

**THE BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT OF SUPPLYING EQUIPMENT  
FOR  
NEW LANDFILL SITE OF MADONA-GHABAWI  
IN  
THE HASHEMITE KINGDOM OF JORDAN**

**OCTOBER 2004**

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
YACHIYO ENGINEERING CO., LTD.**

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## PREFACE

In response to a request from the Government of the Hashemite Kingdom of Jordan, the Government of Japan decided to conduct a basic design study on the Project of Supplying Equipment for New Landfill Site of Madona-Ghabawi in Jordan and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Jordan a study team from June 13 to July 9, 2004.

The team held discussions with the officials concerned of the Government of Jordan, and conducted a field study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Jordan in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Hashemite Kingdom of Jordan for their close cooperation extended to the teams.

October, 2004

Seiji Kojima  
Headquarters  
Japan International Cooperation Agency

October, 2004

## **LETTER OF TRANSMITTAL**

We are pleased to submit to you the implementation review study report on the Project of Supplying Equipment for New Landfill Site of Madona-Ghabawi in the Government of the Hashemite Kingdom of Jordan.

This study was conducted by Yachiyo Engineering Co., Ltd., under a contract to JICA, during the period from June, 2004 to October, 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Jordan and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

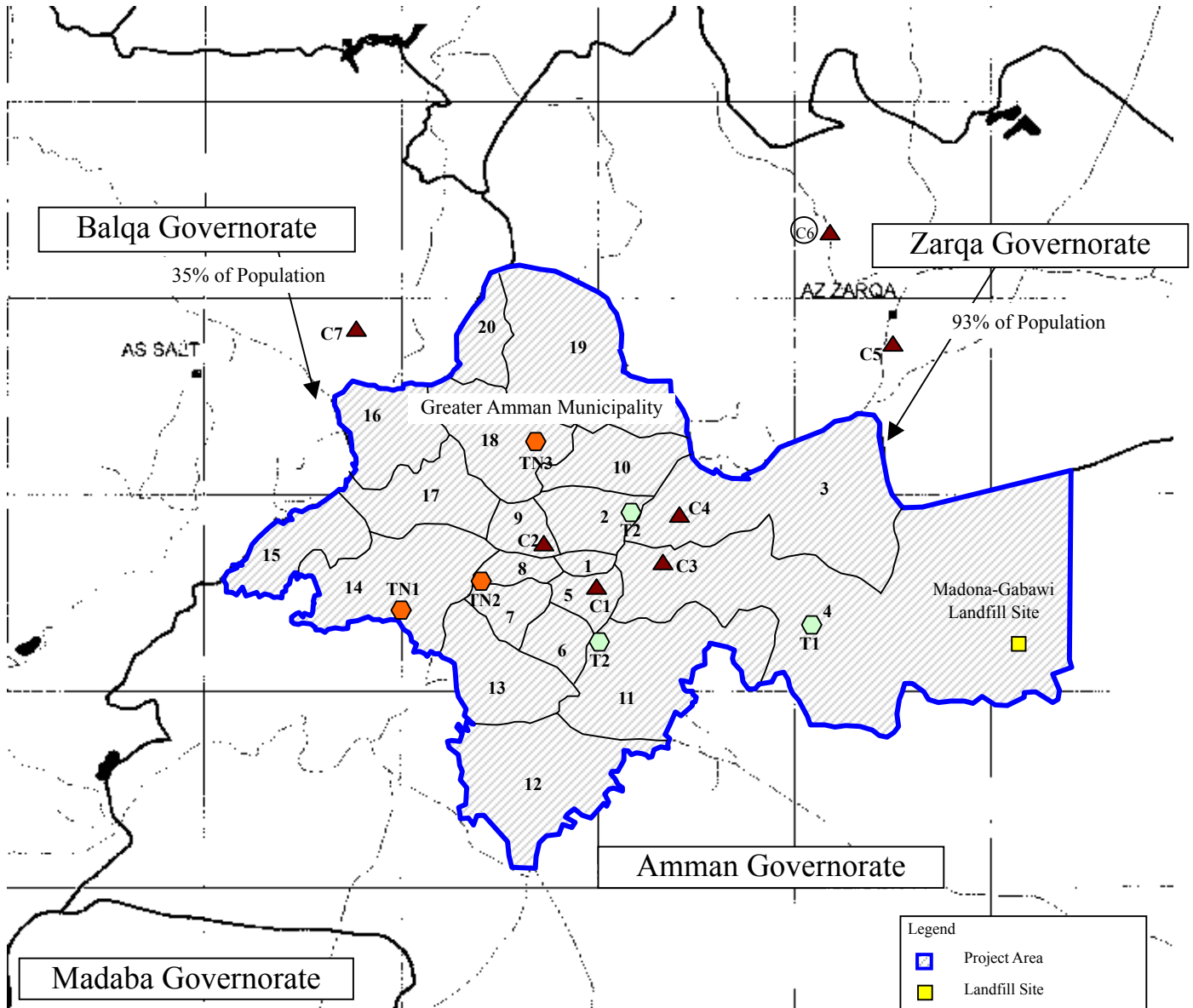
Very truly yours,

Masahiro Takeuchi

Project Manager,  
Basic Design Study Team on the  
Project of Supplying Equipment for New  
Landfill Site of Madona-Ghabawi  
Yachiyo Engineering Co., Ltd.



**THE HASHEMITE KINGDOM OF JORDAN**



(Unit : km<sup>2</sup>)

No.	Name	Area	No.	Name	Area
1	MADINA	2.4	20	ABU NASIER	6.8
2	BASMAN	15.6	Total		657.0
3	MARQA	62.4	Palestinian Refugee Camp		
4	NASIR	197.5	C1	AL-WIHDAT	
5	YARMOUK	5.2	C2	EL-HUSSEIN	
6	RAS-AL-AIN	6.7	C3	PRINCE HASSAN	
7	BADER	9.8	C4	HITTEEN (MARQA)	
8	ZAHRAN	13.8	C5	ZARQA	
9	ABDALI	11.0	C6	SUKHNEH	
10	TARIQ	24.6	C7	BAQA'A	
11	QUEISMEH	50.6	Existing Transfer Station		
12	KHRBET AL SOUK	54.4	T1	AL-SHAAR	
13	MUQABALEIN	23.2	T2	EINGHAZAL	
14	WADI-AL-SIR	38.2	T3	YARMOUK	
15	NEW BADER	16.4	Proposed Transfer Station		
16	SWEILEH	19.4	TN1	ZAHRAN	
17	TLA-AL-ALI	25.2	TN2	WADI-AL-SIR	
18	JBEIHA	28.4	TN3	AL-JBEIHA	
19	SHAFABADRAN	45.4			

**Legend**

- Project Area
- Landfill Site
- ▲ Palestinian refugee camp
- ◻ Existing Transfer Station
- ◻ Proposed Transfer Station



0 1 2 3 4 5km



**PROJECT SITE**

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## Abbreviations

E/N	Exchange of Notes
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
HP	Horse Power
IEE	Initial Environmental Examination
JD	Jordanian Dinar
JICA	Japan International Cooperation Agency
JUST	Jordan University of Science and Technology
M/D	Minutes of Discussion
MOGA	Municipality of Greater Amman
M/P	Master Plan
PDM	Project Design Matrix
PS	Pferde Starke
ROPS	Roll Over Protective Structure
TMS	Time and Motion Study
TOR	Terms of Reference
TSS	Total Suspended Solid
TVSS	Total Volatile Suspended Solid

## **SUMMARY**

## Summary

In areas covering the Municipality of Greater Amman (MOGA) (area of 657 km<sup>2</sup> and population of 1.35 million), which is the capital of the Hashemite Kingdom of Jordan (Jordan), the adjacent Municipality of Zarqa (population of 0.39 million) and other neighbouring towns and villages, the amount of generated solid waste is expected to increase from some 2,400 tons/day (2002) to some 3,500 tons/day in 2010 with a constant increase of the population.

Meanwhile, a decision was taken in 2003 to close the Ruseifeh Landfill Site because of (i) the occurrence of such environmental problems as bad odour and the scattering of waste, adversely affecting the inhabitants of the neighbouring area which had been developed for residential purposes, and (ii) the reduced capacity to receive waste for landfill.

Following this decision, the MOGA constructed a new landfill site capable of receiving waste up to 2025 at Madona-Ghabawi located some 30 km east of the city. For the construction of this new landfill site, the plan was formulated with French assistance and the EIA was conducted by Queen Rania Al-Abdullah Center for Environmental Science & Technology of the Jordan University of Science and Technology prior to its construction.

Meanwhile, the MOGA has been experiencing several problems regarding the solid waste management work of collection in the city, transfer and final disposal, including serious concern regarding a rapid decline of the collection capacity as well as efficiency due to aging of the vehicles, the low collection rate in areas of low income people as there is a shortage of compactors which are suitable for the narrow roads in these areas and the inability to apply a proper landfill method at the final disposal (landfill) site because of the shortage of equipment. In fact, the MOGA prepared the Implementation of a Global Solid Waste Management Scheme in 2002 which is the master plan for solid waste management (hereinafter referred to as the solid waste management M/P) for the purposes of constructing and operating final disposal (landfill) sites as well as transfer facilities and improving solid waste collection in the city.

Against this background, the Government of Jordan has requested (i) the procurement of waste collection vehicles, (ii) the procurement of landfill site equipment, (iii) the procurement of transfer station vehicles and (iv) the procurement of operation and maintenance vehicles, all of which are proposed by the solid waste management M/P, in its attempt to efficiently operate the solid waste management service.

Because of the possibility that the Project could affect the environment, a preliminary study was conducted by Japan International Cooperation Agency (JICA) prior to the basic design study and it was confirmed that the EIA (Environmental Impact Assessment) findings at the Madona-Ghabawi Landfill Site where the requested landfill site equipment will be used meet the requirements under the JICA Guidelines for Environmental and Social Considerations as well as the Guidelines Regarding Grant Aid for Solid Waste Management. Moreover, the present Basic Design Study Team confirmed that the subject matters of the preliminary study on environmental impacts had not changed after the preliminary study, posing no fresh problems, and also conducted an IEE (Initial Environmental Examination) survey on the possible adverse environmental and social impacts of the three new transfer stations for which the provision of new equipment is planned under the Project, confirming the suitability of the Project.

The same preliminary study found that the equipment procured under the Project for Improvement of Solid Waste Management in the Greater Amman (hereinafter referred to as the “Phase 1 Project”) is well maintained and is still in working order today (2004) even though it has exceeded the common depreciation period of seven years for the type of equipment in question.

As a result of preliminary study mentioned above, Japanese government decided to implement basic design for this study. Japan International Cooperation Agency (JICA) dispatched Basic Design Study Team (hereinafter referred to as “the study team”) to Jordan from 13th of June 2004 to 9th of July 2004. The study team discussed with Jordanian government officials such as Ministry of Planning and International Cooperation, Municipality of Greater Amman, etc., and confirmed adequacy of requested contents, implemented field survey of current conditions of study area, and collect the relevant data.

During this period, the study team discussed the necessary for and specifications of the requested vehicles and equipment and also studied the conditions of the existing vehicles and equipment in detail. It was found that the number of small compactors was insufficient to efficiently conduct waste collection in low income areas, including Palestinian refugee camps; therefore, small compactors had a higher priority than medium or large compactors. In the case of transfer station vehicles, open-type trailers were given high priority because of the deterioration of the existing vehicles. Another finding was the low priority of landfill compactor among the range of landfill equipment.

Based on these study findings, the relevance of the waste management vehicles and equipment in the project area was confirmed and the draft basic design, including the soft

component, was prepared, taking the vehicle/equipment operation and maintenance capability of the MOGA into consideration.

Following the completion of this draft basic design, the JICA dispatched a Draft Report Explanation Team (hereinafter refers to as “the explanation team”) to Jordan from 3rd to 10th of September 2004 to explain the outline of the basic design and to discuss the planned contents.

The principles of the basic design for the improvement of equipment (including the present situation), equipment plan and soft component plan based on the basic design study are outlined in the following table.

#### Basic Design Policy

Items		Policy	
Target year		2010	Current (2003)
Solid Waste Collection Amount in MOGA		2,387 t/d	1,752 t/d
Solid Waste Generated Amount in Target Areas		3,483 t/d	2,520t/d
Collection Ratio	MOGA	95%	92%
	Low income area (including seven Palestinian refugee camps)	90%	60%

#### Outline of Equipment Plan

Classification	Items	Specifications or Equivalence	Initial Request
Waste Collection Vehicle	- Inter City Compactor (Small)	4 m <sup>3</sup> class	20
	- Inter City Compactor (Medium)	8 m <sup>3</sup> class	4
	- Inter City Compactor (Large)	16 m <sup>3</sup> class	5
Transfer Station Vehicle	- Long Chassis Open-type Trailer	40m <sup>3</sup> class	8
	- Tractor Head for Trailer	230 PS class	6
Landfill Site Equipment	<i>Garbage Disposal Machinery</i>		
	- Bulldozer (Small)	180 HP class	2
	- Bulldozer (Middle)	220 HP class	2
	<i>Soil Excavation Machinery</i>		
	- Bulldozer (Large)	320 HP class	1
	- Backhoe	125 HP class	2
	- Wheel Loader	200 HP class	3
Operation and Maintenance Vehicle	- Dozer Shovel	125 HP class	2
	- Motor Grader	150 HP class	1
	- Vibratory Roller	120 HP class	1
	- Water Tanker (Sprinkler truck)	6m <sup>3</sup>	2
	- Double Cab Pick Up	5 Seats class	2
	- Dump Truck	10 m <sup>3</sup>	6
Total	- Passenger Bus for the Landfill Staff	30 seats class	1
	- Mobile Workshop	4x2, 160 PS class	1
			69

### Outline of Soft Component Plan

Items	Activities
1. Technical assistance on landfill operation	Advice and technical assistance required to establish the pushing-up cell type landfill method
2. Technical assistance on equipment operation	<ul style="list-style-type: none"> <li>• Advice and technical assistance for implementation of a TAM survey</li> <li>• Advice for the formulation of an optimal collection/transportation route plan</li> </ul>

If the Project is implemented with grant aid provided by the Government of Japan, the total project cost is estimated to be ¥1,687 million (Japanese portion of approximately ¥743 million and Jordanian portion of approximately ¥944 million). The anticipated implementation period of the Project consists of 1.5 months for the detailed design, 2.0 months for the tender and selection of suppliers and 8.0 months for equipment procurement.

As the implementation of the Project is expected to have the positive effects listed below, it is believed that the Project is highly urgent as well as beneficial.

- As a result of procurement of collection and transportation vehicles, the solid waste collection ratio for the entire MOGA will improve from the current 92% (2003) to 95% in the target year of 2010. In Palestinian refugee camps and areas of low income people in particular, the solid waste collection ratio will greatly improve from the current some 60% to 90% in the target year. The total service population will amount to 3,827 thousand in the year 2010.
- As a result of procurement of transfer station vehicles, the handling capacity at transfer stations will increase from the present 900 tons/day to 2,300 tons/day.
- The newly procured landfill site equipment will make pushing-up cell type landfilling, which is the proper landfilling method, possible, allowing sufficient compaction to prolong the life of the landfill site and safer operation. Besides, as the MOGA can construct the No. 2 and No. 3 cells without external assistance, landfill operation can be properly planned and implemented.
- The procurement of new operation and maintenance vehicles will have the following effects: 1) improvement of the hygiene conditions at the landfill site; 2) speedy and more extensive patrols to monitor the situation of solid waste collection; 3) improvement of efficiency of the transportation of soil, etc. at the landfill site; 4) securement of means of commuting for some 70 landfill site workers and management staff and 5) quicker response to break downs of the

operation and maintenance vehicles as well as heavy equipment.

The planned vehicles and equipment will be operated and maintained by the MOGA which employs some 4,500 people for waste management to conduct the collection and transportation of waste of some 2.08 million people living in the municipality and also to conduct maintenance work regarding waste disposal for some three million people in the MOGA and its surrounding area at present (2003). No problems are anticipated in regard to the maintenance capability of the MOGA as the municipality currently operates and maintains vehicles and equipment of the same level as those to be procured under the Project. The personnel required to operate the planned vehicles and equipment under the Project will be secured through the redeployment and training of existing personnel.

In the financial aspect, the MOGA has continually allocated some 12% of the municipal budget to waste management in the last five years and this waste management operation and maintenance budget appears to be sufficient. Waste management by the MOGA in the post-project period is assured as it is expected that the operation and maintenance budget will maintain its present share of the municipal budget due to increased revenue from the service charge, etc. as a result of the increased waste disposal volume. While it will be necessary for the MOGA to provide large funding following the implementation of the Project as described earlier, the scale of the required funding is believed to be within its funding capability given the facts that the MOGA has official expressed in writing its commitment to providing such funding and that the MOGA has appropriate an adequate budget in the past (in 2001, the MOGA secured some ¥900 million for investment in the solid waste management sector).

In the environmental aspect, the Jordanian side has conducted an EIA. The JICA's Preliminary Study Team established that the contents and findings of this EIA conform to both the Guidelines Regarding Grant Aid for Solid Waste Management and the JICA Guidelines for Environmental and Social Considerations. Moreover, the IEE (Initial Environmental Examination) conducted by the Basic Design Study Team for the new transfer stations to be constructed by the Jordanian side also found that the Project will not have any major adverse impacts in terms of the environmental and social considerations.

The MOGA is required to complete the following work for the Project by the time set forth for the successful implementation of the Project and also for the sustained operation and maintenance of waste management using the new vehicles and equipment in the post-project period.

