent waste scattering and free access to site Define the disposal site area
2. Guard-house	A=30m ²	Control station of the disposal site
3. Embankment	L=300m, H=W _{TOP} =5m	Re-arrangement of existing accumulated waste as a core of embankment <Rehabilitation way of the site> Prevent waste out-flowing Performance of waste accumulation at a certain height
4. Gas removal pipe	1 location, L=5.0m	Acceleration of waste decomposition Prevent offensive odor and destruction of ecological system
5. Leachate collection pipe	1 pipe, L=50m	Prevent mud condition of the site and keep the proper landfill operation Collection leachate and directing it to the pond
6. Monitoring well	1 nos, 12m depth	Monitoring of groundwater quality
7. Cover soil	Approx. 7,500m ³	Prevent offensive odor, harmful insect, waste self-burning, and waste scattering Reduction of leachate amount

Note: Cover soil composed of the sand from the site itself and construction debris from Lattakia city.

4.1.4 Equipment Rented

Equipment rented by the *JICA Study Team* for the implementation of the pilot study is listed in Table 4.1.3.

Table 4.1.3 Equipment Rented for the Pilot Study

Equipment	Capacity	Landfill works
1. Bulldozer	1 nos, HP 200	Waste push-up, spread and compaction Spread and compaction of cover soil
2. Backhoe (Excavator)	1 nos, Bucket 0.8m ³	Excavation of cover soil & accumulated waste
3. Dump truck	1 nos, 8 ton	Transportation of cover soil & accumulated waste

Note: Rental period of equipment is approx.3 months.

4.2 PROCEDURE OF THE PILOT STUDY

This pilot study is composed of two stages, described as follows. Site plan of the pilot study is shown in Figure 4.2.1.

a. *Stage-1: Preparation and rehabilitation of Al-Bassa disposal site*

- Site preparation (clean-up the site and improve access road)
- Re-arrangement of existing disorderly accumulated waste and covering with soil

- Construction of embankment (by using existing waste and construction debris)
- Installation of leachate collection pipe and gas removal pipe
- Improvement of site operation road
- During stage-1 activities, control facilities (guard house, fence and monitoring well) have been installed.

b. Stage-2: Improvement of landfill operation for the daily incoming waste

- Introduction of controlled landfill operation by waste push-up/ cell method and covering with soil
- Practice for the control of incoming vehicles
- Practice for the control of scavenging activities

4.3 IMPLEMENTATION SCHEDULE

Implementation schedule of the pilot study is shown in Table 4.3.1.

Table 4.3.1 Implementation Schedule

Item	June	July	August
<i>Stage-I: Rehabilitation</i>			
a. Site preparation/ access road improvement	■		
b. Construction of embankment	■	■	
c. Re-arrangement of existing waste	■	■	
d. Installation of leachate and gas pipe		■	
e. Improvement of site operation road		■	
f. Installation of control facilities	■	■	
<i>Stage-2: Operation improvement</i>			
a. Introduction of controlled landfill		■	■
b. Practice of incoming vehicle control		■	■
c. Practice of scavenging activity control		■	■

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

4.4 PILOT STUDY ACTIVITIES

4.4.1 Rehabilitation of Pilot Study Area

Accumulated waste amount in Al-Bassa disposal site is estimated to 224,000m³ in total area of Zone-I, II, and III (approx. 90 hectare). While, in this pilot study area (1.5 hectare), about 7,400m³ of waste is spread and/or accumulated. The main purpose of the rehabilitation of pilot study area is how to rearrange the existing accumulated waste.

Rehabilitation method carried out by the pilot study is described as follows. Site plan and photo for the rehabilitation are shown in Figure 4.1.2 and 4.4.1, respectively.

- Push the existing accumulated waste to south and east end of the pilot study area where the surrounding embankments proposed to be constructed, by bulldozer.

- By using this waste, making the core of the embankment. The height of the embankment is about 5m, the width of the top of embankment is 5m, and the slope is 1:4 inclinations in both sides.
- Embankment is covered by soil (sand) taken from surroundings, and at the top of the embankment, construction debris taken from Lattakia city is installed.

Typical section of the embankment is shown in Figure 4.4.2.

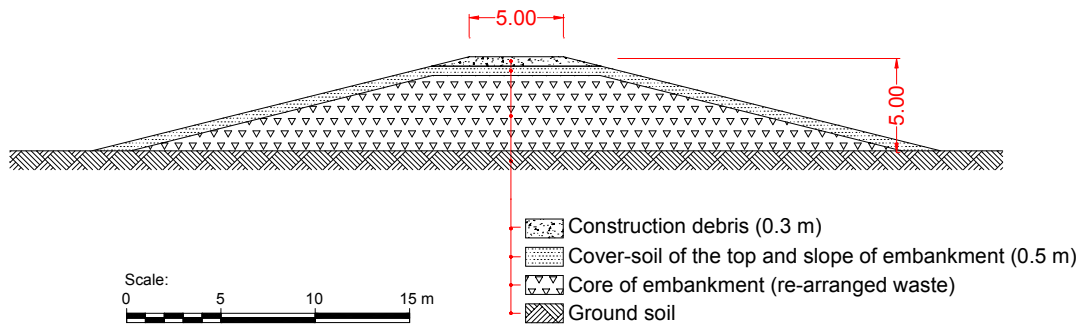


Figure 4.4.2 Typical Section of Embankment

This activity of the pilot study will be one of the concrete sample/experiences shown to Syrian side about how to rehabilitate/re-arrange the existing accumulated waste and/or close the existing disposal sites in the proper manner.

4.4.2 Landfill Operation Improvement

“Controlled landfill” is the method for the waste disposal used worldwide which minimizes the environmental impacts and protects public health. Waste to be disposed of should be compacted and covered with a layer of soil and after all disposal operations have been completed, alternative land use is possible.

Solid waste must be sufficiently spread and compacted so as to stabilize the landfill area and to prolong the lifetime of disposal site. Soil cover must be placed systematically and periodically after landfilling of each layer and/or cell of the waste.

(1) Landfill Method

In order to perform the sufficient spreading and compaction of the waste, combination of the “cell method” and “push-up method” has been adopted for the operation improvement of the pilot study in Al-Bassa disposal site. The following items were verified through the landfill operation of the pilot study area:

- Waste spreading should not be too thick. Municipal waste thickness of each layer shall be about 30 cm, which is effective for compaction work carried out by landfill equipment (bulldozer).
- Landfill layer and/or cell should be made as uniform as possible by the push-up method, taking into consideration the waste compaction efficiency. Gradient of

the waste slope should be 1:4, to ensure effective operation of landfill equipment.

- Thickness of each waste cell should be less than 3 m, according to waste characteristics of mixed municipal waste and efficiency of landfill work.

Conceptual drawing and photo of landfill operation procedures including “cell method” and “push-up method” are shown in Figure 4.4.3 and 4.4.4, respectively.

(2) Cover Soil

Covering soil is the basic and the most effective counter-measure to environmental impacts created at the waste disposal sites. Covering soil, which consist of daily/periodical and final covering, shall be carried out at proper times during landfill operation, in order to prevent the waste scattering, offensive odor, harmful insects, waste self-burning, reduction of leachate amount, etc. The main purposes and thickness of each soil cover implemented in this pilot study are shown in the following Table 4.4.1.

Table 4.4.1 Cover Soil Classification

Type of cover soil	Main purposes	Thickness
Daily/ periodical covering ^{*)}	Prevent scattering of waste, diffusion of offensive odor, breeding of harmful vectors, self-burning of waste Reduction of leachate amount Secure trafficability of landfill equipment and collection vehicle	30 cm (top of waste cell) 20 cm (slope of waste cell)
Final covering	Ultimate land use Landscaping Minimize the leachate amount Environmental prevention measures	50 cm

Note: Periodical covering includes “intermediate covering”, which installed for each waste cell.

Procedure for the installation of covering soil in this pilot study is; 1st placed the cover soil near the bottom-end of waste cell by dump truck, 2nd push-up and spread the cover soil from bottom to up along the slope of waste cell by bulldozer, 3rd compaction the soil and waste for several times by bulldozer.

4.4.3 Practice for the Control of Incoming Vehicles and Scavenging Activities

(1) Data Collection and Analysis of Incoming Vehicles

In general, a data collection of incoming vehicles is essential for the following control items of solid waste management.

- Understanding the waste disposal amount will be the basic factor for the waste disposal planning
- Understanding the working hours per trip of each collection vehicle will be the basic factor for the planning of effective collection routes and method
- By checking the incoming vehicles at the entrance of disposal site, it can be possible to instruct them a designated waste haled-in area in the disposal site etc.