- (1) Construction of new transfer stations
  - Acquisition of land at the planned construction sites
  - Construction of the transfer stations
- (2) Construction of the No. 2 cell at the Madona-Ghabawi Landfill Site
- (3) Environmental monitoring at the Madona-Ghabawi Landfill Site
- (4) Purchase of spare parts

The implementation of the work listed above is essential for the implementation of the Project with the grant aid cooperation of the Government of Japan. The MOGA has committed itself to the establishment of a proper project implementation system and the implementation of its obligatory undertakings without fail in an official document. Accordingly, the implementation of the Project is feasible, highly significant and highly relevant to the objectives of Japan's grant aid scheme.



Preface	
Letter of Transmittal	
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# **CHAPTER 1 Background of the Project**

## **Chapter 1 BACKGROUND OF THE PROJECT**

### **1.1 Background and Outline of the Request for Grant Aid**

In areas covering the Municipality of Greater Amman (MOGA) (area of 657 km<sup>2</sup> and population of 1.35 million), which is the capital of the Hashemite Kingdom of Jordan (Jordan), the adjacent Municipality of Zarqa (population of 0.39 million) and other neighbouring towns and villages, the amount of generated solid waste is expected to increase from some 2,400 tons/day (2002) to some 3,500 tons/day in 2010 with a constant increase of the population.

Meanwhile, a decision was taken in 2003 to close the Ruseifeh Landfill Site because of (i) the occurrence of such environmental problems as bad odour and the scattering of waste, adversely affecting the inhabitants of the neighbouring area which had been developed for residential purposes, and (ii) the reduced capacity to receive waste for landfill.

Following this decision, the MOGA constructed a new landfill site capable of receiving waste up to 2025 at Madona-Ghabawi located some 30 km east of the city. For the construction of this new landfill site, the plan was formulated with French assistance and the EIA was conducted Queen Rania Al-Abdullah Center for Environmental Science & Technology of the Jordan University of Science and Technology prior to its construction.

Meanwhile, the MOGA has been experiencing several problems regarding the solid waste management work of collection in the city, transfer and final disposal, including serious concern regarding a rapid decline of the collection capacity as well as efficiency due to aging of the vehicles, the low collection rate in areas of low income people as there is a shortage of compactors which are suitable for the narrow roads in these areas and the inability to apply a proper landfill method at the final disposal (landfill) site because of the shortage of equipment. In fact, the MOGA prepared the Implementation of a Global Solid Waste Management Scheme in 2002 which is the master plan for solid waste management (hereinafter referred to as the solid waste management M/P) for the purposes of constructing and operating final disposal (landfill) sites as well as transfer facilities and improving solid waste collection in the city.

Against this background, the Government of Jordan has requested (i) the procurement of waste collection vehicles, (ii) the procurement of landfill site equipment, (iii) the procurement of transfer station vehicles and (iv) the procurement of operation and

maintenance vehicles, all of which are proposed by the solid waste management M/P, in its attempt to efficiently operate the solid waste management service.

Because of the possibility that the Project could affect the environment, a preliminary study was conducted by Japan International Cooperation Agency (JICA) prior to the basic design study and it was confirmed that the EIA (Environmental Impact Assessment) findings at the Madona-Ghabawi Landfill Site where the requested landfill site equipment will be used meet the requirements under the JICA Guidelines for Environmental and Social Considerations as well as the Guidelines Regarding Grant Aid for Solid Waste Management. Moreover, the present Basic Design Study Team confirmed that the subject matters of the preliminary study on environmental impacts had not changed after the preliminary study, posing no fresh problems, and also conducted an IEE (Initial Environmental Examination) survey on the possible adverse environmental and social impacts of the three new transfer stations for which the provision of new equipment is planned under the Project, confirming the suitability of the Project.

The same preliminary study found that the equipment procured under the Project for Improvement of Solid Waste Management in the Greater Amman (hereinafter referred to as the "Phase 1 Project") is well maintained and is still in working order today (2004) even though it has exceeded the common depreciation period of seven years for the type of equipment in question.

Following the preliminary study, the basic design study was conducted to examine the contents of the Jordanian request in detail to establish a project with an appropriate scale and contents. The finally confirmed contents of the Jordanian request are shown in Table 1.2-1.

**Table 1.2-1 Items Requested by the Jordanian Side**

<b>Classification</b>	<b>Items</b>	<b>Specifications or Equivalence</b>	<b>Initial Request</b>
Waste Collection Vehicle	- Inter City Medium Size Compactor	4 – 8 m <sup>3</sup>	20
	- Inter City Large Compactor	8 – 16 m <sup>3</sup>	10
Transfer Station Vehicle	- Long Shassis Compacting Trainl	30 – 50m <sup>3</sup>	8
	- Tractor Head for Trail		6
Landfill Site Equipment	<u><i>Garbage Disposal Machinery</i></u>		
	- Bulldozer (Small)	180 HP	2
	- Bulldozer (Middle)	220 HP	2
	- Landfill Compactor	30 – 40 Ton	1
	- Wheel Loader	215 HP + Bucket	3
	- Dozer Shovel	135 HP + Bucket	2
	- Backhoe	125 HP	2
	<u><i>Soil Excavation Machinery</i></u>		
	- Bulldozer (Large)	320 HP	1
	- Motor Grader	155 HP	1
- Vibratory Roller	133 HP	1	
Operation and Maintenance Vehicle	- Water Tanker (Sprinkler truck)	6 – 8 m <sup>3</sup>	3
	- Double Cab Pick Up	5 Seats	2
	- Dump Truck	8 – 10 m <sup>3</sup>	6
	- Passenger Bus for the Landfill Staff	20 Seats	1
	- Mobile Workshop	Aluminum Van Body, 4 x 4, 9 ton	1

## **CHAPTER 2 Contents of the Project**

## **CHAPTER 2 CONTENTS OF THE PROJECT**

### **2.1 Basic Concept of the Project**

#### **2.1.1 Overall Goal and Project Target**

Jordan has set the overall goal of improvement of environment in the urban areas through implementing the following action plan mentioned in the superordinate plans such as the National Socio-Economic Development Plan, Agenda 21, Solid Waste Management M/P, etc.;

- 1) Improvement of environment management skill
- 2) Upgrading of solid waste collection ratio (75% for the whole Jordan and 100% for MOGA by the year 2015)
- 3) Application of effective method for collection, transportation, treatment and disposal of solid waste

To the above overall goal, this project has targets of upgrading the solid waste collection ratio of MOGA from 90% in 2002 to 95% in 2010 and improvement of solid waste management skill for collection, transportation and disposal through the procurement of solid waste management vehicles and equipments of waste collection vehicles, transfer station vehicles, final disposal equipments and vehicles for maintenance and operation.

#### **2.1.2 Basic Concept of the Project**

To achieve the project target described above, the following inputs and actions are planned under the Project. Through this inputs and actions, the MOGA will acquire landfill equipment, transfer vehicles and collection vehicles and will be able to sufficient conduct its solid waste collection service and adequate disposal.

- (1) Projects included in the Japanese Cooperation
  - 1) Procurement of waste collection vehicles
  - 2) Procurement of transfer station vehicles
  - 3) Procurement of equipment for final landfill site
  - 4) Procurement of vehicles for operation and maintenance
  - 5) Technical assistance for solid waste management using the procured vehicles and equipment (soft component)



(2) Obligatory for the Jordanian Side

- 1) Construction of three new transfer stations
- 2) Construction of a second cell at the Madona-Ghabawi Landfill Site
- 3) Construction of a leachate treatment facility at the Madona-Ghabawi Landfill Site
- 4) Implementation of environmental monitoring at the Madona-Ghabawi Landfill Site
- 5) Deployment of the necessary personnel for the collection vehicles, transfer stations and landfill site
- 6) Arrangement of the budget required for the construction work described above and operation and maintenance of the vehicles and equipment
- 7) Formulation of plan for appropriate collection and disposal of waste

## **2.2 Basic Design of the Requested Japanese Assistance**

### **2.2.1 Design Policy**

(1) Basic Policies

The basic design policies for the Project are listed below.

- To determine the optimum specifications and quantities of the vehicles and equipment to be procured, taking the current conditions as well as future plan for the entire solid waste management system featuring such subjects as the solid waste amount, collection method, transfer system and final disposal site management, etc. into consideration
- To prepare an equipment plan which takes the impacts on the environment and society into full consideration
- To prepare an equipment plan which takes procurement from third countries into consideration in view of the post-project maintenance and economical operation of the procured vehicles/equipment, including the ease of spare parts procurement and the availability of after-services by manufacturers in Jordan
- To examine the necessity and an effective method of soft assistance, including soft components and technical cooperation, so that the procured vehicles/equipment are fully utilised in an effective manner

- To treat the requested quantities of the vehicles/equipment as the maximum quantities so that the Jordanian side is responsible for the procurement of vehicles/equipment of which the number exceeds the requested quantity of each type of vehicle/equipment

## (2) Policies Regarding Natural Conditions

As the MOGA is located in a hilly area, there are many steep roads. In addition, roads in the areas inhabited by low income people, including the areas inhabited by Palestinian refugees, are often very narrow. Such road conditions make the operation of large vehicles difficult, making it essential to consider the introduction of small and medium size vehicles to serve these areas. The road width in other areas is relatively wide, allowing the operation of large vehicles without difficulty. The equipment plan for the Project should, therefore, take these road conditions into consideration when examining the specifications of the vehicles/equipment.

## (3) Policies Regarding Socioeconomic Conditions

Roads in densely populated areas currently have no side space for the placement of containers and residents place their solid waste in bags in front of their homes for collection. Small collection vehicles which lack a container lifting mechanism are operated in these areas. Containers are, however, placed in areas where there is a wide enough road width, making it essential for the collection vehicles operating in these areas to be equipped with a container lifting mechanism.

In addition to above, sizes and numbers of vehicles for collection and transfer station will be planned to carry out effective collection and transportation considering appropriate operation of total six numbers of transfer stations to reduce the cost for transportation of wastes.

## (4) Policies Regarding Procurement Conditions

The existing vehicles in the project area were mainly procured from Germany, Sweden and Japan in view of their quality, ease of obtaining spare parts and the reliable after-service provided by manufacturers in these countries. In the light of this situation, the procurement of small vehicles from Japan is intended while ensuring competition by adding third countries to the possible procurement sources for medium size and large vehicles. Meanwhile, although heavy equipment will basically be procured from Japan, that made in third countries will be added to the shortlist depending on the types of equipment to ensure competitive procurement.

(5) Policies Regarding Use of Local Company

Because no local manufacturing, installation or other work is involved in the Project, there is no specific policy regarding use of local company. However, as might be expected, a local company will be used for the transportation of some vehicles/equipment in Jordan.

(6) Policies Regarding Operation and Maintenance Ability of Implementing Body

The section responsible for the operation and maintenance of the vehicles and equipment used for solid waste management in the MOGA is the Machinery Department (i.e. the Central Workshop). This department runs a major workshop in the city where almost all maintenance and repair work is conducted. The control of spare parts is computerised and the systematic planning of spare parts procurement means that a system is in place to immediately respond to the various types of required repairs.

The some 10 year old small compactors (4 m<sup>3</sup>) procured in Phase 1 are still in good working order even though their general expected lifespan has elapsed. This might be due to superior ability of operation and maintenance of equipment.

Considering above-mentioned conditions, the most appropriate equipment plant will be formulated.

(7) Policies Regarding Equipment Grades

In consideration of the current operation and maintenance system, the grades of the new vehicles and equipment are planned to be equal to those of the existing vehicles and equipment procured in Phase 1.

(8) Policies Regarding Procurement Method and Schedule

The main vehicles and equipment of which the procurement is planned under the Project are collection vehicles (compactors), transfer trailers and landfill equipment. As they are not manufactured in Jordan, they must be procured from Japan or third countries. The candidate third countries will be decided taking the ease of obtaining spare parts and the availability of a reliable after-service, etc. into consideration.

The total procurement period will be approximately 11.5 months after the signing of the E/N, consisting of some 1.5 months for the detailed design, some 2 months for the tender and supplier contracts, some 5.5 months for manufacturing and factory inspection and some 2.5 months for transportation and acceptance inspection, etc.

## 2.2.2 Basic Plan

### 2.2.2.1 Basic Conditions

#### (1) Target Year

The target year for the Project is set at 2010 which is five years after the assumed year of handing over (2005) of the vehicles and equipment to be provided under the Project to the Jordanian side.

Accordingly, the design figures for the solid waste amount and others required for preparation of the equipment plan are those applicable for 2010.

#### (2) Target Areas and Design Service Population

##### 1) Target Areas

The target areas of the Project are those shown in Table 2.2.2.1-1.

**Table 2.2.2.1-1 Target Areas of the Project**

Type of Planning	Target Area
Planning of collection and transfer station vehicles	MOGA
Planning of final disposal equipment	MOGA; parts of Zarqa and Balqa Governorates (including seven Palestinian refugee camps)

##### 2) Design Service Population

The design service population in the target year of the Project is set as shown in Table 2.2.2.1-2 based on data obtained from the Demographic Department of the MOGA and the Implementation of the Global Solid Waste Management Scheme (the Master Plan).

**Table 2.2.2.1-2 Design Service Population**

Target Area Year	MOGA	Balqa		Zarqa		Total
		Total Population	35%	Total Population	93%	
2004	2,175,000	363,620	127,270	870,000	809,100	3,111,370
2010	2,760,000	418,190	146,370	990,000	920,700	3,827,070

### (3) Generated Solid Waste Amount

The solid waste amount generated in the target areas in the period from 2002 to 2010 is shown in Table 2.2.2.1-3.

**Table 2.2.2.1-3 Service Population and Generated Solid Waste Amount in Target Areas**

Year	Unit Generation of Solid Waste	MOGA*1		Balqa*2		Zarqa*3		Total	
		Service Population	Generated Solid Waste Amount	Service Population (35% of Total Population)	Generated Solid Waste Amount	Service Population (93% of Total Population)	Generated Solid Waste Amount	Service Population	Generated Solid Waste Amount
		kg/person/day	x 10 <sup>3</sup>	tons/day	x 10 <sup>3</sup>	tons/day	x 10 <sup>3</sup>	tons/day	x 10 <sup>3</sup>
2002	0.83	1,999	1,660	121	101	772	641	2,893	2,401
2003	0.84	2,085	1,752	124	104	791	664	3,000	2,520
2004	0.85	2,175	1,849	127	108	809	688	3,111	2,645
2005	0.86	2,269	1,951	130	112	828	712	3,227	2,775
2006	0.87	2,359	2,053	134	116	846	736	3,339	2,905
2007	0.88	2,454	2,159	137	120	865	761	3,455	3,041
2008	0.89	2,552	2,271	140	125	883	786	3,575	3,182
2009	0.90	2,654	2,389	143	129	902	812	3,699	3,329
2010	0.91	2,760	2,512	146	133	921	838	3,827	3,483

Source: Master Plan

\*1 The service population in MOGA is calculated based on the following conditions.

Base population: 1,917,000 in 2001 (Municipal Demographic Department)

Population Increase Rate: set at 4.3%/year until 2005 and 4.0% from 2006 to 2010, taking the specific conditions of MOGA into consideration as shown below.

<population increase rate>	-2005	-2006-2010
	: 2.8%	2.5%
Population increase due to the inflow of refugees and others from neighbouring countries:	0.5%	0.5%
<u>Population increase due to inflow from other governorates in Jordan following further urbanisation:</u>	<u>1.0%</u>	<u>1.0%</u>
Total	: 4.3%	4.0%

\*2 Balqa: 2002-2005: 2.5%, 2006-2010: 2.3%

\*3 Zarqa: 2002-2005: 2.4%, 2006-2010: 2.2%

The amount of solid waste for the design of each vehicle/equipment is determined as follows based on the figures in the said table.

- ① Design solid waste amount for collection and transfer station vehicles : 2,512 tons/day
- ② Design solid waste amount for landfill site equipment and maintenance vehicles : 3,483 tons/day

(4) Design Composition of Solid Waste

1) Average Composition of Solid Waste

The average composition of the solid waste collected in the target year of 2010 is believed to be similar to that given in the Master Plan (organics: 41.4%; plastics: 14.2%; paper, etc: 12.6% (paper: 6.3%; cardboard: 6.3%); textiles: 6.9% and others). See Table 1.1-11 for further details).

2) Specific Gravity of Waste (Loaded Solid Waste Weight)

The value of the specific gravity of the waste inside the collection and transfer vehicles, i.e. the loaded solid waste weight, which is required for the planning of the solid waste collection and transfer vehicles, is set as shown in Table 2.2.2.1-4 based on relevant data actually measured in Jordan.

**Table 2.2.2.1-4 Design Specific Gravity of Waste (Loaded Solid Waste Weight)**

Category	Type	Volume (m <sup>3</sup> )	Specific Gravity (tons/m <sup>3</sup> )	Loaded Solid Waste Weight (tons)
Collection Vehicle	Large	16	0.42	6.7
	Medium	8	0.40	3.2
	Small	4	0.40	1.6
Transfer Station Vehicle	Open type	40	0.35	14.0

(5) Collection Method and Collection Hours

Based on the planned continuation of the present three shift collection regime in 2010 by the competent authority, the collection method and collection hours shown in Table 2.2.2.1-5 are adopted for the Project.

**Table 2.2.2.1-5 Collection Method and Collection Hours**

	Collection Hours (Shift)		
	Morning	Afternoon	Night
Collection Method	Container collection method		
Transfer Station	Three existing and three new stations		
Working Hours	06:00 – 14:00	14:00 – 22:00	22:00 – 06:00
Work Load Factor	60%	30%	10%
Work Load on Holidays	20%	10%	None

\*Ratio of average total collection amount on week days to collection amount for each shift

(6) Target Collection Ratio and Collection Amount

The target collection ratio for 2010 is 95%, including the Palestinian refugee camps. Accordingly, the target collection amount is 2,387 tons/day which is 95% of the generated solid waste amount of 2,512 tons/day.