- Checking hauled-in waste type and amount are the basic data for collection of tipping fees

Based on the above understandings, data collection of every collection vehicles coming into Al-Bassa disposal site has started on July 15th 2001 as a joint work with Lattakia municipality. Collected data for each vehicle is shown in Table 4.4.2.

Table 4.4.2 Data of Incoming Vehicles

No	Check Item	Description
1	Collection working shift	“Morning shift” or “Night shift”
2	Date	
3	Incoming and departure time	
4	Vehicle registration number	
5	Driver’s name	
6	Vehicle type	
7	Municipality, Contractor, etc.	Lattakia, Jableh, Qurdaha, Other municipality, Private sector, Others
8	Waste type	Domestic, commercial, road & part, construction, industrial, medical, others

Collected data has been analyzed by daily base and weekly base. The sample of weekly base analysis is shown in Figure 4.4.5 (*Week No.7 July 21st-27th 2001*).

(2) Introduction of Smooth Landfill Operation and Safety Scavenging Activities

It was found that the scavenging activities sometimes disturb and cause the delay of landfill works by bulldozer as well as discharging works by collection vehicles. This is because waste-pickers are used to activities very close to the landfill equipment such as when the bulldozer is pushing waste and when the collection vehicles are discharging waste. Dangerous situations between waste-pickers and landfill equipment/ collection vehicles were sometimes observed during the landfill operation. Meanwhile, it was discovered that accidents involving landfill equipment and waste-pickers sometimes happen.

Site inspection carried out by the JICA Study Team found that, on the average, approx. 70% of the waste-pickers are collecting recyclables while discharged by the vehicles, while, 20% are scavenging while pushed by the bulldozer. Remaining 10% are active at other areas of the disposal site.

Based on the above-mentioned understandings, in order to introduce the smooth landfill operation and safety scavenging activities, JICA Study Team proposed to create two working phases at the pilot study area. Namely, working phase at the disposal site shall be separated between landfill operation area (Working Phase-1), and both waste discharging and scavenging area (Working Phase-2).

Each activity should be carried out alternately: i.e. on the first day, landfill works are in working phase-1. Waste discharging as well as scavenging activities shall be in working phase-2; then on the second day, landfill works are in working phase-2, both waste discharging and scavenging activities shall be in working phase-1, and so on.

This landfill method has been started on August 10th 2001 and is continuing. Site inspectors appointed by the Lattakia municipality are instructing landfill operators,

vehicle drivers, and waste-pickers everyday at which working phase they should work. A conceptual drawing of this landfill work is shown in Figure 4.1.2.

(3) Improvement of Sanitary Conditions of Waste-pickers

In August 9th 2001, JICA Study Team in cooperation with its counterpart team organized a meeting with waste-pickers (60 persons), collection vehicle drivers (25 persons), and landfill operators (5 persons) at the control house located in the pilot study area of Al-Bassa. The major purpose of the meeting designated by the JICA Study Team is to ensure safe and smooth landfill operations (mentioned above article (2)), as well as to improve the sanitary conditions of the scavenging activities.

In the meeting, *JICA Study Team* guided the waste-pickers to prevent the direct contact between their bodies and the waste which may contain dangerous substances by wearing gloves, boots... etc. Boots were distributed to all the waste-pickers attended the meeting.

Additionally, the meeting itself was worthwhile for all parties including the waste-pickers because it was their first opportunity to communicate with each other. It will be the starting point to realize the coexistence of all parties under the instruction of the municipality.

4.5 MESSAGE THROUGH THE PILOT STUDY

The followings are the messages through the pilot study works.

- Accumulated waste amount was not as much as it appeared to be. Therefore, it was possible to verify that the rehabilitation of Al-Bassa disposal site is not a difficult work and the Syrian side also recognize this.
- It was verified that the cover soil make drastically reduced the generation of flies, self-burning of waste and offensive odors.
- Controlled landfill introduced in the pilot study has was accepted by the Syrian side as a basic landfill system.
- Introduction of two working phases in the disposal site was essential for the smooth landfill operations and safety scavenging activities.
- Waste-picker's participation was practiced and verified. It is recommended that waste-picker's participation shall be continuously introduced to maintain safe operation and sanitary condition.
- The efforts of the Syrian side on the implementation of the pilot study were sufficient. It is expected that the Syrian side will responsibly continue with the proper landfill work.

Photos showing "Before" and "After" the implementation of the pilot study is shown in Figure 4.4.6.

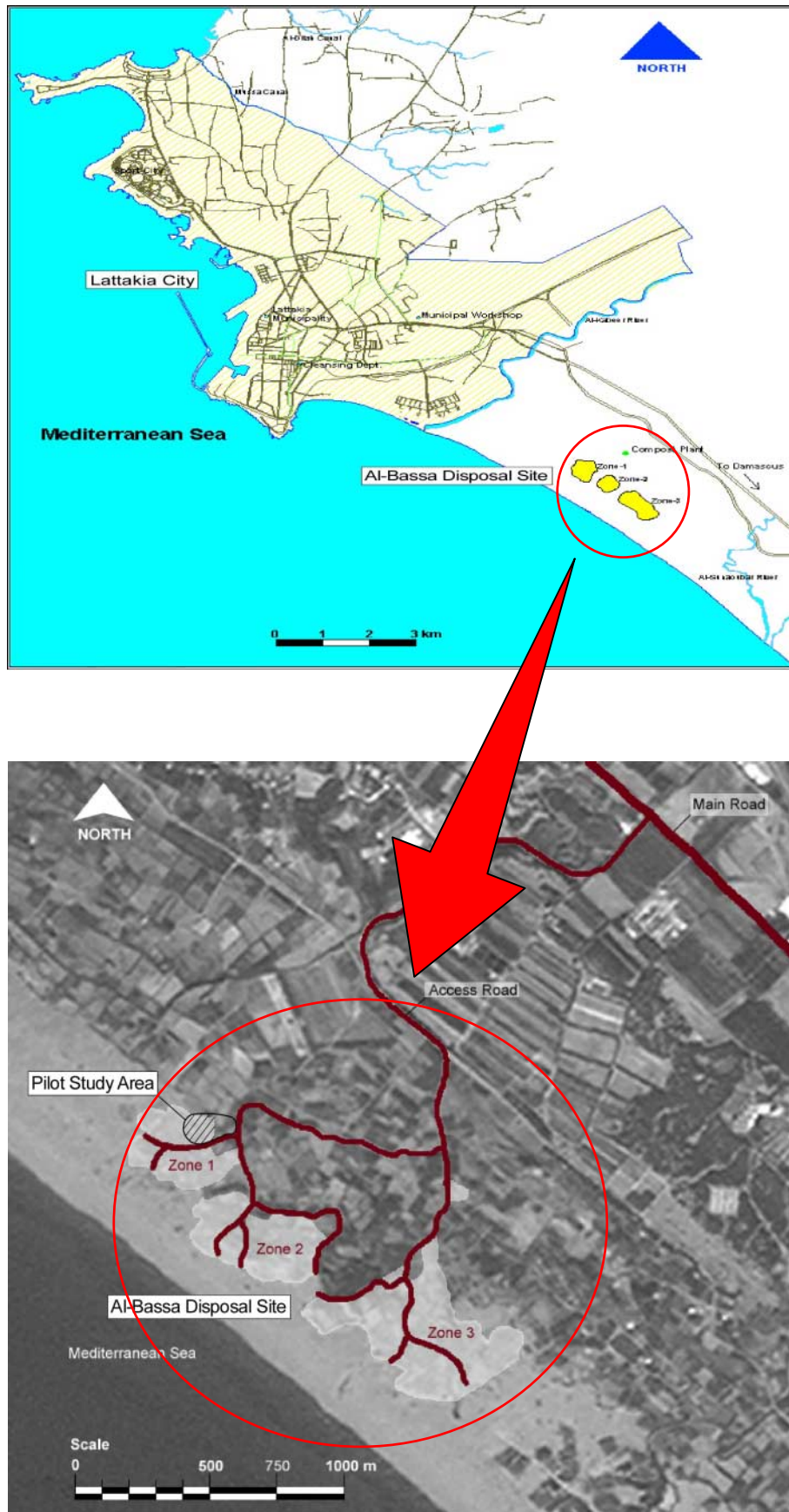


Figure 4.1.1 Location of the Pilot Study Area