(7) Final Disposal

Final disposal is made by means of landfill based on the following design conditions.

- 1) Solid waste amount for landfill : 3,483 tons/day (see Table 2.2.2.1-3)
- 2) Landfill method : pushing-up cell type landfill method
- 3) Soil cover : at least 10% of the disposed solid waste amount

### **2.2.2.2 Plan for Waste Collection and Transfer Station Vehicles**

(1) Waste Collection Vehicles

1) Basic Design Conditions

The following matters are taken into consideration for the planning of the waste collection vehicles.

- The waste collection ratio in the Palestinian refugee camps should be increased to a similar level to that in other areas in MOGA.
- Many of the roads in the Palestinian refugee camps are narrow.
- The working ratio of collection vehicles declines every year.
- Specifications of vehicles are suitable for efficient collection and transportation services.
- Vehicles for which spare parts and after services can be easily obtained in Jordan should be selected.

2) Working Ratio

a. Definition of Working Ratio

The working ratio of a waste collection vehicle is defined as follows.

$$WR = (365 - A - B - C)/365$$

WR : working ratio (%)

- A : non-working days (calculated using the work load on holidays in Table 2.2.2.1-5)
- B : days for periodic inspection and/or repair work
- C : non-working days other than the above (due to unexpected repair work and renewal of the licence, etc.)
- 365 : time conversion factor (One year is equal to 365 days)
- 7 : time conversion factor (One week is equal to 7 days)

b. Design Working Ratio

The design working ratio is set at 85% as described below.

$$A = 365/7 \times (1-0.3) = 36 \text{ days (Collection rate on a holiday a week is estimated 30\%)}$$

$$B = 12 \text{ days (regular monthly inspection} \times 12)$$

$$C = 5 \text{ days}$$

$$WR = (365 - 36 - 12 - 5) \div 365 = 85\%$$

c. Decline of Working Ratio in Time

As the working ratio of a waste collection vehicle declines in time because of the increased number of inspection and repair days, the working ratio in 2010 must be estimated to calculate the solid waste collection amount in the said year by the existing vehicles. For this purpose, the following relationship between the length of operation and the working ratio has been agreed through discussion with the section to be responsible for vehicle maintenance on the Jordanian side.

First seven years: 85% (the design working ratio is sustained)

Eighth year onwards: an annual decline of 5%

$$WR = 85\% - 5\% \times [(2010 - N) - 7]$$

N: year of vehicle purchase

Example: if a vehicle is purchased in 1995, the WR is  
45% [85% - 5% x (2010 - 1995 - 7)]

3) List of Existing Waste Collection Vehicles

The manufacturer and year of purchase of the waste collection vehicles currently in use are shown in Table 2.2.2.2-1. Out of the total of 121 vehicles, 118 (98%) were manufactured by Mercedes, Volvo and Japanese companies.



**Table 2.2.2.2-1 List of Manufacturers of Existing Collection Vehicles**

Year of Purchase	Large (16 m <sup>3</sup> )			Medium (8 m <sup>3</sup> )		Small (4 m <sup>3</sup> )	Total
	Mercedes	Volvo	Iveco	Mercedes	Nissan	Toyota	
-1985	6	1					7
-1990		4					4
-1995		13				21	34
-2000	18	4	1	9			32
2001-	26	3	2	6	7		38
Total	50	25	3	15	7		121
	78			22		21	
%	64%	32%	4%	68%	32%	100%	100%
	100%			100%		100%	

Source: MOGA

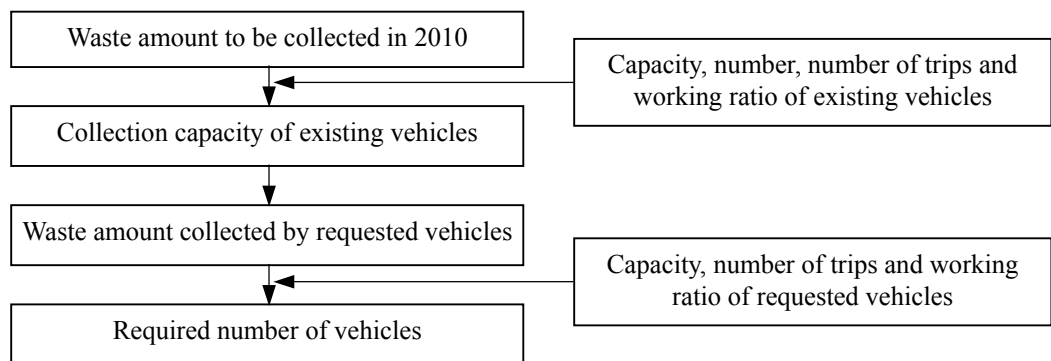
#### 4) Vehicle Specifications

The collection vehicles to be planned for the Project comprise 4, 8 and 16 m<sup>3</sup> compactors as requested. See “Specifications of Equipment (Table 2.2.3-1 to 2.2.3-3)” for further details.

#### 5) Number of Vehicles

##### a. Calculation Process

The required number of collection vehicles is calculated for each collection district using the following process.



##### b. Solid Waste Collection Amount in 2010

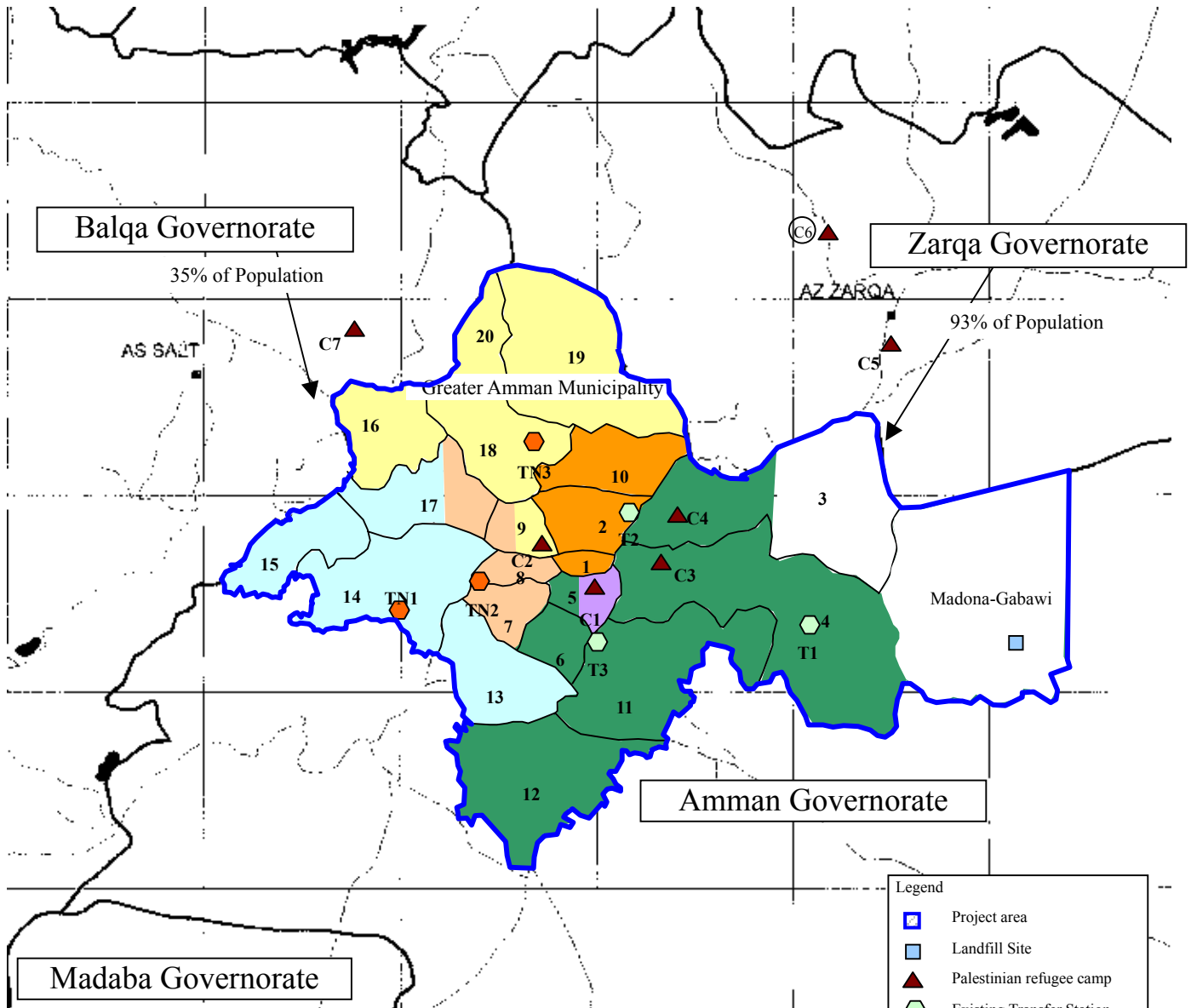
The expected solid waste amount generated, collection amount and transportation destination for each collection district in 2010 are shown in Table 2.2.2.2-2, zone map of waste transfer areas after construction of new transfer stations is shown in Fig. 2.2.2.2-1, and waste flow in entire Amman Municipality is shown in Fig 2.2.2.2-2.

**Table 2.2.2.2-2 Solid Waste Amounts Generated, Collected and Transferred by District (2010)**

No.	District	Solid Waste Generated t/d	Collection Rate %	Solid Waste Amount Collected t/d	Destination Transfer Station						Direct to Disposal Site t/d
					Existing			New			
					T1	T2	T3	TN1	TN2	TN3	
					Al Shaar	Ein Ghazal	Yarumouk	Zaharan	Wadi Al Sir	Al Jubeiha	
1	Madina	141	95%	134		134					
2	Basman	206	95%	196		196					
3	Marqa	127	95%	121	61						60
4	Nasir	98	95%	93	93						
5	Yarmouk	183	95%	174	70		104				
6	Ras Al Ain	102	95%	98	98						
7	Bader	133	95%	127			127				
8	Zahran	123	95%	117			117				
9	Abdali	256	95%	243			105			138	
10	Tariq	38	95%	36		36					
11	Qweismeh	217	95%	206	206						
12	Khrbet Al Souk	82	95%	78	78						
13	Muqablein	72	95%	68				68			
14	Wadi Al Sir	239	95%	227				227			
15	New Bader	7	95%	7				7			
16	Sweileh	118	95%	112						112	
17	Tla Al Ali	170	95%	161			47		114		
18	Jubeiha	100	95%	95						95	
19	Shafa Badran	7	95%	7						7	
20	Abu Nuseir	49	95%	46						46	
-	Central Market	25	95%	24							24
-	Slaughter Houses	19	95%	18							18
Total		2,512	95%	2,387	605	366	104	396	416	398	102
					1,075			1,210			102
					2,387						

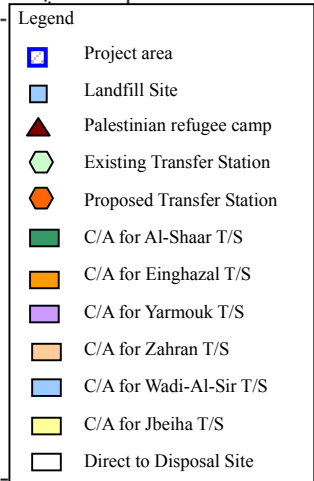
c. Collection Amount by Vehicle and District

The expected solid waste collection amount by type of vehicle in 2010 in each district is shown in Table 2.2.2.2-3.



(Unit : km<sup>2</sup>)

No.	Name	Area	No.	Name	Area
1	MADINA	2.4	20	ABU NASIER	6.8
2	BASMAN	15.6	Total		657.0
3	MARQA	62.4	Palestinian Refugee Camp		
4	NASIR	197.5	Existing Transfer Station		
5	YARMOUK	5.2	C1	AL-WIHDAT	
6	RAS-AL-AIN	6.7	C2	EL-HUSSEIN	
7	BADER	9.8	C3	PRINCE HASSAN	
8	ZAHRAN	13.8	C4	HITTEEN (MARQA)	
9	ABDALI	11.0	C5	ZARQA	
10	TARIQ	24.6	C6	SUKHNEH	
11	QUEISMEH	50.6	C7	BAQA'A	
12	KHRBET AL SOUK	54.4	Existing Transfer Station		
13	MUQABALEIN	23.2	T1	AL-SHAAR	
14	WADI-AL-SIR	38.2	T2	EINGHAZAL	
15	NEW BADER	16.4	T3	YARMOUK	
16	SWEILEH	19.4	Proposed Transfer Station		
17	TLA-AL-ALI	25.2	TN1	ZAHRAN	
18	JBEIHA	28.4	TN2	WADI-AL-SIR	
19	SHAFA BADRAN	45.4	TN3	AL-JBEIHA	



C/A: Collection area  
T/S: Transfer Station



0 1 2 3 4 5km

Fig. 2.2.2.2-1 Zone Map of Waste Transfer Areas in 2010

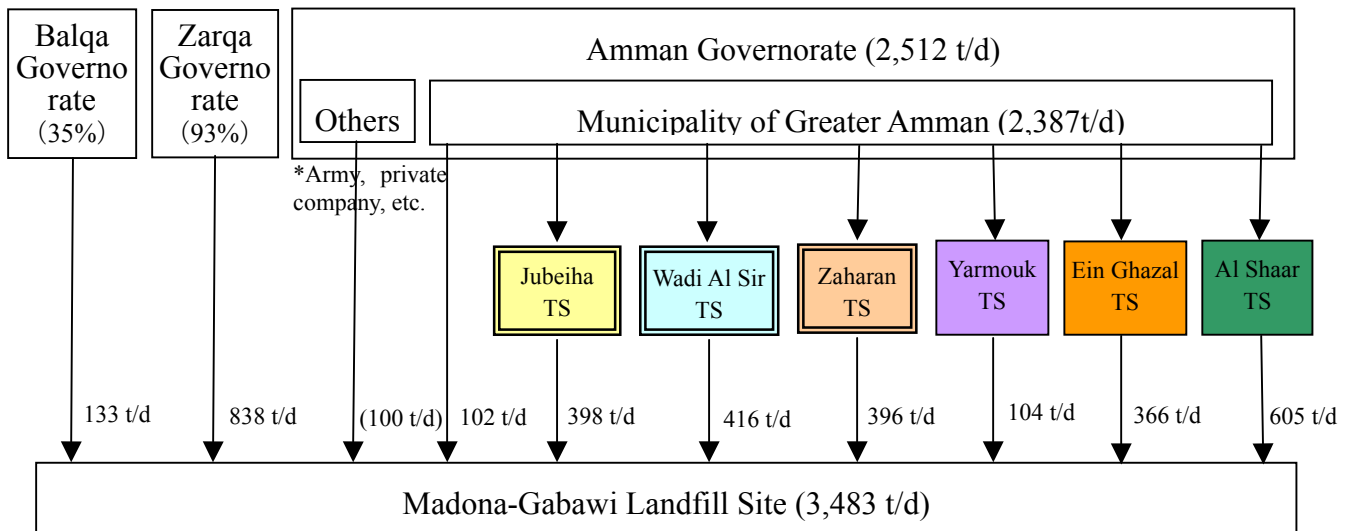


Fig. 2.2.2.2-2 Waste Flow in the Target Year 2010

Table 2.2.2.2-3 Solid Waste Collection Amount by Vehicle and District

No.	District	Solid Waste Amount Collected (t/d)				
		Large	Medium	Small	Hoist Truck	Total
1	Madina	81	23	30		134
2	Basman	78	93	25		196
3	Marka	90		31		121
4	Nasir	78		15		93
5	Yarmouk	92		64	18	174
6	Ras Al Ain	85		12		97
7	Bader	114		13		127
8	Zahran	117				117
9	Abdali	71	139	15	18	243
10	Tariq	24		12		36
11	Qweismeh	118	23	13	52	206
12	Khrbet Al Souk	65		13		78
13	Muqablein	68				68
14	Wadi Al Sir	156	23	13	35	227
15	New Bader	7				7
16	Sweileh	99		13		112
17	Tla Al Ali	138	23			161
18	Jubeiha	82		13		95
19	Shafa Badran	7				7
20	Abu Nuseir	21		25		46
-	Central Market	24				24
-	Slaughter Houses				18	18
	Total	1,615	324	307	141	2,387

Note: An increased collection amount is planned to boost the collection rate at Palestinian refugee camps.

d. Number of Trips

While the average number of trips by type of vehicle is principally based on the current situation, the number of trips by large vehicles is increased as there will be no direct trips to the disposal site due to the introduction of three new transfer stations.

**Table 2.2.2.2-4 Planned Average Number of Trips by Collection Vehicle**

Shift	Morning	Afternoon	Night	Total
Large Compactor (16 m <sup>3</sup> )	3.3	1.5	0	4.8
Medium Compactor (8 m <sup>3</sup> )	4	1	1	6
Small Compactor	5	2	1	8

e. Calculation Results

Table 2.2.2.2-5 shows the results of the calculation of the required number of collection vehicles. In short, 5 large compactors, 4 medium compactors and 20 small compactors will be required. Relation between requested number and required number is shown in Table 2.2.2.2-6.