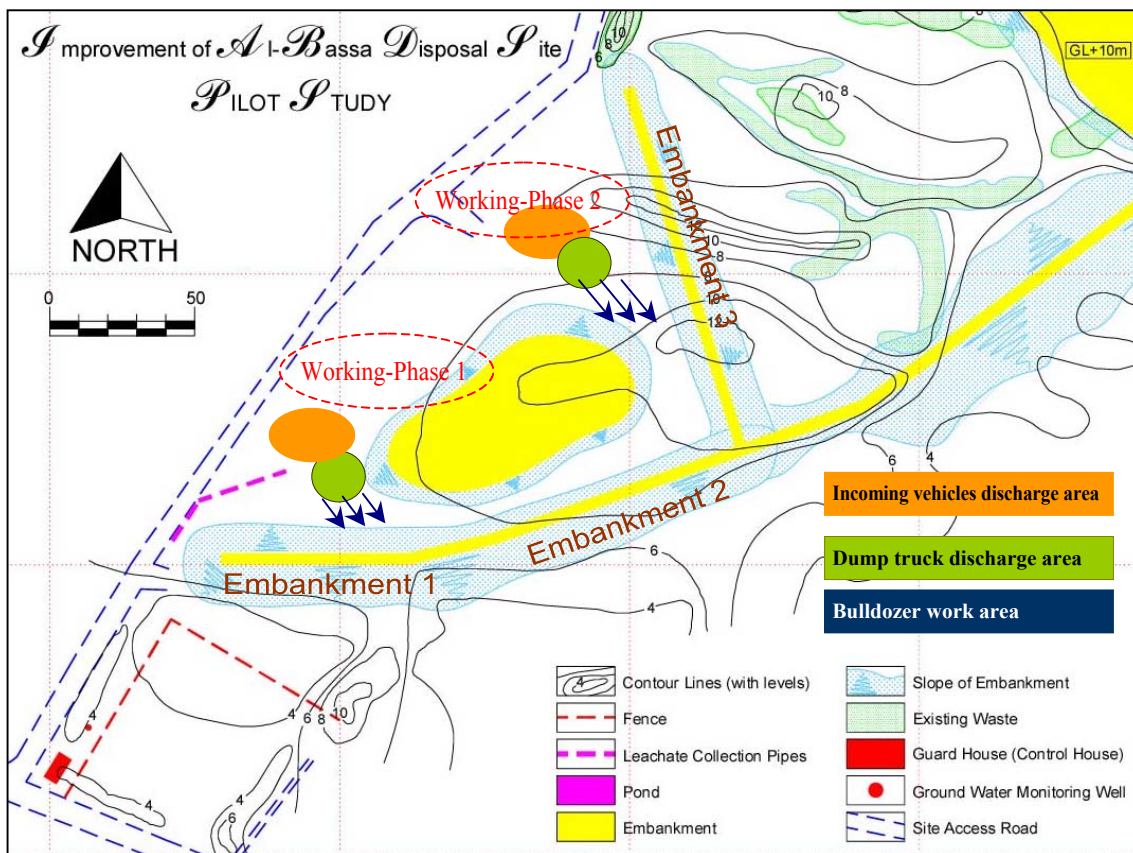
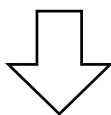
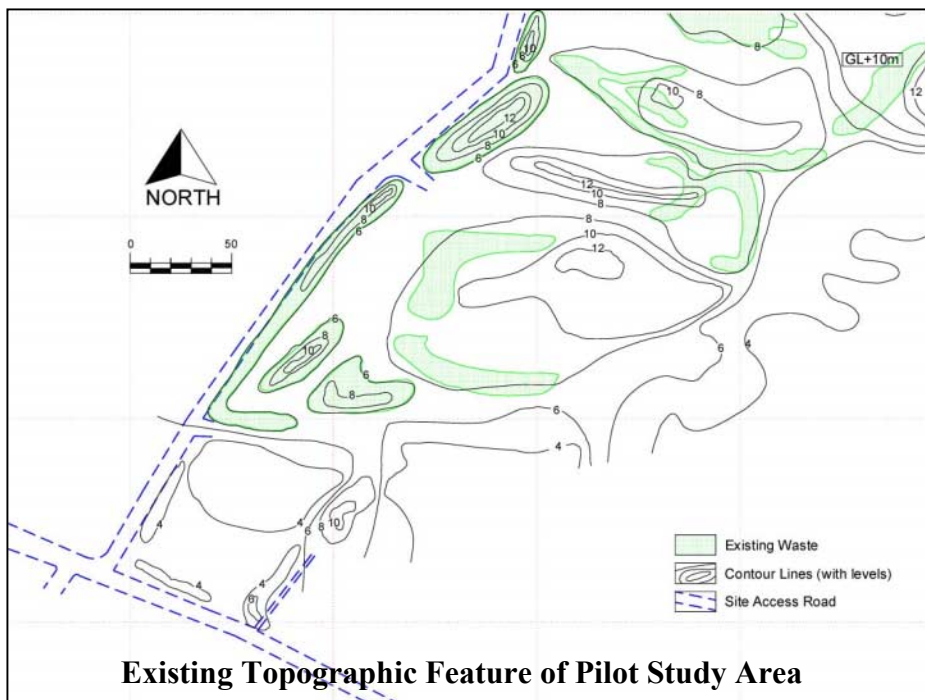