**Table 2.2.2.2-5 Calculation Table of Required Waste Collection Vehicles**

District		Gen. waste	Colle. Ratio	Waste to be collected			Large Compacter					Middle Compacter					Small Compacter					Hoist Truck	Total
				Total	Exist.	Add.	Waste	Cap.	Trip	Effic.	Q'ty	Waste	Cap.	Trip	Effic.	Q'ty	Waste	Cap.	Trip	Effic.	Q'ty		
No	Name	t/d	%	t/d	t/d	t/d	t/d	t/d		%		t/d	t/unit		%		t/d	t/unit		%		t/d	t/d
1	Madina	141	95%	134	92	42	19.5	6.7	6	85%	1	2.5	3.2	6	85%	0	20.3	1.6	8	85%	2	0.0	42
2	Basman	206	95%	196	161	35	-4.1	6.7	6	85%	0	23.5	3.2	6	85%	1	15.2	1.6	8	85%	1	0.0	35
3	Marka	127	95%	121	94	27	6.8	6.7	4	85%	0	0.0	3.2	6	85%	0	20.3	1.6	8	85%	2	0.0	27
4	Nasir	98	95%	93	76	17	7.1	6.7	4	85%	0	0.0	3.2	6	85%	0	10.1	1.6	8	85%	1	0.0	17
5	Yarmouk	183	95%	174	109	65	16.2	6.7	6	85%	1	0.0	3.2	6	85%	0	40.6	1.6	8	85%	4	8.3	65
6	Ras Al Ain	102	95%	97	74	23	15.7	6.7	5	85%	1	0.0	3.2	6	85%	0	7.6	1.6	8	85%	1	0.0	23
7	Bader	133	95%	127	113	14	6.3	6.7	6	85%	0	0.0	3.2	6	85%	0	7.6	1.6	8	85%	1	0.0	14
8	Zahran	123	95%	117	98	19	18.7	6.7	6	85%	1	0.0	3.2	6	85%	0	0.0	1.6	8	85%	0	0.0	19
9	Abdali	256	95%	243	197	46	1.8	6.7	5	85%	0	27.5	3.2	6	85%	1	10.1	1.6	8	85%	1	6.8	46
10	Tariq	38	95%	36	26	10	2.7	6.7	5	85%	0	0.0	3.2	6	85%	0	7.6	1.6	8	85%	1	0.0	10
11	Qweismeh	217	95%	206	169	37	-8.8	6.7	5	85%	0	10.7	3.2	6	85%	1	7.6	1.6	8	85%	1	27.4	37
12	Khrbet Al Souk	82	95%	78	61	17	9.1	6.7	4	85%	0	0.0	3.2	6	85%	0	7.6	1.6	8	85%	1	0.0	17
13	Muqablein	72	95%	68	63	5	5.4	6.7	5	85%	0	0.0	3.2	6	85%	0	0.0	1.6	8	85%	0	0.0	5
14	Wadi Al Sir	239	95%	227	181	46	9.4	6.7	5	85%	0	10.7	3.2	6	85%	0	7.6	1.6	8	85%	1	17.9	46
15	New Bader	7	95%	7	0	7	7.0	6.7	3	85%	0	0.0	3.2	6	85%	0	0.0	1.6	8	85%	0	0.0	7
16	Sweileh	118	95%	112	94	18	10.3	6.7	5	85%	0	0.0	3.2	6	85%	0	7.6	1.6	8	85%	1	0.0	18
17	Tla Al Ali	170	95%	161	150	11	9.0	6.7	4	85%	0	1.6	3.2	6	85%	1	0.0	1.6	8	85%	0	0.0	11
18	Jubeiha	100	95%	95	66	29	20.9	6.7	5	85%	1	0.0	3.2	6	85%	0	7.6	1.6	8	85%	1	0.0	29
19	Shafa Badran	7	95%	7	0	7	7.0	6.7	3	85%	0	0.0	3.2	6	85%	0	0.0	1.6	8	85%	0	0.0	7
20	Abu Nuseir	49	95%	46	25	21	6.4	6.7	4	85%	0	0.0	3.2	6	85%	0	15.2	1.6	8	85%	1	0.0	21
-	Central Market	25	95%	24	21	3	2.7	6.7	5	85%	0	0.0	3.2	6	85%	0	0.0	1.6	8	85%	0	0.0	3
-	Slaughter Houses	19	95%	18	13	5	0.0	6.7	0	85%	0	0.0	3.2	6	85%	0	0.0	1.6	8	85%	0	5.3	5
	Amount of Waste	2,512	95%	2,387	1,883	504	169.1					76.5					192.6					65.7	504
	Quantity of Vehicles										5					4					20		

**Table 2.2.2.2-6 Planned Number of Collection Vehicles**

Request		Planned				
Type	Number	S.N.	Type	Required Number	By Japan	By Jordan*
Medium (4 – 8 m <sup>3</sup> )	20	1-1-1	Small (4 m <sup>3</sup> )	20	20	0
		1-1-2	Medium (8 m <sup>3</sup> )	4	4	0
Large (8 – 16 m <sup>3</sup> )	10	1-1-3	Large (16 m <sup>3</sup> )	5	5	0
Total	30			29	29	0

(2) Transfer Station Vehicles

1) Basic Design Conditions

Transfer station vehicles are planned based on the following request in regard to new transfer stations.

a. New Transfer Station Plan

① Construction sites

New transfer stations are introduced in the following three districts.

- Jubeiha
- Wadi Al Sir
- Zahran

② Planned timing for construction completion: November, 2005

③ Transfer capacity: approximately 400 tons/day x 3 = approximately 1,200 tons/day

④ Working hours: 24 hours/day (in three shifts)

⑤ Transfer vehicles (per new transfer station)

The following types of vehicles will be combined.

- 40 m<sup>3</sup> open type trailer : 4 units
- 50 m<sup>3</sup> compacting type trailer : 3 units

b. Requested Vehicles

Original request : 30 – 50 m<sup>3</sup> compacting type trailers

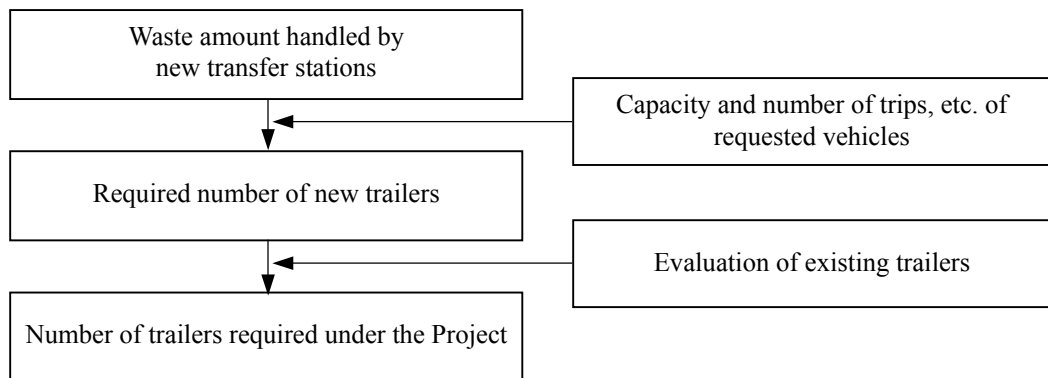
Revised request : 40 m<sup>3</sup> open type trailers

2) Specifications

Based on the revised request, the Japanese side will procure the 40 m<sup>3</sup> open type trailers. See “Specifications of Equipment (Table 3.2.3-4)” for further details.

3) Number of Vehicles

The required number of vehicles is determined in accordance with the following calculation process.



a. Waste Amount Handled by New Transfer Stations

The design waste amount handled by each new transfer station is 396-416 tons/day as shown in Table 2.2.2.2-2.

b. Loading Weight of Trailer

The design loading weight of a 40 m<sup>3</sup> open type trailer and that of a 50 m<sup>3</sup> compacting type trailer is 14 tons/trip and 25 tons/trip as shown in Table 2.2.2.1-4.

c. Number of Trips

The design number of trips is 6 trips/day for 40 m<sup>3</sup> open type trailers and 4 trips/day for 50 m<sup>3</sup> compacting type trailers as shown in Table 2.2.2.2-7.

**Table 2.2.2-7 Design Number of Trips for Trailers at New Transfer Stations**

Type of Trailer	Required Time (hours)				Number of Trips			
	Loading	Outward	Inward	Total	Morning	Afternoon	Night	Total
40 m <sup>3</sup> open type trailer	0.5	1.0	1.0	2.5	3	2	1	6
50 m <sup>3</sup> compacting type trailer	1.5	1.0	1.0	2.5	2	1	1	4



d. Required Number of Trailers

The combination of three 40 m<sup>3</sup> open type trailers and two 50 m<sup>3</sup> compacting type trailers per new transfer station is the optimum combination as shown in Table 2.2.2-8. Hence, for three new transfer stations, total nine 40 m<sup>3</sup> open type trailers and six 50 m<sup>3</sup> compacting type trailers are required.

**Table 2.2.2-8 Calculation Table of Number of Required Trailers at Each New Transfer Station**

Type and Number		40 m <sup>3</sup> Open Type Trailer				
		0	1	2	3	4
50 m <sup>3</sup> Compacting Type Trailer	0	0	76	151	227	302
	1	90	166	241	317	392
	2	180	256	331	407	482
	3	270	346	421	497	572
	4	360	436	511	587	662
	5	450	526	601	677	752

Note) Working ratio of the trailers is estimated as 90% because of no regular monthly inspection.

Regarding the number of tractor head, due to the short time for loading, same number of tractor head is required for open type trailer as each existing transfer station has.

For compacting trailer which needs longer time for loading, only one tractor head is not able to fulfill the planned number of trips for two trailers t each transfer station. Two tractor heads are necessary.

50 m<sup>3</sup> compacting type trailers and tractor heads are not included in request. These vehicles need to be procured by Jordanian side.

Considering future increase of trips of transfer station vehicles and deterioration of existing equipment, the results of required number of transfer station vehicles are described in Table 2.2.2.2-9. At Al Shaar transfer station, two numbers of 30 m<sup>3</sup> open type trailers become surplus. However, the extra trailers are set for protection for decrease of working ratio caused by deterioration of Yarmouk transfer station. Therefore, there is no extra trailer which can be diverted to new transfer stations.

**Table 2.2.2.2-9 Results of Calculation of Number of Required Transfer Station Vehicles**

Transfer Station	Class.	Type of Vehicle	Purch. Year	Unit Cap	Q'ty	Trip	Working ratio		Cap..	Collect. waste	Diff.	Judge	
				t/ trip	Uinit	Trip/d	Year	%	t/d	t/d	t/d		
T1	Al Shaar	Existing	Open type trailer (30m <sup>3</sup> )	1995	12	7	6	15	50%	252			
			Compacting type trailer(50m <sup>3</sup> )	2003	25	5	4	7	90%	450			
			Sub-total							702			
		Additional	Open type trailer (30m <sup>3</sup> )	1995	12	-2	6	15	50%	-72			
			Total							630	605	25	OK
T2	Ein— Ghazal	Existing	Open type trailer (30m <sup>3</sup> )	1995	12	3	6	15	50%	108			
			Compacting type trailer(50m <sup>3</sup> )	2003	25	3	4	7	90%	270			
			Sub-total							378	366	12	OK
T3	Yarmouk	Existing	Open type trailer (30m <sup>3</sup> )	1993	12	2	6	17	40%	58			
			Open type trailer (30m <sup>3</sup> )	2003	12	2	6	15	50%	72			
		Sub-total							130	104	26	OK	
Total									1,138	1,075	63		

As stated above, planned number of transfer station vehicles is shown in Table 2.2.2.2-10.

**Table 2.2.2.2-10 Planned Number of Transfer Station Vehicles**

Request		Plan				
Type	Number	S.N.	Type	Required No.	By Japan* <sup>1</sup>	By Jordan* <sup>2</sup>
Long chassis trailer	8	1-2-1	Open type (40m <sup>3</sup> )	9	8	1
		—	Compacting type (50m <sup>3</sup> )	6	0	6
Tractor head for trailer	6	1-2-2	For open type trailer	9	6	3
		—	For compacting type trailer	6	0	6

\*1. Procure the requested number of vehicles.

\*2. Procure the excess number of vehicles.

### 2.2.2.3 Plan for Final Disposal Site equipment

#### (1) Landfill Equipment

##### 1) Types of Requested Equipment and Their Purpose of Use

The requested solid waste disposal equipment for landfill operation consist of two (small) bulldozers, two (medium size) bulldozers and one landfill compactor, all of which are used for the crushing as well as levelling of solid waste and the levelling and compacting of the covering soil for cell type sanitary landfill operation.

## 2) Basic Design Conditions

The equipment required for landfill operation is planned in accordance with the following conditions.

- a. The solid waste amount to be accepted (disposal amount) in the target year of 2010 is 3,483 tons/day as shown in Table 2.2.2.1-3.
- b. Sanitary landfill operation using covering soil is conducted every day by means of applying a 0.3 m thick covering soil layer to each 3 m thickness of solid waste.
- c. The working ratio of the landfill equipment is the same as that of the vehicles at 85%.
- d. The nominal specific gravity of the solid waste before and after compacting is 0.35 tons/m<sup>3</sup> and 0.7 tons/m<sup>3</sup> respectively.
- e. The soil compaction ratio is 1.4 for loosened soil to compacted soil and 1.25 for loosened soil to ground soil.
- f. At the landfill site, carrying waste is done on three shifts 24 hour basis, and levelling and compacting work is done on two shifts 16 hour basis.

## 3) Equipment Specifications

While three types of equipment have been requested for landfill operation, the landfill compactor has been omitted from the scope of the Project due to the following reasons, leaving two types of bulldozers (small and medium size) for examination of the required number of equipment.

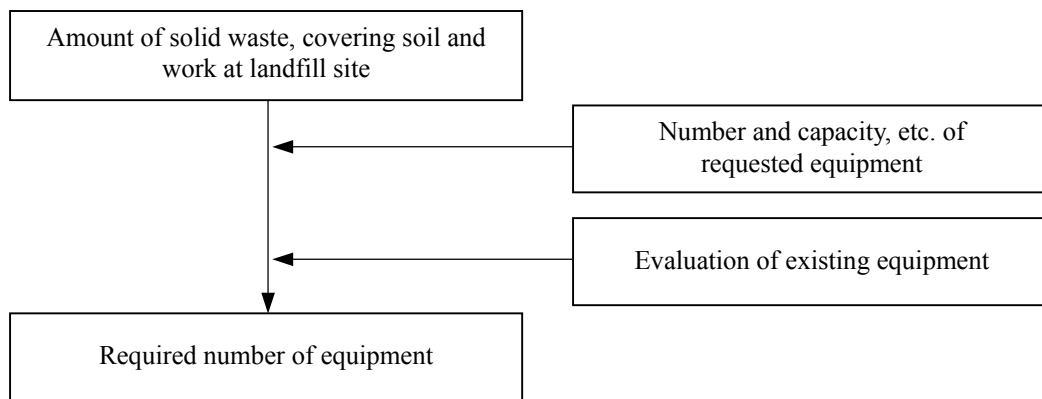
- a. While a landfill compactor is used to crush, level and compact solid waste, these functions can be fully performed by bulldozers.
- b. As a landfill compactor travels on wheels, it is unsuitable for the levelling and compacting of the clayey fine soil to be used for the planned sanitary landfill at the Madona-Ghabawi landfill site.
- c. If the crushing of compacted solid waste is the main purpose of the requested landfill compactor, the existing six landfill compactors can be used for this purpose.
- d. One landfill compactor was newly purchased in 2003.

Concerning the bulldozer specifications, considering the amount of waste discharged from the relay transportation vehicles (approximately 16~25 tons/truck) and the width of waste heaps (approximately 3~4 m), the combination of 180 HP (20 ton) class and 220 HP (25 ton) class bulldozers as contained in the request is ideal. Quantities of equipment will be examined based on this premise. See “Specifications of Equipment (Table 3.2.3-6 and 3.2.3-7)” for further details.

#### 4) Number of Equipment

##### a. Calculation Process

The required number of equipment is calculated using the following process.



##### b. Work Amount of Landfill Equipment

###### ① Amount of solid waste subject to levelling and compacting

Amount of solid waste before compacting

$$3,483 \text{ tons/day} \div 0.35 \text{ tons/m}^3 = 9,951 \text{ m}^3/\text{day}$$

Amount of solid waste after compacting

$$3,483 \text{ tons/day} \div 0.7 \text{ tons/m}^3 = 4,976 \text{ m}^3/\text{day}$$

###### ② Required amount of covering soil (loosened soil)

Required amount of soil after compacting per day

$$4,976 \text{ m}^3/\text{day} \times 0.3/3.0 \text{ m} = 498 \text{ m}^3/\text{day}$$

Amount of loosened soil

$$498 \text{ m}^3/\text{day} \times 1.4 = 697 \text{ m}^3/\text{day}$$

The daily amount of work described above is divided by type of bulldozer as follows.

Amount of solid waste to be disposed (before compacting)

Small bulldozers	:	4,478 m <sup>3</sup>
Medium bulldozers	:	5,473 m <sup>3</sup>
Total	:	9,951 m <sup>3</sup>

Covering soil (loosened soil)

Small bulldozers	:	313 m <sup>3</sup>
Medium bulldozers	:	384 m <sup>3</sup>
Total	:	697 m <sup>3</sup>

c. Required Number of Landfill Equipment

① Work capacity of a single bulldozer

- Solid waste levelling capacity

The work amount of a bulldozer per hour is calculated by the following expression.

$$\text{Earth work amount: } 60 \times q \times E_1 \times E_2 \div C_m \quad (\text{m}^3/\text{hour})$$

Where,

60 : time conversion factor (60 minutes is equal to one hour)

q : amount of solid waste dozed per cycle (m<sup>3</sup>)

The size of the bowl for calculation purposes is the standard size with a trash rack.

$$q = 0.45 \times B \times H^2 \quad (\text{m}^3)$$

B: bowl width (3.0 m for a small bulldozer; 3.6 m for a medium bulldozer)

H: bowl height (2.2 m)

$$= 0.45 \times 3.0 \times 2.2^2 = 6.53 \quad (\text{small bulldozer}),$$

or

$$= 0.45 \times 3.6 \times 2.2^2 = 7.84 \quad (\text{medium bulldozer})$$

E<sub>1</sub> : work efficiency (0.65)

E<sub>2</sub> : working ratio (0.85)

C<sub>m</sub> : cycle time (one minute)

< Small Bulldozer >

$$\text{Earth work amount} = 60 \times 6.53 \times 0.65 \times 0.85 \div 1.0 = 217 \text{ m}^3/\text{hour}$$

< Medium Bulldozer >

$$\text{Earth work amount} = 60 \times 7.84 \times 0.65 \times 0.85 \div 1.0 = 260 \text{ m}^3/\text{hr}$$

- Solid waste compacting capacity

The amount of solid waste calculated by the following expression indicates the amount of compacted solid waste on completion of this operation.

$$\text{Amount of compacted solid waste} \\ = 2 \times V \times W \times D \times E_1 \times E_2 \div N \text{ (m}^3\text{/hour)}$$

Where,

- V : compacting speed ( 3,500 m/hour)
- W : effective compaction width per operation (0.9 m)
- D : thickness of compacted solid waste (0.9 m)
- N : number of compacting operations (4)
- E<sub>1</sub> : work efficiency (0.8)
- E<sub>2</sub> : working ratio (0.85)

$$\text{Amount of compacted solid waste} \\ = 2 \times 3,500 \times 0.9 \times 0.9 \times 0.8 \times 0.85 \div 4 = 964 \text{ m}^3\text{/hour}$$

- Covering soil dozing and levelling work capacity

The earth work amount of a bulldozer to doze and level the covering soil per one hour is calculated by the following expression.

$$\text{Earth work amount} = 60 \times q \times E_1 \times E_2 \div C_m \text{ (m}^3\text{/hour)}$$

Where,

- 60 : time conversion factor (60 minutes is equal to one hour)
- q : amount of work dozed per cycle (2.0 m<sup>3</sup> for a small bulldozer; 2.5 m<sup>3</sup> for a medium bulldozer)
- E<sub>1</sub> : work efficiency (0.7)
- E<sub>2</sub> : working ratio (0.85)
- C<sub>m</sub>: cycle time (one minute)

< Small Bulldozer >

$$\text{Work amount} = 60 \times 2.0 \times 0.7 \times 0.85 \div 1 = 71 \text{ m}^3\text{/hour}$$

< Medium Bulldozer >

$$\text{Work amount} = 60 \times 2.5 \times 0.7 \times 0.85 \div 1 = 89 \text{ m}^3\text{/hr}$$

- Covering soil compacting work capacity

The amount of covering soil to be compacted per one hour of operation by a bulldozer is calculated by the following expression. The amount of compacted covering soil calculated indicates the amount of compacted covering soil on completion of this operation.

$$\text{Amount of compacted covering soil} \\ = 1.33 \times V \times W \times D \times E_1 \times E_2 \div N \text{ (m}^3\text{/hour)}$$

Where,

1.33: conversion factor for soil  
(before compaction 1.2 / after compaction 0.9 = 1.33)

V : compacting speed (3,500 m/hour)

W : effective compacting width per operation (0.9 m)

D : thickness of compacted covering soil (0.3 m)

N : number of compacting operations (4)

E<sub>1</sub> : work efficiency (0.8)

E<sub>2</sub> : working ratio (0.85)

Amount of compacted covering soil

$$= 1.33 \times 3,500 \times 0.9 \times 0.3 \times 0.8 \times 0.85 \div 4 = 214 \text{ m}^3\text{/hour}$$

## ② Calculation of working hours

- Work amount per bulldozer

Assuming the use of two bulldozers of each type to handle the work amounts described above, the work amount per bulldozer is expected to be as follows.

< Small Bulldozer >

Dozing of solid waste  $4,478 \text{ m}^3 \div 2 = 2,239 \text{ m}^3$

Compacting of solid waste  $4,478 \text{ m}^3 \div 2 = 2,239 \text{ m}^3$

Dozing of covering soil  $313 \text{ m}^3 \div 2 = 157 \text{ m}^3$

Compacting of covering soil  $313 \text{ m}^3 \div 2 = 157 \text{ m}^3$

< Medium Bulldozer >

Dozing of solid waste  $5,473 \text{ m}^3 \div 2 = 2,737 \text{ m}^3$

Compacting of solid waste  $5,473 \text{ m}^3 \div 2 = 2,737 \text{ m}^3$

Dozing of covering soil  $384 \text{ m}^3 \div 2 = 192 \text{ m}^3$

Compacting of covering soil  $384 \text{ m}^3 \div 2 = 192 \text{ m}^3$

- Working hours

- < Small Bulldozer >

- Solid waste landfilling

- Dozing  $2,239 \text{ m}^3 \div 217 \text{ m}^3/\text{hr} = 10.3 \text{ hr}$

- Compacting  $2,239 \text{ m}^3 \div 964 \text{ m}^3/\text{hr} = 2.3 \text{ hrs}$

- Working hours 12.6 hours

- Covering soil application

- Dozing  $157 \text{ m}^3 \div 71 \text{ m}^3/\text{hr} = 2.2 \text{ hrs}$

- Compacting  $157 \text{ m}^3 \div 214 \text{ m}^3/\text{hr} = 0.7 \text{ hrs}$

- Working hours 2.9 hours

- Total 15.5 hours

- < Medium Bulldozer >

- Solid waste landfilling

- Dozing  $2,737 \text{ m}^3 \div 260 \text{ m}^3/\text{hr} = 10.5 \text{ hrs}$

- Compacting  $2,737 \text{ m}^3 \div 964 \text{ m}^3/\text{hr} = 2.8 \text{ hrs}$

- Working hours 13.3 hours

- Covering soil application

- Dozing  $192 \text{ m}^3 \div 89 \text{ m}^3/\text{hr} = 2.2 \text{ hrs}$

- Compacting  $192 \text{ m}^3 \div 214 \text{ m}^3/\text{hr} = 0.9 \text{ hrs}$

- Working hours 3.1 hours

- Total 16.4 hours

The above calculation results indicate that the working hours per bulldozer will be 15.5 hours for a small bulldozer and 16.4 hours for a medium bulldozer, suggesting that the requested number of bulldozers is appropriate.

#### d. Evaluation of Existing Equipment

Evaluation of existing landfill equipment is described as follows.

##### i) Landfill Compactor

Municipality of Greater Amman has six landfill compactors. Out of these, five landfill



compactors are made in 1988. In the year 2005, when the above-mentioned bulldozer are procured, it is expected that existing landfill compactors will become seventeen years old and working ration will decrease below 35%. In addition to the aforementioned, because the covering soil at Madona-Ghabawi landfill site is silty clay and the soil particles are very small, it is not suitable for a cell method for landfilling, which is proposed by this project. Therefore, it is not expected that these existing landfill compactors can be used positively. Nevertheless, one landfill compactor procured in 2003 is relatively new, so that it can be used for crushing work which is expected as work by requested landfill compactor.

ii) Bulldozer

Municipality of Greater Amman has one bulldozer made in 1994 which was procured in phase 1. This bulldozer has been used since Russeifa old landfill was operated, and its engine often overheats current few years. Hence, it cannot be used for main equipment for landfilling hereafter.

5). Summary of Landfill Equipment

The planning contents for the landfill equipment are summarised in Table 2.2.2.3-1.

**Table 2.2.2.3-1 Planning Contents for Landfill Equipment**

Item No.	Equipment	Main Spec.	Purpose of Use	Number		Provider	
				Requested	Required	Japan	Jordan
2-1-1	Bulldozer (small)	180 HP Class	Crushing, dozing and compacting of solid waste and covering soil for cell type landfilling	2	2	2	-
2-1-2	Bulldozer (medium)	220 HP Class		2	2	2	-
-	Landfill Compactor	35 ton Class	For the same purpose described above but not required as its functions can be performed by a bulldozer	1	-	-	-

(2) Soil Excavation Equipment

1) Types of Requested Equipment and Their Purpose of Use

The requested equipment for soil excavation and other purposes consist of one large bulldozer and two backhoes as excavation equipment for the construction of the second cell at the Madona-Ghabawi landfill site, three wheel-loaders for the loading

of excavated soil, two dozer shovels for the piling up of excavated soil and one motor grader and one vibratory roller for road construction and other purposes.

## 2) Basic Design Conditions

A range of equipment relating to excavation and other work is planned based on the following conditions.

- a. The dimensions of the second cell (excavation amount) are 334 m long, 333 m wide and 10 m deep (excavation amount: 1,112,000 m<sup>3</sup>).
- b. The construction period is 12 months (365 days) from November, 2005.
- c. The construction work is conducted six days a week with seven actual working hours per day.
- d. The equipment working ratio is 85%.
- e. The soil compaction ratio is 1.25 for loosened soil to ground soil.

## 3) Standard Work Amount

- a. Excavation amount per day (amount of ground soil)

$$1,112,000 \text{ m}^3 \div (365 \div 7 \times 6) = 3,554 \text{ m}^3/\text{day}$$

- b. Amount of loosened soil

$$3,554 \text{ m}^3/\text{day} \times 1.25 = 4,443 \text{ m}^3/\text{day}$$

## 4) Bulldozer (Large)

- a. Preconditions for Planning

- ① Purpose of use

To excavate the ground of the planned second cell site

- ② Excavation amount

Some 60% of the planned excavation amount is to be conducted by bulldozer and the remaining some 40% by backhoes (based on experience at the first cell). Accordingly, the excavation amount by bulldozer is 2,133 m<sup>3</sup>/day (3,554 m<sup>3</sup>/day x 0.6).

b. Equipment Specifications

The procurement of the requested 320 HP class bulldozer is planned. As the ground at the planned construction site is relatively favourable for excavation, the bulldozer will not be equipped with a ripper. See “Specifications of Equipment to be procured” for further details.

c. Working Capacity of Bulldozer

The earth work amount of a bulldozer per hour (Q) is calculated by the following expression.

$$Q = 3,600 \times q \times E_1 \div C_m \text{ (m}^3\text{/hour)}$$

Where, 3600 : time conversion factor (one hour is equal to 3600 sec.)

q : excavation amount per cycle (m<sup>3</sup>)

$$q = a \times q_0$$

q<sub>0</sub> : blade capacity (9 m<sup>3</sup>)

a : filling factor (0.8)

$$q = 0.8 \times 9$$

$$= 7.2$$

E<sub>1</sub> : work efficiency (0.75)

C<sub>m</sub> : required time for each cycle (51 seconds)

Therefore,

$$\begin{aligned} Q &= 3,600 \times 7.2 \times 0.75 \div 51 \\ &= 381 \text{ m}^3\text{/hour} \end{aligned}$$

d. Calculation of Working Hours

The working hours (T) are calculated by the following expression.

$$T = V \div Q \div E \div N$$

Where, V : excavation amount (2,133 m<sup>3</sup>)

Q : work amount (381 m<sup>3</sup>/hour)

E : working ratio (0.85)

N : number of equipment (1)

Therefore,

$$\begin{aligned} T &= 2,133 \text{ m}^3 \div 381 \text{ m}^3\text{/hour} \div 0.85 \div 1 \\ &= 6.6 \text{ hours} \end{aligned}$$

Based on the above calculation results, the work can be implemented within the 7 hours planned for construction work. Hence, the specifications and number of requested bulldozers are judged to be appropriate.

## 5) Backhoe

### a. Preconditions for Planning

#### ① Purpose of use

To excavate the ground at the planned second cell site

#### ② Excavation amount

The excavation amount by backhoe is 1,422 m<sup>3</sup>/day (3,554 m<sup>3</sup>/day x 0.4) as already described in 4)–a–①.

### b. Equipment Specifications

The procurement of the requested 125 HP class backhoes is planned. See “Specifications of Equipment to be procured” for further details.

### c. Working Capacity of Backhoe

The earth work amount of a backhoe per hour (Q) is calculated by the following expression.

$$Q = 3,600 \times q \times E_1 \div C_m \text{ (m}^3\text{/hour)}$$

Where, 3600 : time conversion factor (one hour is equal to 3600 sec.)

q : excavation amount per cycle (m<sup>3</sup>)

$$q = a \times q_0$$

q<sub>0</sub> : backhoe loading capacity (0.8 m<sup>3</sup>)

a : filling factor (1.0)

$$q = 0.8 \times 1.0$$

$$= 0.8$$

E<sub>1</sub> : work efficiency (0.75)

C<sub>m</sub> : required time for each cycle (15 seconds)

Therefore,

$$Q = 3,600 \times 0.8 \times 0.75 \div 15$$

$$= 144 \text{ m}^3\text{/hour}$$

d. Calculation of Working Hours

The working hours (T) are calculated by the following expression.

$$T = V \div Q \div E \div N$$

Where, V : excavation amount (1,422 m<sup>3</sup>)  
Q : earth work amount (144 m<sup>3</sup>/hour)  
E : work efficiency (0.85)  
N : number of equipment (2)

Therefore,

$$\begin{aligned} T &= 1,422 \text{ m}^3 \div 144 \text{ m}^3/\text{hour} \div 0.85 \div 2 \\ &= 5.8 \text{ hours} \end{aligned}$$

Based on the above calculation results, the work can be implemented within the approximate 7 hours planned for construction work. On the other hand, in case that equipment is one rank lower, working hours amount to about 8 hours. Hence, the specifications and number of requested backhoes is judged to be appropriate for the earth work that can be implemented within 7 hours.

6) Wheel Loader

a. Preconditions for Planning

① Purpose of use

To load the soil excavated by bulldozer or backhoe on to a dump truck

② Loading amount

The loosened excavated soil is loaded on to dump trucks by wheel loaders at a rate of 4,443 m<sup>3</sup>/day.

b. Equipment Specifications

The procurement of the requested 215 HP class wheel loaders is planned.

In view of the experience gained during construction of the first cell, the requested 215 HP (3.5 m<sup>3</sup>) wheel loaders are suited to the said purpose of use and shall be planned as such. Although the separate bucket requested in addition to the standard bucket already attached

to the wheel loader, this shall be removed from the equipment to be procured since it is not considered particularly necessary for construction of the second cell.

See “Specifications of Equipment to be procured” for further details.

c. Work Capacity of Wheel Loader

The earth work amount of a wheel loader per one hour of operation (Q) is calculated by the following expression.

$$Q = 3,600 \times q \times E_1 \times C_m \text{ (m}^3\text{/hour)}$$

Where, 3600 : time conversion factor (one hour is equal to 3600 sec.)  
 q : loading amount per cycle (m<sup>3</sup>)  
 $q = a \times q_0$   
 $q_0$  : loading capacity of bucket (3.5 m<sup>3</sup>)  
 a : filling factor (0.85)  
 $q = 3.5 \times 0.85$   
 $= 2.975$   
 $E_1$  : work efficiency (0.8)  
 $C_m$  : required time per cycle (33 seconds)

Therefore,

$$Q = 3,600 \times 2.975 \times 0.8 \div 33$$

$$= 260 \text{ m}^3\text{/hour}$$

d. Calculation of Working Hours

The working hours are calculated by the following expression.

$$T = V \div Q \div E \div N$$

Where, V : excavation amount (4,443 m<sup>3</sup>)  
 Q : work amount (283 m<sup>3</sup>/hour)  
 E : working ratio (0.85)  
 N : number of wheel loaders (3)

Therefore,

$$T = 4,443 \text{ m}^3 \div 260 \text{ m}^3\text{/hour} \div 0.85 \div 3$$

$$= 6.7 \text{ hour}$$

Based on the above calculation results, the work can be implemented within the approximate 7 hours planned for construction work. On the other hand, in case that equipment is one rank lower with 180 HP (30m<sup>3</sup>) class, working hours amount to about 8 hours. Hence, the specifications and number of requested wheel loaders is judged to be appropriate for the earth work that can be implemented within 7 hours.

## 7) Dozer Shovel

### a. Preconditions for Planning

#### ① Purpose of use

To pile up the excavated soil (to be used as covering soil) which is transported by the dump trucks

#### ② Amount of soil to be removed

30% of the loosened soil at a rate of 4,443 m<sup>3</sup>/day is to be removed and piled up, resulting in a daily amount of soil to be removed of 1,333 m<sup>3</sup>/day (4,443 x 0.3).

### b. Equipment Specifications

The procurement of the requested 135 HP class dozer shovels is planned. See Appendix-3 “Specifications of Equipment to be procured” for further details.

### c. Work Capacity of Dozer Shovel

The earth work amount of a dozer shovel per hour (Q) is calculated by the following expression.

$$Q = 3,600 \times q \times E_1 \div C_m \text{ (m}^3\text{/hour)}$$

Where, 3600 : time conversion factor (one hour is equal to 3600 sec.)

q : piling up amount per cycle (m<sup>3</sup>)

$$q = a \times q_0$$

q<sub>0</sub> : loading capacity of bucket (2.2 m<sup>3</sup>)

a : filling factor (0.95)

$$q = 2.2 \times 0.95$$

$$= 2.1$$

E<sub>1</sub> : work efficiency (0.8)

C<sub>m</sub> : required time per cycle (51 seconds)

Therefore,

$$Q = 3,600 \times 2.1 \times 0.8 \div 51 \\ = 118 \text{ m}^3/\text{hour}$$

d. Calculation of Working Hours

The working hours are calculated by the following expression.

$$T = V \div Q \div E \div N$$

Where, V : excavation amount (1,333 m<sup>3</sup>)  
Q : earth work amount (118 m<sup>3</sup>/hour)  
E : working ratio (0.85)  
N : number of dozer shovels (2)

Therefore,

$$T = 1,333 \text{ m}^3 \div 118 \text{ m}^3/\text{hour} \div 0.85 \div 2 \\ = 6.6 \text{ hours}$$

Based on the above calculation results, the work can be implemented within the 7 hours planned for construction work. Hence, the specifications and number of requested dozer shovels are judged to be appropriate.