Figure 4.1.2 Site Plan of Pilot Study



Guard-House & Signboard



Fence



Monitoring Well



Leachate Collection Pipe



Gas Removal Pipe



Embankment

Figure 4.1.3 Photo of Control Facilities



<Rearrangement of Existing Accumulated Waste as a Core of Embankment>

Figure 4.4.1 Rehabilitation of Pilot Study Area

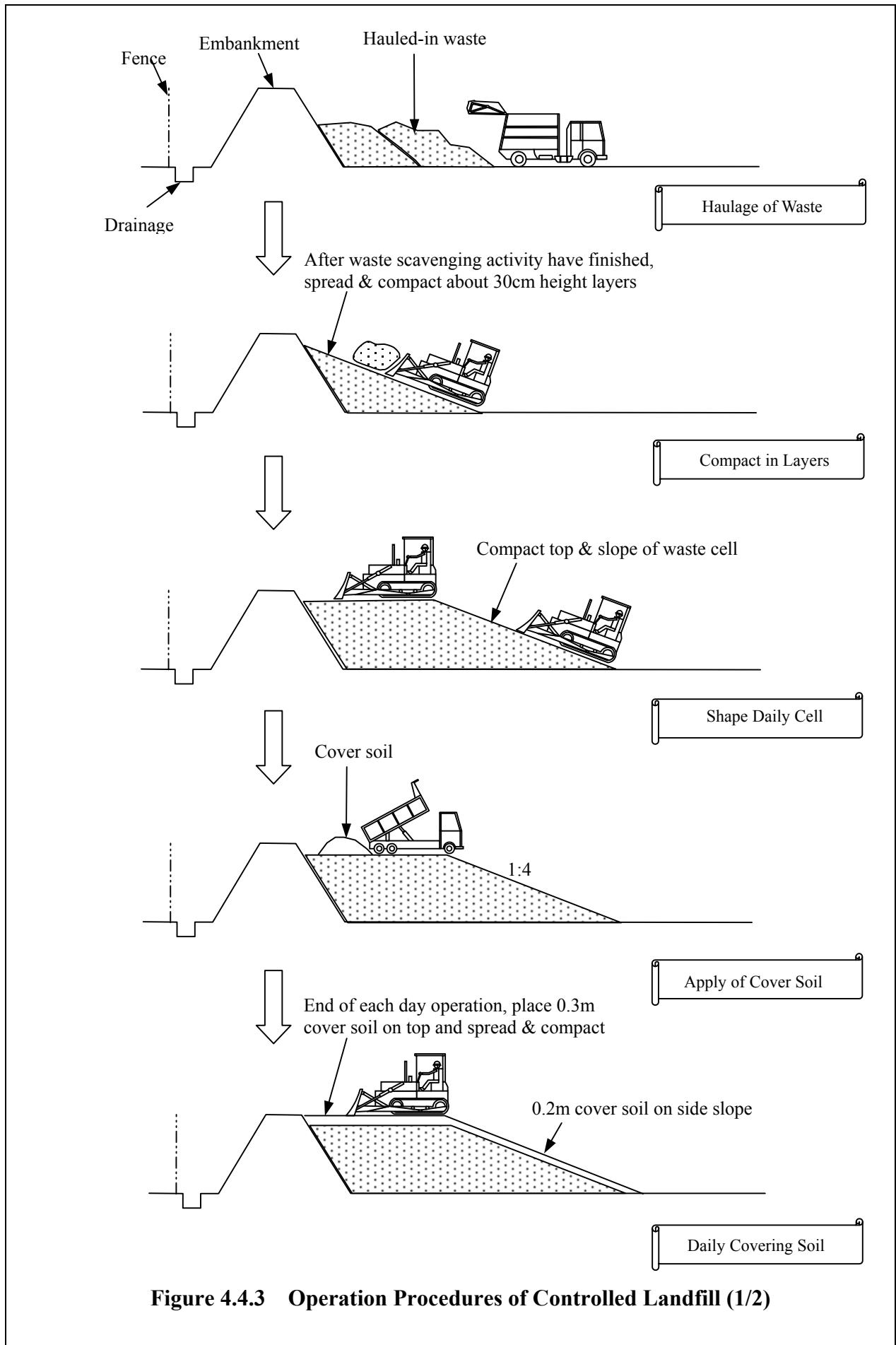


Figure 4.4.3 Operation Procedures of Controlled Landfill (1/2)