8) Motor Grader

a. Preconditions for Planning

① Purpose of use

To be mainly used for the surface finishing of the landfill site and the construction/improvement of internal and access roads

② Target area of site improvement plan

The scope of the site improvement plan is some 250,000 m<sup>2</sup> (500 m x 500 m) centering on the completed first landfill cell site. As this area is to be improved in 30 days, the daily target area for improvement is 8,333 m<sup>2</sup>/day (250,000 m<sup>2</sup> ÷ 30 days).

b. Equipment Specifications

The procurement of the requested 155 HP class motor grader is planned. See “Specifications of Equipment to be procured” for further details.



c. Work Capacity of Motor Grader

The earth work amount of a motor grader per hour (Q) is calculated by the following expression.

$$Q = 1,000 \times V \times (Le - Lo) \times E_1 \div n \text{ (m}^2\text{/hour)}$$

Where, 1000 : conversion factor for length  
(One kilo meter is equal to 1000 meter.)  
V : moving speed (3 km/hour)  
Le : effective blade width (3.2 m)  
Lo : overlapping width (0.3 m)  
E<sub>1</sub> : work efficiency (0.6)  
n : number of trips (2)

Therefore,

$$\begin{aligned} Q &= 1,000 \times 3 \times (3.2 - 0.3) \times 0.6 \div 2 \\ &= 2,610 \text{ m}^2\text{/hour} \end{aligned}$$

d. Calculation of Working Hours

The working hours (T) are calculated by the following expression.

$T = A \div Q \div E \div N$   
Where, A : target area for improvement (8,333 m<sup>2</sup>/day)  
Q : earth work amount (2,610 m<sup>2</sup>/hour)  
E : working ratio (0.85)  
N : number of motor graders (1)

Therefore,

$$\begin{aligned} T &= 8,333 \text{ m}^2 \div 2,610 \text{ m}^2\text{/hour} \div 0.85 \div 1 \\ &= 3.8 \text{ hours} \end{aligned}$$

Accordingly, the work can be implemented within the 7 hours planned for construction work. Moreover, these specifications, which happen to be the minimum values, coincide with the capability (blade width) of motor graders used overseas as well as motor graders that are intended for foreign countries. Accordingly, equipment that is one rank lower, of the type used on narrow roads in Japan, shall not be considered for application here.

## 9) Vibratory Roller

### a. Preconditions for Planning

#### ① Purpose of use

To be mainly used for the surface finishing of the landfill site and the construction/improvement of internal and access roads.

#### ② Target area of site improvement plan

As in the case of the motor grader, the scope of the site improvement plan is some 250,000 m<sup>2</sup> (500 m x 500 m) centering on the completed first landfill cell site. As the surface layer of 0.2 m is to be compacted in 30 days, the daily target volume for compaction is 1,667 m<sup>3</sup>/day (250,000 m<sup>2</sup>) x 0.2 ÷ 30 days).

### b. Equipment Specifications

The procurement of the requested 133 HP class vibratory roller is planned. See “Specifications of Equipment to be procured” for further details.

### c. Work Capacity of Vibratory Roller

The earth work amount of a vibratory roller per hour (Q) is calculated by the following expression.

$$Q = 1,000 \times V \times (L_e - L_o) \times h \times E_1 \text{ (m}^3\text{/hour)}$$

Where, 1000 : conversion factor for length  
(One kilo meter is equal to 1000 meter.)  
V : moving speed (1.5 km/hour)  
L<sub>e</sub> : effective blade width (2.0 m)  
L<sub>o</sub> : overlapping width (0.3 m)  
h : compacting depth per trip (0.2 m)  
E<sub>1</sub> : work efficiency (0.6)

Therefore,

$$\begin{aligned} Q &= 1,000 \times 1.5 \times (2.0 - 0.3) \times 0.2 \times 0.6 \\ &= 306 \text{ m}^3\text{/hour} \end{aligned}$$

d. Calculation of Working Hours

The working hours (T) are calculated by the following expression.

$$T = V \div Q \div E \div N$$

Where, V : target volume for improvement (1,667 m<sup>3</sup>/day)  
Q : earth work amount (306 m<sup>3</sup>/hour)  
E : working ratio (0.85)  
N : number of vibratory rollers (1)

Therefore,

$$\begin{aligned} T &= 1,667 \text{ m}^3 \div 306 \text{ m}^3/\text{hour} \div 0.85 \div 1 \\ &= 6.4 \text{ hours} \end{aligned}$$

Based on the above calculation results, the work can be implemented within the 7 hours planned for construction work. Hence, the specifications and number of requested vibratory rollers are judged to be appropriate.

10) Evaluation of Existing Equipment

Evaluation of existing soil excavation equipment is described as follows.

a. Wheel loader

Municipality of Greater Amman has two wheel loaders; one is made in 1994 and the other is made in 1996. However, it is mainly used for excavation and loading for 16 hours a day on a two-shift basis. Therefore, they cannot be used for construction of second cell.

As far as working ration is concerned, the existing wheel loader will have been used for 15 years old in the target year 2010 and its working ratio will become about 30%. Hence, renewal of equipment is required.

b. Dozer shovel

Municipality of Greater Amman has one dozer shovel made in 1994, which was procured during phase 1. However, it is also mainly used for excavation, loading and covering work for landfill waste for 16 hours a day on a two-shift basis. Therefore, they cannot be used for construction of second cell.

As far as working ration is concerned, in the target year 2010, working ratio of dozer shovel will become about 30%, same as wheel loader. Hence, renewal of equipment is required.

11) Background of request for equipment for construction of the second cell

During construction of first cell, Municipality of Greater Amman leased equipment for construction from private companies and the Army. However, lease from private sector costs about 1 million JD (about 150 million Japanese yen). On the other hand, lease from the Army depends on national or international circumstances, etc.

Although Municipality of Greater Amman has considerable number of equipment for construction, about 70% of equipment is 10 years old since purchasing and deterioration is in progress. As a result, equipment of which working ratio is more than 50% is only 30% of entire equipment and used for other public works mainly for road construction to the full. Therefore, the equipment cannot be diverted to construction of second cell at Madona Ghabawi.

From the year 2008, construction work for third cell is intended to start. Immediate schedule for construction at Madona Ghabawi landfill site is shown in Table 2.2.2.3-2.

**Table 2.2.2.3-2 Schedule for Construction at Madona Ghabawi Landfill Site**

	2004	2005	2006	2007	2008	2009	2010
Leachate Treatment Facility	■						
Delivery of Const. Equipment		▼					
Construction of 2 <sup>nd</sup> Cell			■				
Construction of 3 <sup>rd</sup> Cell					■		
Construction of 4 <sup>th</sup> Cell							■

Considering these conditions, procurement of heavy machinery equipment for construction of second cell is indispensable. Municipality of Greater Amman desires Japanese grant strongly and submit an additional letter related to request for equipment for construction of second cell.

Note)  $0.9\text{JD}/\text{m}^3(\text{Unit price}) \times 1,112,000 \text{ m}^3 (\text{Excavated amount})=1,000,800\text{JD} (150,000,000 \text{ JPY})$

12) Use of Equipment after Completion of Construction of Second Cell

Construction of second cell is scheduled to be completed by the end of 2006. After 2008, construction of third cell will start. Excavating equipment will be used for

this construction.

During the year 2007, between two construction periods,

Bulldozer is used for adjustment work such as leveling and compacting covering soil, wheel loader and dozer shovel are used for loading and transportation of covering soil. Additionally, they are used for supporting work for over-aged equipment. Backhoe will be used for maintenance of landfill site and access road.

### 13) Summary of Soil Excavation Equipment

The planning contents of the equipment relating to soil excavation, etc. are summarised in Table 2.2.2.3-3.

**Table 2.2.2.3-3 Planning Contents of Equipment Relating to Soil Excavation, etc.**

Item No.	Equipment	Main Spec.	Purpose of Use	Number		Provider	
				Requested	Required	Japan	Jordan
2-2-1	Bulldozer (Large)	320 HP Class	Ground excavation for second cell construction; levelling and compacting of covering soil	1	1	1	-
2-2-2	Backhoe	125 HP Class	Ground excavation for second cell construction; access road maintenance	2	2	2	-
2-2-3	Wheel Loader	215 HP Class + Bucket	Loading of excavated soil from the second cell construction site for use as covering soil	3	3	3	-
2-2-4	Dozer Shovel	135 HP Class + Bucket	Removal of excavated soil from the second cell construction site; moving of covering soil	2	2	2	-
2-2-5	Motor Grader	155 HP Class	Construction/improvement of internal roads; finishing of covering soil surface at the first cell site; access road maintenance	1	1	1	-
2-2-6	Vibratory Roller	133 HP Class	Construction/improvement of internal roads; finishing of covering soil surface at the first cell site; access road maintenance	1	1	1	-

### 2.2.2.4 Plan for Operation and Maintenance Vehicles

#### (1) Water Tanker

##### 1) Purpose of Use

The water tankers will be used to spray water for the purposes of compacting the covering soil and reducing dust during covering soil compacting operation at a landfill site and also to spray water on the access road to reduce dust.

2) Equipment Specifications

Requested water tanker with 6 to 8 m<sup>3</sup> tank is studied. See “Specifications of Equipment to be procured” for further details.

3) Number of Water Tankers

The required number of the water tankers is calculated based on the following criteria:

a. Spraying Area

The main purpose of water spraying is to prevent dust at the landfill site and, given the conditions of the site, the target area is inferred to be 276,000 m<sup>2</sup> as follows;

-Road	: 20 m x 2,500 m=50,000m <sup>2</sup>
-Damped area	: 400 m x 440 m=176,000m <sup>2</sup>
-Afforestation in the site	: 20 m x 1,500 m=30,000m <sup>2</sup>
-Access road	: 20 m x 1,000 m=20,000m <sup>2</sup>
<u>Total</u>	<u>276,000m<sup>2</sup></u>

b. Amount of Spraying

Given the conditions of the landfill site, spraying at a rate of 0.25 mm/day\* is required for above-mentioned purposes. Therefore amount of spray water is 69 m<sup>3</sup> (=0.25 x 276,000 ÷ 1,000).

\* The existing 5 m<sup>3</sup> class water tanker covers an area of some 22,500 m<sup>2</sup> (150 square metres). This results in a spraying rate of 0.25 mm (5 m<sup>3</sup> ÷ 22,500 m<sup>2</sup> x 1,000).

c. Time Cycle of Water Tanker Operation

One cycle lasting for 60 minutes consists of five minutes for water supply to the tank, 10 minutes for the return trip to the target site and 45 minutes for spraying operation.

d. Working Hours

The actual working hours per day is set at seven hours.

e. Efficiency

The work efficiency and working ratio are set at 80% and 85% respectively.

f. Required Number

Considering that the spraying capacity of existing water tanker with 5 m<sup>3</sup> tank is 11.2 m<sup>3</sup>, specification and number of new water tank is required to cover the water amount of 57.8m<sup>3</sup>/day (=69.0 – 11.2).

Two water tankers with 6 m<sup>3</sup> tank are required as calculated in Table 2.2.2.4-1

**Table 2.2.2.4-1 Specifications and Numbers of Water Tanker**

Type	Tank Capacity (m <sup>3</sup> )	Q'ty (unit)	Trip	Efficiency (%)	Working Ratio (%)	Water Spraying (m <sup>3</sup> /day)	Total Water Spraying (m <sup>3</sup> /day)
Existing Water Tanker	5	1	7	80	40	11.2	—
New Water Tanker	6	2	7	80	85	57.1	68.3
	7	2	7	80	85	66.6	77.8
	8	2	7	80	85	76.2	87.4

4) Evaluation of Existing Equipment

Although Municipality of Greater Amman has one water tanker made in 1994 which was procured during phase 1, it cannot cover the required amount of spraying water. Therefore, procurement of new water tankers is indispensable.

(2) Double Cab Pick Up Truck

1) Purpose of Use

The double cap pick up trucks will be used for business trips by staff members of the Department of Environment and General Sanitation who workplace will be moved to the landfill site (trips for meetings with municipal officials, including those of the Transport Department and Vehicle Department, and other purposes) and also for patrols by inspectors to check the state of solid waste collection in the service area.

2) Equipment Specifications

In view of prospective visits of usually up to three staff members of the Department of Environment and General Sanitation at a time to the municipal office and patrols

by one or two inspectors at a time, the request for five-seater general-purpose double cab pick up trucks is judged to be appropriate. See “Specifications of Equipment to be procured” for further details.

3) Number of Double Cab Pick Up Trucks

Given the purpose of use described above, two pick up trucks are planned to serve business trips and patrols respectively.

4) Evaluation of Existing Equipment

Although there is one double cab pick up truck which was procured for operation and maintenance equipment at Madona-Ghabawi landfill site, this equipment is for operation and maintenance section of Madona-Ghabawi landfill site (44 workers), not same as mentioned above. Therefore, joint use for both purposes is hardly achievable.

(3) Dump Truck

1) Purpose of Use

The dump trucks will mainly be used for the transportation of excavated soil from the second cell construction site at the Madona-Ghabawi landfill site. Following the completion of the second cell construction work, they will be used as replacements for the existing dump trucks (made in 1984 through 1996) used to transport covering soil.

2) Equipment Specifications

Based on the request for 8 – 10 m<sup>3</sup> class dump trucks, the procurement of 10 m<sup>3</sup> class dump trucks is planned because of their better efficiency (because of their larger loading capacity). See “Specifications of Equipment to be procured” for further details.

3) Number of Dump Trucks

The required number of the above-mentioned 10 m<sup>3</sup> class dump trucks is calculated based on the following criteria.

a. Soil Amount to be Transported

The daily amount of soil to be transported is 3,830 m<sup>3</sup> as indicated in 2.2.3-(2)-2).



b. Time Cycle of Transportation

One cycle is six minutes, consisting of two minutes for loading, three minutes for the return trip and one minute for unloading, etc.

c. Working Hours

The actual working hours are set at seven hours per day.

d. Efficiency

The work efficiency and the working ratio are set at 80% and 85% respectively.

e. Required Number of Dump Trucks

Eight dump trucks are required based on the following calculation result.

$$3,830 \text{ m}^3 \div (10 \text{ m}^3 \times 7 \text{ hours} \times 60 \text{ minutes/hour} \div 6 \text{ minutes} \times 0.8) \div 0.85 = 8$$

As the request is for six dump trucks, the remaining two must be met by the existing dump trucks or newly purchased by the Jordanian side at its own expense.

4) Evaluation of Existing Equipment

Municipality of Greater Amman has six dump trucks (made in 1984 x1, in 1987 x1, in 1994 x2, and in 1996 x2). These are used for transportation of covering soil, so that cannot be diverted to construction of second cell. Moreover, some old dump trucks are more than 20 years old and renewal must be considered.

(4) Passenger Bus

1) Purpose of Use

The passenger bus will be used to commute staff members and workers working at the landfill site.

2) Equipment Specifications

Although a 20 seats bus was originally requested, the procurement of a 30 seats bus is planned because of the expected number of passengers shown in Table 2.2.2.4-2. See "Specifications of Equipment to be procured" for further details.

**Table 2.2.2.4-2 Expected Number of Commuter Bus Passengers**

	Landfill Site Workers			Staff of Department of Environment and General Sanitation	Total
	Staff	Workers	Sub-Total		
Early Morning		15	15		15
Morning/Evening	4		4	25	29
Afternoon		15	15		15
Night		10	10		10
Total	4	40	44	25	69

3) Number of Passenger Buses

As one bus should be sufficient to meet the demand, the procurement of one 30 seats passenger bus is planned.

4) Evaluation of Existing Equipment

There is no public transportation to Madona-Ghabawi landfill site. Currently, workers go there by pickup own by municipality (some workers ride on the bed of pickup) or motorcycle. In consideration with increase of commuters who attend Madona-Ghabawi landfill site and their safety, it is indispensable that new passenger bus for exclusive use for commuters. Municipality of Greater Amman has submitted a letter which mentioned that

(5) Mobile Workshop Truck

1) Purpose of Use

Following the relocation of the landfill site to Madona-Ghabawi located some 30 km from the centre of MOGA, a mobile workshop truck will be used to deal with the breakdowns of vehicles and construction machinery on access roads and at the landfill site.

2) Equipment Specifications

In view of the purpose of use described above, the planned mobile workshop truck will be equipped with a jib crane, electric welder with a generator, gas welder/cutter and air compressor, etc. Although a 4 x 4 truck similar to the mobile workshop truck provided in Phase 1 has been requested, the new mobile workshop truck to be provided under the Project is a 4 x 2 because of its prospect of travelling on relatively flat roads. See “Specifications of Equipment to be procured” for further details.

3) Number of Mobile Workshop Trucks

As one mobile workshop truck should be sufficient to meet the demand, the procurement of one mobile workshop truck is planned.

4) Evaluation of Existing Equipment

A mobile workshop made in 1994 which procured for the purpose of repairing inter city compactor during phase 1, is now working full-time likewise other mobile workshops. This equipment cannot be applied to access road to Madona-Ghabawi or breakdown of landfill equipment. In addition to this, new transfer station will be constructed and more numbers of mobile workshops are required. Hence, procurement new mobile workshop based on Madona-Ghabawi landfill site is indispensable.

(6) Summary of Planned Contents of the Operation and Maintenance Vehicles

The planned contents of the operation and maintenance vehicles are summarised in Table 2.2.2.4-3.

**Table 2.2.2.4-3 Planned Contents of Operation and Maintenance Vehicles**

Item No.	Vehicle Type	Main Spec.	Purpose of Use	Number		Provider	
				Requested	Required	Japan	Jordan
3-1	Water Tanker	6 m <sup>3</sup> Class Tank	Water spraying for compacting of covering soil and dust reduction at the landfill site; spraying for the access road	3	2	2	-
3-2	Double Cab Pick Up Truck	5 seats or more	Patrols by inspection team to check the state of solid waste collection in the service area and state of transportation on the access road	2	2	2	-
3-3	Dump Truck	10 m <sup>3</sup> Class	Loading of excavation soil from the second cell construction site and covering soil for the first cell	6	8	6	2
3-4	Passenger Bus for Landfill Staff	30 Seats Class	Commuting of landfill staff and staff of the Department of Environment and General Sanitation	1	1	1	-
3-5	Mobile Workshop Truck	4 x 2; 9 ton Class	Maintenance of waste collection vehicles, transfer equipment and landfill equipment	1	1	1	-

### 2.2.2.5 Outline of Specifications and Numbers of Equipment

As the result of the study, equipment shown in Table 2.2.2.5-1 will be procured by the Japanese side for this Project. See “Specifications of Equipment to be procured” for further details.

**Table 2.2.2.5-1 Summary of Equipment to be Procured**

No.	Equipment	Specification	Quantity
<b>1</b>	<b>Waste Collection &amp; Transfer Station Vehicle</b>		
1-1	Waste collection vehicle		
1-1-1	Inter city compactor (small)	4 m <sup>3</sup> class compactor	20
1-1-2	Inter city compactor (medium)	8 m <sup>3</sup> class compactor	4
1-1-3	Inter city compactor (large)	16 m <sup>3</sup> class compactor	5
1-2	Transfer station vehicle		
1-2-1	Long chassis open type trailer	40 m <sup>3</sup> open type trailer	8
1-2-2	Tractor head for trailer	For 40 m <sup>3</sup> open type trailer, 230 PS class	6
<b>2</b>	<b>Landfill site equipment</b>		
2-1	Landfill Equipment		
2-1-1	Bulldozer (small)	180 HP class, tilt dozer	2
2-1-2	Bulldozer (medium)	220 HP class, tilt dozer	2
2-2	Soil Excavation Equipment		
2-2-1	Bulldozer (large)	320 HP class, tilt dozer	1
2-2-2	Backhoe	0.8 m <sup>3</sup> class, 125 HP class	2
2-2-3	Wheel loader	3.5 m <sup>3</sup> class, 200 HP class	3
2-2-4	Dozer shovel	1.8 m <sup>3</sup> class, 125 HP class	2
2-2-5	Motor grader	3.5 m class, 150 HP class	1
2-2-6	Vibratory roller	2 x 1.4 m class, 120 HP class	1
<b>3</b>	<b>Operation and maintenance vehicle</b>		
3-1	Water tanker	6 m <sup>3</sup> with tank, 180PS class	2
3-2	Double cab pick-up	5 seats class, 4x4, 100 PS class	2
3-3	Dump truck	10 m <sup>3</sup> , 15tons class, 290 PS class	6
3-4	Passenger bus for the landfill staff	30 seats class, 4x2, 130 PS class	1
3-5	Mobile workshop	Box shape body, 4x2, 160 PS class	1
	Total		69

### **2.2.3 Basic Design Drawing**

The general specifications of the equipment to be procured in the project are shown in Table 2.2.3-1 to 2.2.3-18, and typical drawings are in figures 2.2.3-1 to 2.2.3-15.

**Table 2.2.3-1 Specifications of Equipment: Inter City Compactor (Small)**

Equipment No : 1-1-1	Equipment name: Small size inter city compactor	Quantity: 20
<p>Specification purpose of use, etc: To be used for collecting general household waste in areas of narrow roads in refugee camps, etc. in Palestine</p>		
<p>Specifications</p> <p>1.Type of vehicle : Plate type compactor truck</p> <p>2.Nominal capacity : 4m<sup>3</sup> class</p> <p>3.Main specifications</p> <p>(1) Steering wheel : Left hand steering wheel</p> <p>(2) Drive method : 4x2 rear drive</p> <p>(3) Max. payload : 2,000 kg or more</p> <p>(4) Vehicle weight (including body) : 3,800 kg or more</p> <p>4.Main dimensions</p> <p>(1) Total length : 6,000mm or less</p> <p>(2) Total width : 2,100mm or less</p> <p>(3) Total height : 2,400mm or less</p> <p>(4) Wheel base : 3,400mm or less</p> <p>(5) Minimum turning radius : 6,300mm or less</p> <p>5. Engine</p> <p>(1) Type : Water-cooled, 4-cycle, diesel engine</p> <p>(2) Max. output : 120ps or more</p> <p>6.Attachments</p> <p>(1) Body volume : 4m<sup>3</sup> or more</p> <p>(2) Hopper volume : 0.5m<sup>3</sup> or more</p> <p>(3) Body operating method : Mechanical manual operation</p> <p>(4) Hopper cover : To be equipped</p> <p>(5) Body coating : Electropaint</p> <p>(6) Air conditioner, etc. : To be equipped, including radio and cassette deck</p> <p>7. Main materials, plate thickness</p> <p>(1) Body top plate : 50kg or more high-tension steel plate、 2 mm or more</p> <p>(2) Hopper bottom plate : 50kg or more high-tension steel plate、 8 mm or more</p> <p>8. Accessories</p> <p>(1) Spare tire : 1 unit</p> <p>(2) Tool kit : 1 set</p>		

**Table 2.2.3-2 Specifications of Equipment: Inter City Compactor (Medium)**

Equipment No : 1-1-2	Equipment name: Medium size inter city compactor	Quantity: 4
Specification purpose of use, etc: To be used for collecting general household waste from containers in areas of relatively narrow roads		
Specifications		
1.Type of vehicle	: Plate type compactor truck	
2.Nominal capacity	: 8m <sup>3</sup> class	
3.Main specifications		
(1) Steering wheel	: Left hand steering wheel	
(2) Drive method	: 4x2 rear drive	
(3) Max. payload	: 4,000 kg or more	
(4) Vehicle weight (including body)	: 7,000 kg or more	
4.Main dimensions		
(1) Total length	: 7,700mm or less	
(2) Total width	: 2,400mm or less	
(3) Total height	: 3,200mm or less	
(4) Wheel base	: 3,800mm or less	
(5) Minimum turning radius	: 7,000mm or less	
5. Engine		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 200ps or more	
6.Attachments		
(1) Body volume	: 8m <sup>3</sup> or more	
(2) Hopper volume	: 0.95m <sup>3</sup> or more	
(3) Body operating method	: Mechanical manual operation	
(4) Container lift	: Arm lifting device for containers in Jordan	
(5) Hopper cover	: To be equipped	
(6) Body coating	: Electropaint	
(7) Air conditioner, etc.	: To be equipped, including radio and cassette deck	
7. Main materials, plate thickness		
(1) Body top plate	: 50kg or more high-tension steel plate、 2 mm or more	
(2) Hopper bottom plate	: 50kg or more high-tension steel plate、 8 mm or more	
8. Accessories		
(1) Spare tire	: 1 unit	
(2) Tool kit	: 1 set	

**Table 2.2.3-3 Specifications of Equipment: Inter City Compactor (Large)**

Equipment No : 1-1-3	Equipment name: Large size inter city compactor	Quantity: 5
Specification purpose of use, etc: To be used for collecting general household waste from containers throughout the city		
Specifications		
1.Type of vehicle	: Plate type compactor truck	
2.Nominal capacity	: 16 m <sup>3</sup> class	
3.Main specifications		
(1) Steering wheel	: Left hand steering wheel	
(2) Drive method	: 4x2 rear drive	
(3) Max. payload	: 9,000 kg or more	
(4) Vehicle weight (including body)	: 12,000 kg or more	
4.Main dimensions		
(1) Total length	: 9,200mm or less	
(2) Total width	: 2,500mm or less	
(3) Total height	: 3,700mm or less	
(4) Wheel base	: 5,000mm or less	
(5) Minimum turning radius	: 7,500mm or less	
5. Engine		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 230ps or more	
6.Attachments		
(1) Body volume	: 15 m <sup>3</sup> or more	
(2) Hopper volume	: 1.5m <sup>3</sup> or more	
(3) Body operating method	: Mechanical manual operation	
(4) Container lift	: Arm lifting device for containers in Jordan	
(5) Hopper cover	: To be equipped	
(6) Body coating	: Electropaint	
(7) Air conditioner, etc.	: To be equipped, including radio and cassette deck	
7. Main materials, plate thickness		
(1) Body top plate	: 50kg or more high-tension steel plate、 2 mm or more	
(2) Hopper bottom plate	: 50kg or more high-tension steel plate、 8 mm or more	
8. Accessories		
(1) Spare tire	: 1 unit	
(2) Tool kit	: 1 set	



**Table 2.2.3-4 Specifications of Equipment: Long Chassis Open-type Trailer**

Equipment No : 1-2-1	Equipment name: Long chassis open-type trailer	Quantity: 8
Specification purpose of use, etc: To be used for relay transportation of solid waste from relay stations to the final disposal site		
Specifications		
1.Type of vehicle	:	Open-type trailer
2.Nominal capacity	:	40m <sup>3</sup>
3.Main specifications		
(1) Max. payload	:	18,000 kg or more
(2) Vehicle weight (including body)	:	9,000 kg or more
4.Main body dimensions		
(1) Total length (inside)	:	10,000mm or less
(2) Total width (inside)	:	2,500mm or less
(3) Total height (inside)	:	2,000mm or less
(4) Volume (inside)	:	40 m3 or more
5. Main materials, plate thickness		
(1) Deck plate	:	Ordinary steel plate, 8.0mm or more
(2) Side panel	:	Ordinary steel plate, 3.2mm or more
(3) Tail gate	:	Ordinary steel plate, 4.5mm or more
6. Tipping mechanism		
(1) Tipping mode	:	Hydraulic cylinder
(2) Max. tipping angle	:	45 degrees or more
(3) Body raising time	:	30 seconds or less
(4) Body lowering time	:	35 seconds or less
7.Combination equipment, etc.		
(1) Combination type	:	King Pin, SAE 2inch
(2) Brake system	:	Inner expansion, air pressure type
(3) Coupling	:	SAE Standard
(4) Suspension	:	Tandem spring type
(5) Equipment	:	Hydraulic pump, hoist cylinder, etc.
8.Accessories		
(1) Spare tire	:	1 unit
(2) Tool kit	:	1 set

**Table 2.2.3-5 Specifications of Equipment: Tractor Head for Trailer**

Equipment No : 1-2-2	Equipment name: Tractor head	Quantity: 6
Component equipment No :	Component equipment name :	Quantity :
Specification purpose of use, etc: To be used for pulling the relay transportation 40 m <sup>3</sup> open-type trailer		
Component parts:		
Specifications		
1. Vehicle type	: Heavy duty tractor head	
2. Trailer	: 40 m <sup>3</sup> open-type trailer	
3. Main specifications		
(1) Steering wheel	: Left hand steering wheel	
(2) Drive method	: 6 x 4 rear drive	
(3) Weight	: 8,000 kg or more	
(4) Total weight when running (Including trailer)	: To be less than the given standard in Jordan	
(5) Crew	: 3 persons	
4. Tractor head main specifications		
(1) Total length	: 7,000mm or less	
(2) Total width	: 2,500mm or less	
(3) Total height	: 3,000mm or less	
(4) Wheel base (including rear wheel)	: 4,600mm or less	
4. Main dimensions coupled to trailer		
(1) Total length	: 15,000mm or less	
(2) Total width	: 2,750mm or less	
(3) Total height	: 4,000mm or less	
5. Engine		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 340ps or more	
6. Equipment		
(1) Air conditioner	: To be equipped	
(2) Audio system	: Radio, cassette deck	
7. Accessories		
(1) Spare tire	: 1 unit	
(2) Tool kit	: 1 set	

**Table 2.2.3-6 Specifications of Equipment: Bulldozer (Small)**

Equipment No : 2-1-1	Equipment name: Bulldozer (small)	Quantity: 2
<p>Specification purpose of use, etc:          To be used for earth covering in sanitary landfilling of collected general household waste on the final disposal site</p>		
<p>Specifications</p> <p>1.Type of vehicle : 180 HP class tilt dozer</p> <p>2.Main dimensions</p> <p>(1) Total length : 5,900mm or less</p> <p>(2) Total width : 4,000mm or less</p> <p>(3) Total height : 3,300mm or less (top of ROPS)</p> <p>(4) Ground clearance : 350mm or more</p> <p>3. Blade</p> <p>(1) Shape : Semi-U tilt type, with trash rack</p> <p>(2) Material : Hard face steel</p> <p>4. Weight : 17,000 kg or more</p> <p>5. Engine, etc.</p> <p>(1) Type : Water-cooled, 4-cycle, diesel engine</p> <p>(2) Max. output : 180 HP or more</p> <p>(3) Max. forward speed : 10km/h or more</p> <p>(4) Max. reverse speed : 12km/h or more</p> <p>(5) Transmission : Forward 3-stage, reverse 3-stage or more</p> <p>6. Track</p> <p>(1) Type : Sealed and lubricated tracks</p> <p>(2) Width : 500mm or more</p> <p>7.Attachments</p> <p>(1) Cab : ROPS steel cab</p> <p>(2) Air conditioner : To be equipped</p> <p>(3) Seat : Adjustable suspension type, with seat belt</p> <p>(4) Engine hood : To be equipped, with side cover</p> <p>(5) Radiator guard : To be equipped</p> <p>(6) Trash rack : Height 500mm or more</p> <p>8.Accessories</p> <p>(1) Standard tool kit : Tool box stored type, 1 set</p>		

**Table 2.2.3-7 Specifications of Equipment: Bulldozer (Medium)**

Equipment No : 2-1-2	Equipment name: Bulldozer (medium)	Quantity: 2
<p>Specification purpose of use, etc:          To be used for earth covering in sanitary landfilling of collected general household waste on the final disposal site</p>		
<p>Specifications</p> <p>1.Type of vehicle : 220 HP class tilt dozer</p> <p>2.Main dimensions</p> <p>(1) Total length : 6,100mm or less</p> <p>(2) Total width : 4,400mm or less</p> <p>(3) Total height : 3,600mm or less (top of ROPS)</p> <p>(4) Ground clearance : 400mm or more</p> <p>3. Blade</p> <p>(1) Shape : Semi-U tilt type, with trash rack</p> <p>(2) Material : Hard face steel</p> <p>4. Weight : 24,000 kg or more</p> <p>5. Engine, etc.</p> <p>(1) Type : Water-cooled, 4-cycle, diesel engine</p> <p>(2) Max. output : 220 HP or more</p> <p>(3) Max. forward speed : 10km/h or more</p> <p>(4) Max. reverse speed : 12km/h or more</p> <p>(5) Transmission : Forward 3-stage, reverse 3-stage or more</p> <p>6. Track</p> <p>(1) Type : Sealed and lubricated tracks</p> <p>(2) Width : 550mm or more</p> <p>7.Attachments</p> <p>(1) Cab : ROPS steel cab</p> <p>(2) Air conditioner : To be equipped</p> <p>(3) Seat : Adjustable suspension type, with seat belt</p> <p>(4) Engine hood : To be equipped, with side cover</p> <p>(5) Radiator guard : To be equipped</p> <p>(6) Trash rack : Height 550mm or more</p> <p>8.Accessories</p> <p>(1) Standard tool kit : Tool box stored type, 1 set</p>		

**Table 2.2.3-8 Specifications of Equipment: Bulldozer (Large)**

Equipment No : 2-2-1	Equipment name: Bulldozer (large)	Quantity: 1
Specification purpose of use, etc: Mainly to be used for ground excavation during construction of the final disposal site		
Specifications		
1.Type of vehicle	: 320 HP class tilt dozer	
2.Main dimensions		
(1) Total length	: 6,700mm or less	
(2) Total width	: 4,900mm or less	
(3) Total height	: 3,800mm or less (top of ROPS)	
(4) Ground clearance	: 500mm or more	
3. Blade		
(1) Shape	: Semi-U tilt type, with trash rack	
(2) Material	: Hard face steel	
4. Weight	: 33,000 kg or more	
5. Engine, etc.		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 310 HP or more	
(3) Max. forward speed	: 10km/h or more	
(4) Max. reverse speed	: 12km/h or more	
(5) Transmission	: Forward 3-stage, reverse 3-stage or more	
6. Track		
(1) Type	: Sealed and lubricated tracks	
(2) Width	: 550mm or more	
7.Attachments		
(1) Cab	: ROPS steel cab	
(2) Air conditioner	: To be equipped	
(3) Seat	: Adjustable suspension type, with seat belt	
(4) Engine hood	: To be equipped, with side cover	
(5) Radiator guard	: To be equipped	
(6) Trash rack	: Height 550mm or more	
8.Accessories		
(1) Standard tool kit	: Tool box stored type, 1 set	

**Table 2.2.3-9 Specifications of Equipment: Backhoe**

Equipment No : 2-2-2	Equipment name: Backhoe	Quantity: 1
Specification purpose of use, etc: Mainly to be used for ground excavation during construction of the final disposal site		
Specifications		
1. Nominal capacity	: 0.8m <sup>3</sup> class	
2. Main dimensions		
(1) Shipping length	: 9,600mm or less	
(2) Shipping overall width	: 3,000mm or less	
(3) Shipping overall height	: 3,100mm or less	
(4) Ground clearance	: 400mm or more	
(5) Digging depth	: 6,500mm or more	
(6) Reach	: 9,500mm or more	
(7) Cutting height	: 9,200mm or more	
(8) Loading height	: 6,500mm or more	
3. Bucket		
(1) Shape	: General type	
(2) Capacity	: 0.8m <sup>3</sup> or more (SAE heaped)	
4. Weight	: 18,000 kg or more	
5. Engine, etc.		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 125 HP or more	
(3) Max. forward speed	: 4km/h or more	
(4) Max. reverse speed	: 5km/h or more	
(5) Transmission	: Forward 3-stage, reverse 3-stage or more	
6. Track		
(1) Type	: Sealed and lubricated tracks	
(2) Width	: 550mm or more	
7. Attachments		
(1) Cab	: ROPS steel cab	
(2) Air conditioner	: To be equipped	
(3) Seat	: Adjustable suspension type, with seat belt	
(4) Engine hood	: To be equipped, with side cover	
(5) Radiator guard	: To be equipped	
8. Accessories		
(1) Standard tool kit	: Tool box stored type, 1 set	