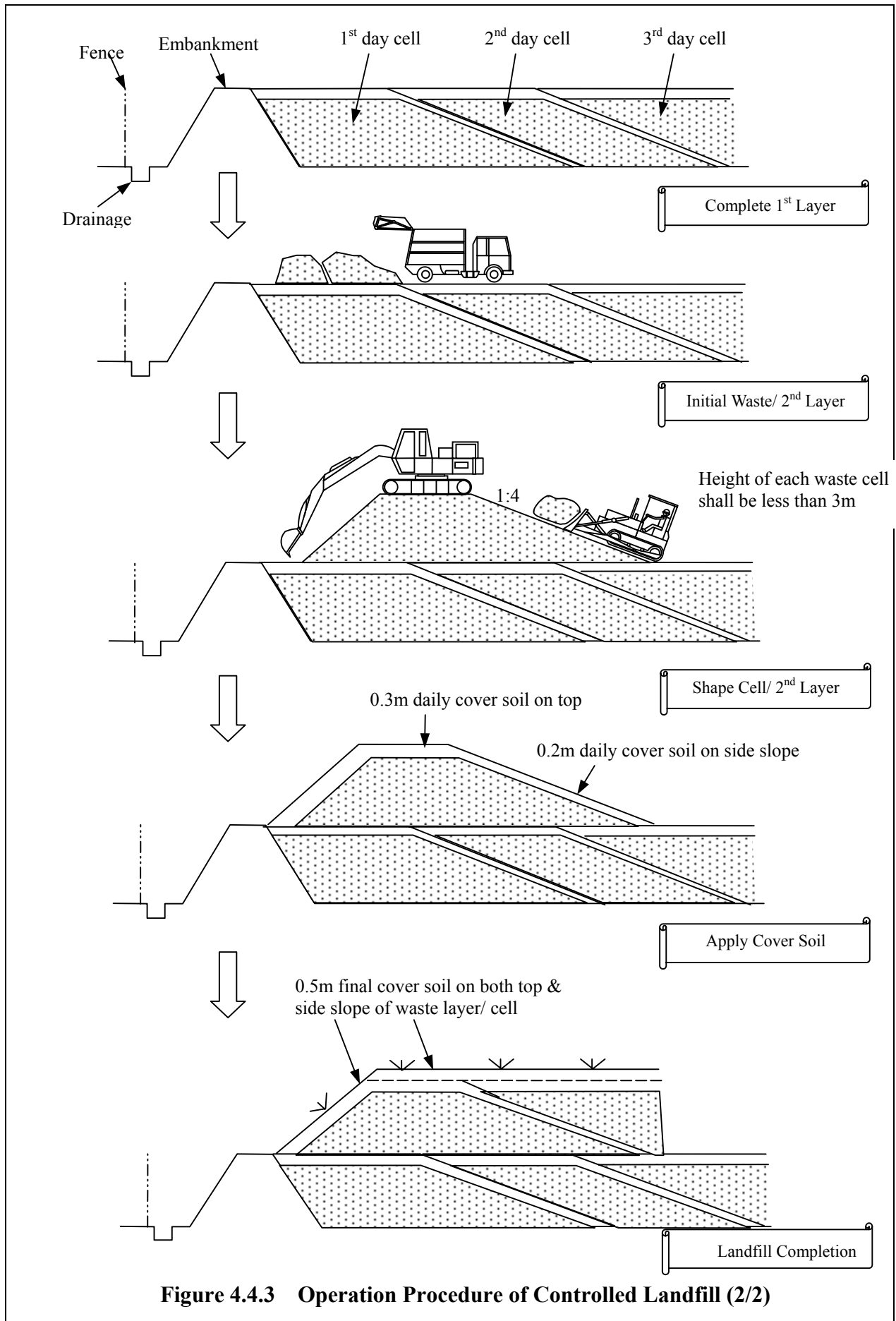


Figure 4.4.3 Operation Procedure of Controlled Landfill (2/2)



<Landfill Operation (Cell Method) with Waste Compaction and Cover Soil>

Figure 4.4.4 Landfill Operation Procedure

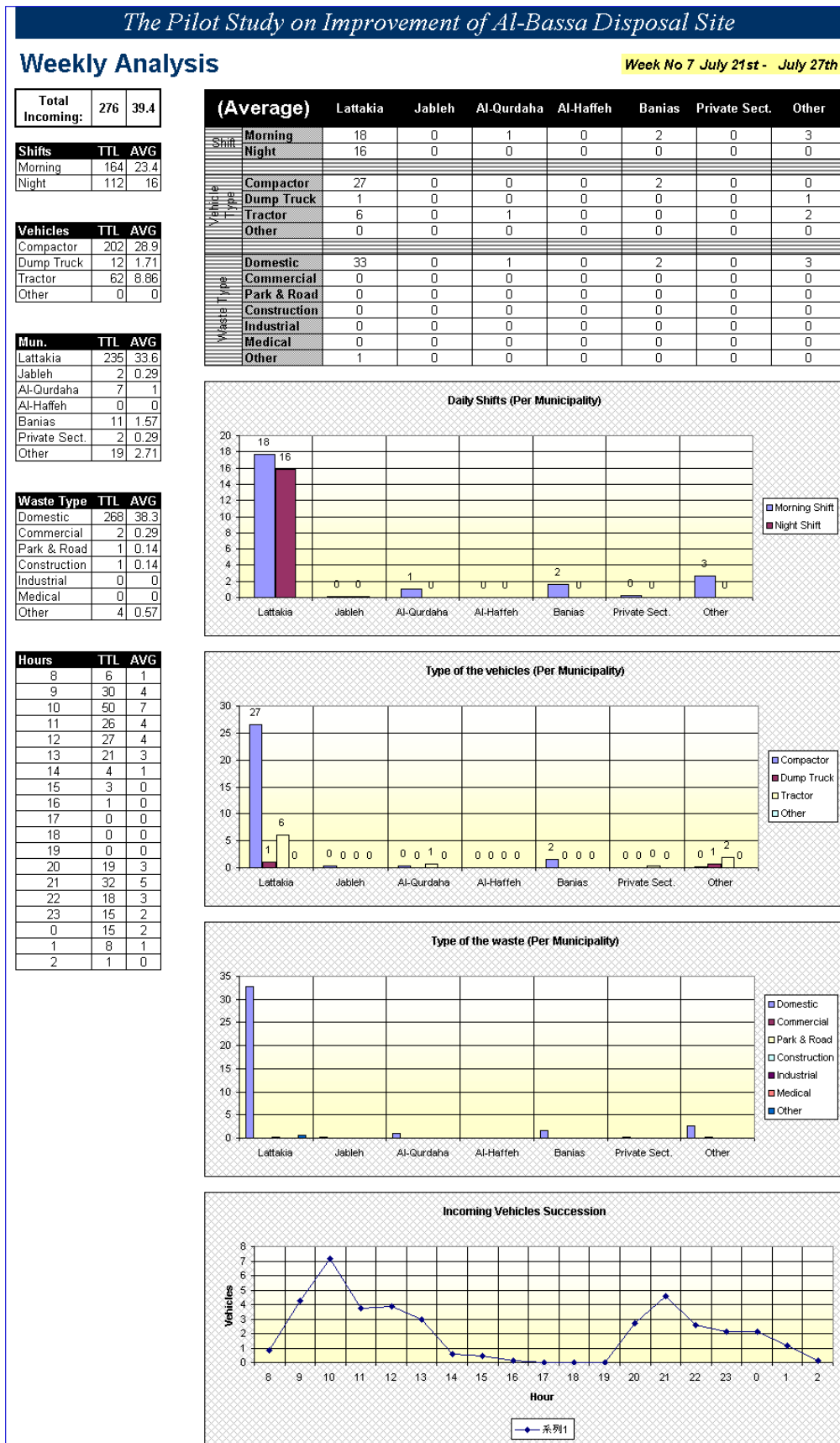


Figure 4.4.5 Weekly Base Analysis of Incoming Collection Vehicles



Figure 4.4.6 Before & After the Pilot Study