**Table 2.2.3-10 Specifications of Equipment: Wheel Loader**

Equipment No : 2-2-3	Equipment name: Wheel loader	Quantity: 3
Specification purpose of use, etc: Mainly to be used for loading excavated earth onto dump trucks during construction of the final disposal site		
Specifications		
1. Nominal capacity	: 3.5m <sup>3</sup> class	
2. Main dimensions		
(1) Total length	: 8,400mm or less	
(2) Total width	: 3,200mm or less	
(3) Total height	: 3,500mm or less	
(4) Wheel base	: 3,500mm or less	
(5) Minimum turning radius (Outside corner of bucket)	: 7,100mm or less	
(6) Ground clearance	: 400mm or more	
3. Bucket		
(1) Shape	: General type	
(2) Capacity	: 3.2m <sup>3</sup> or more (SAE heaped)	
4. Weight	: 16,000 kg or more	
5. Engine, etc.		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 200 HP or more	
(3) Max. forward speed	: 30 km/h or more	
(4) Max. reverse speed	: 30 km/h or more	
(5) Max. rim pull	: 13,000 kg or more	
6. Wheels		
(1) Wheel base	: 3,500 mm or less	
(2) Tread	: 2,300 mm or less	
7. Attachments		
(1) Cab	: ROPS steel cab	
(2) Air conditioner	: To be equipped	
(3) Seat	: Adjustable suspension type, with seat belt	
(4) Engine hood	: To be equipped, with side cover	
(5) Radiator guard	: To be equipped	
8. Accessories		
(1) Standard tool kit	: Tool box stored type, 1 set	

**Table 2.2.3-11 Specifications of Equipment: Dozer Shovel**

Equipment No : 2-2-4	Equipment name: Dozer shovel	Quantity: 2
Specification purpose of use, etc: To be used for moving excavated earth during construction of the final disposal site		
Specifications		
1. Nominal capacity	: 1.8m <sup>3</sup> class	
2. Main dimensions		
(1) Total length	: 6,200mm or less	
(2) Total width	: 2,500mm or less	
(3) Total height	: 3,400mm or less (top of ROPS)	
(4) Ground clearance	: 380mm or more	
3. Bucket		
(1) Shape	: General type	
(2) Capacity	: 3.2m <sup>3</sup> or more (SAE heaped)	
4. Weight	: 15,000 kg or more	
5. Engine, etc.		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 125 HP or more	
(3) Max. forward speed	: 9km/h or more	
(4) Max. reverse speed	: 9km/h or more	
(5) Transmission	: Forward 3-stage, reverse 3-stage or more	
6. Track		
(1) Type	: Sealed and lubricated tracks	
(2) Width	: 450mm or more	
7. Attachments		
(1) Cab	: ROPS steel cab	
(2) Air conditioner	: To be equipped	
(3) Seat	: Adjustable suspension type, with seat belt	
(4) Engine hood	: To be equipped, with side cover	
(5) Radiator guard	: To be equipped	
8. Accessories		



**Table 2.2.3-12 Specifications of Equipment: Motor Grader**

Equipment No : 2-2-5	Equipment name: Motor grader	Quantity: 1
Specification purpose of use, etc: To be used for ground and road leveling work on the final disposal site		
Specifications		
1. Type of vehicle	: Articulated motor grader	
2. Main dimensions		
(1) Total length	: 8,600mm or less	
(2) Total width	: 2,600mm or less	
(3) Total height	: 3,500mm or less (top of ROPS)	
(4) Wheel base	: 6,300mm or less	
(5) Minimum turning radius (Outside corner of bucket)	: 7,300mm or less	
(6) Ground clearance	: 350mm or more	
3. Blade		
(1) Shape	: Standard type	
(2) Material	: Hard face steel	
(3) Width	: 3,500mm or more	
(4) Height	: 600mm or more	
4. Weight	: 12,000 kg or more	
5. Engine, etc.		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 150 HP or more	
(3) Max. forward speed	: 40 km/h or more	
(4) Max. reverse speed	: 25 km/h or more	
(5) Max. drawbar pull	: 7,000 kg or more	
6. Wheels		
(1) Wheel base	: 6,500 mm or less	
(2) Tread	: 2,300 mm or less	
7. Attachments		
(1) Cab	: ROPS steel cab	
(2) Air conditioner	: To be equipped	
(3) Seat	: Adjustable suspension type, with seat belt	
(4) Engine hood	: To be equipped, with side cover	
(5) Radiator guard	: To be equipped	
8. Accessories		
(1) Standard tool kit	: Tool box stored type, 1 set	

**Table 2.2.3-13 Specifications of Equipment: Vibratory Roller**

Equipment No : 2-2-6	Equipment name: Vibratory roller	Quantity: 1
Specification purpose of use, etc: To be used for ground and road leveling work on the final disposal site		
Specifications		
1.Type of vehicle	: 155 HP class vibratory roller	
2.Main dimensions		
(1) Total length	: 5,800mm or less	
(2) Total width	: 2,500mm or less	
(3) Total height	: 3,100mm or less	
(4) Wheel base	: 3,000mm or less	
(5) Drum width	: 2,000mm or more	
(6) Ground clearance	: 400mm or more	
3.Roll and tires		
(1) Front roll	: Vibrating, drive type	
(2) Front roll dimensions	: 2,000mm (W) x 1,500mm (D) or more,	
(3) Rear tires	: Drive type	
4.Operating conditions		
(1) Operating weight	: 10,000 kg or more	
(2) Minimum turning radius (Outside of roller)	: 5,900mm or less	
(3) Climbing ability	: 60% (31degrees) or more	
5. Engine, etc.		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 120 HP or more	
(3) Max. forward speed	: 10 km/h or more	
(4) Max. reverse speed	: 10 km/h or more	
(5) Max. centrifugal force	: 22,000 kg or more	
(6) Max. amplitude	: 1.5mm or more	
6.Attachments		
(1) Cab	: ROPS steel cab	
(2) Air conditioner	: To be equipped	
(3) Seat	: Adjustable suspension type, with seat belt	
(4) Engine hood	: To be equipped, with side cover	
(5) Radiator guard	: To be equipped	
7.Accessories		
(1) Standard tool kit	: Tool box stored type, 1 set	

**Table 2.2.3-14 Specifications of Equipment: Water Tanker**

Equipment No : 3-1	Equipment name: Water tanker	Quantity: 2
Specification purpose of use, etc: To be used for sprinkling water to prevent dust generation mainly on the final disposal site		
Specifications		
1.Type of vehicle	: Elliptical section type water tank truck	
2.Nominal capacity	: 6 m <sup>3</sup> class	
3.Main specifications		
(1) Steering wheel	: Left hand steering wheel	
(2) Drive method	: 4x2 rear drive	
(3) Max. payload	: 6,000 kg or more	
(4) Vehicle weight (including body)	: 4,000 kg or more	
4.Main dimensions		
(1) Total length	: 7,000mm or less	
(2) Total width	: 2,400mm or less	
(3) Total height	: 2,600mm or less	
(4) Wheel base	: 4,500mm or less	
(5) Minimum turning radius	: 7,500mm or less	
5. Engine		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 180ps or more	
6.Water tank		
(1) Type	: Elliptical cross section type	
(2) Volume (effective)	: 6m <sup>3</sup> or more	
(3) Material, plate thickness	: Inside epoxy coating, steel plate, 3.2mm or more	
7.Attachments		
(1) Sprinkling pump	: Volute pump, 500 lit/min or more	
(2) Air conditioner	: To be equipped	
(3) Audio system	: Radio, cassette deck	
8. Accessories		
(1) Hose	: 2 units	
(2) Hose winch	: 2 sets	
(3) Suction basket strainer	: 1 set	
(4) Spare tire	: 1 unit	
(5) Tool kit	: 1 set	

**Table 2.2.3-15 Specifications of Equipment: Double Cab Pickup**

Equipment No : 3-2	Equipment name: Double cab pickup	Quantity: 2
<p>Specification purpose of use, etc:          To be used for patrolling the city to observe waste collection and for work communications between workers on the final disposal site</p>		
<p>Specifications</p> <p>1.Type of vehicle : Double cab pickup</p> <p>2. Seating capacity : 5 persons</p> <p>3.Main specifications</p> <p>(1) Steering wheel : Left hand steering wheel</p> <p>(2) Drive method : 4x4</p> <p>(3) GVW : 2,500 kg or more</p> <p>(4) Maximum payload : 900 kg or more</p> <p>4.Main dimensions</p> <p>(1) Total length : 5,200mm or less</p> <p>(2) Total width : 2,000mm or less</p> <p>(3) Total height : 1,800mm or less</p> <p>(4) Wheel base : 3,000mm or less</p> <p>(5) Minimum turning radius : 6,500mm or less</p> <p>5. Engine</p> <p>(1) Type : Water-cooled, 4-cycle, diesel engine</p> <p>(2) Max. output : 180ps or more</p> <p>6.Loadbed dimensions</p> <p>(1) Total length (inside) : 1,300mm or more</p> <p>(2) Total width (inside) : 1,300mm or more</p> <p>(3) Side height : 430mm - 500mm or less</p> <p>7.Equipment</p> <p>(1) Air conditioner : To be equipped</p> <p>(2) Audio system : Radio, cassette deck</p> <p>8.Accessories</p> <p>(1) Spare tire : 1 unit</p> <p>(2) Tool kit : 1 set</p>		

**Table 2.2.3-16 Specifications of Equipment: Dump Truck**

Equipment No : 3-3	Equipment name: Dump truck	Quantity: 6
Component equipment No :	Component equipment name :	Quantity :
Specification purpose of use, etc: Mainly to be used for carrying excavated earth during construction of the second cell on the final disposal site		
<b>Component parts:</b>		
<b>Specifications</b>		
1.Type of vehicle	: Back discharge type dump truck	
2. Seating capacity	: 10	
3.Main specifications		
(1) Steering wheel	: Left hand steering wheel	
(2) Drive method	: 6x4 rear drive	
(3) Maximum payload	: 15,000 kg or more	
(4) Vehicle weight	: 9,800 kg or more	
(5) Total weight when running	: To be less than the given standard in Jordan	
4.Main dimensions		
(1) Total length	: 8,000mm or less	
(2) Total width	: 2,600mm or less	
(3) Total height	: 3,200mm or less	
(4) Wheel base	: 5,000mm or less	
(5) Minimum turning radius	: 7,500mm or less	
5. Engine		
(1) Type	: Water-cooled, 4-cycle, diesel engine	
(2) Max. output	: 290ps or more	
6.Loadbed dimensions		
(1) Total length (inside)	: 4,600mm or more	
(2) Total width (inside)	: 2,2000mm or more	
(3) Side height	: 900mm – 1,100mm or less	
7.Equipment		
(1) Air conditioner	: To be equipped	
(2) Audio system	: Radio, cassette deck	
8.Accessories		
(1) Spare tire	: 1 unit	
(2) Tool kit	: 1 set	

**Table 2.2.3-17 Specifications of Equipment: Passenger Bus**

Equipment No : 3-4	Equipment name: Passenger bus	Quantity: 1
Specification purpose of use, etc: To be used for transporting workers of the final disposal site and the Environmental and Sanitary Control Department to and from work		
Specifications		
1.Type of vehicle	:	Passenger bus
2. Seating capacity	:	30 persons or more
3.Main specifications		
(1) Steering wheel	:	Left hand steering wheel
(2) Drive method	:	4x2 rear drive
(3) GVW	:	5,500 kg or more
4.Main dimensions		
(1) Total length	:	7,500mm or less
(2) Total width	:	2,500mm or less
(3) Total height	:	2,800mm or less
(4) Wheel base	:	4,000mm or less
(5) Minimum turning radius	:	6,500mm or less
5. Engine		
(1) Type	:	Water-cooled, 4-cycle, diesel engine
(2) Max. output	:	130ps or more
6.Passenger room dimensions		
(1) Total length (inside)	:	6,000mm or more
(2) Total width (inside)	:	1,800mm or more
(3) Total height (inside)	:	1,750 mm or more
7.Equipment		
(1) Air conditioner	:	To be equipped
(2) Audio system	:	Radio, cassette deck
(3) Seats	:	Reclining type
(4) Curtains	:	To be equipped
8.Accessories		
(1) Spare tire	:	1 unit
(2) Tool kit	:	1 set

**Table 2.2.3-18 Specifications of Equipment: Mobile Workshop**

Equipment No : 3-5	Equipment name: Mobile workshop	Quantity: 1
Specification purpose of use, etc: To be used for inspecting and repairing relay transportation vehicles and equipment at the final disposal site		
Specifications 1.Type of vehicle : Box-shape body mobile workshop 2.Main specifications (1) Steering wheel : Left hand steering wheel (2) Drive method : 4x2 rear drive (3) GVW : 7,000 kg or more 4.Main dimensions (1) Total length : 7,000mm or less (2) Total width : 2,400mm or less (3) Total height : 3,500mm or less (4) Wheel base : 3,800mm or less (5) Minimum turning radius : 6,800mm or less 5. Engine (1) Type : Water-cooled, 4-cycle, diesel engine (2) Max. output : 160ps or more 6.Body dimensions (1) Body length : 4,300mm or more (2) Body width : 2,1000mm or more (3) Body height : 2,000 mm or more 7.Jib crane (1) Type : Floor-fixed, manual (2) Capacity : 500kg or more 8. Main tools onboard At a minimum, the following tools shall be carried onboard: (1)Electric welder : 10 KVA, engine output approx. 15HP (2) Air compressor : Approx. 15 kg/cm <sup>2</sup> , motor output approx. 2 KW (3) Grinder : Approx. 200 mm (4) Silicon charger : Approx. 1.5KW (5) Electric drill : Drill cap approx. 13 mm (6) Bench press : 10 ton (7) Hydraulic jack : 10 ton (8) Fire extinguisher : Powder, type, approx. 3.5 kg (9) Oxygen cylinder : 47L type (10) Acetylene cylinder : 7kgtype		

Equipment No : 3-5	Equipment name: Mobile workshop	Quantity: 1
(11) Gas welder	: Including oxygen regulator and other accessories	
(12) Tool box	: Annrox 450 mm x 300 mm x 120 mm	
9. Equipment		
(1) Air conditioner	: To be equipped	
(2) Audio system	: Radio, cassette deck	
10. Accessories		
(1) Spare tire	: 1 unit	
(2) Tool kit	: 1 set	



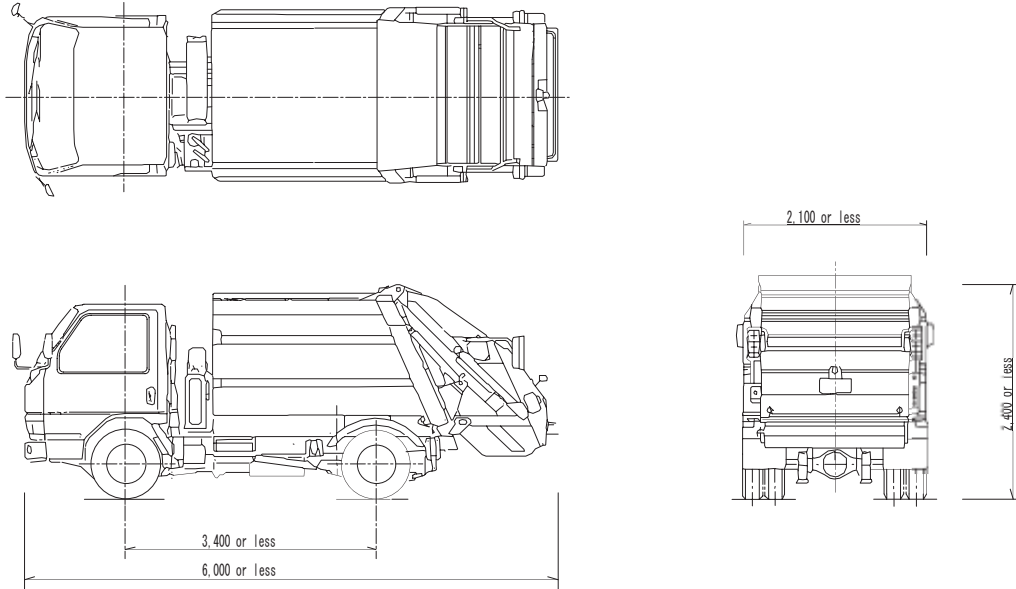


Fig. 2.2.3-1 Typical Drawings of Inter City Compactor (Small)

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of 4m Compactor Truck			
REV.	DATE	BY	REVISION
Rev. 0001	Rev.	0-1-1	0
<b>yec</b>		YAZH YTE ENGINEERING CONSULTING	CO., LTD. AND ARCHITECTS

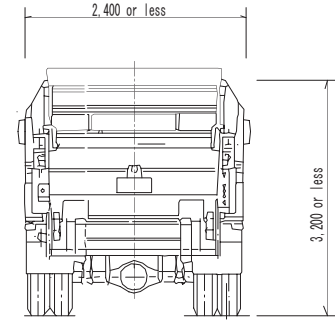
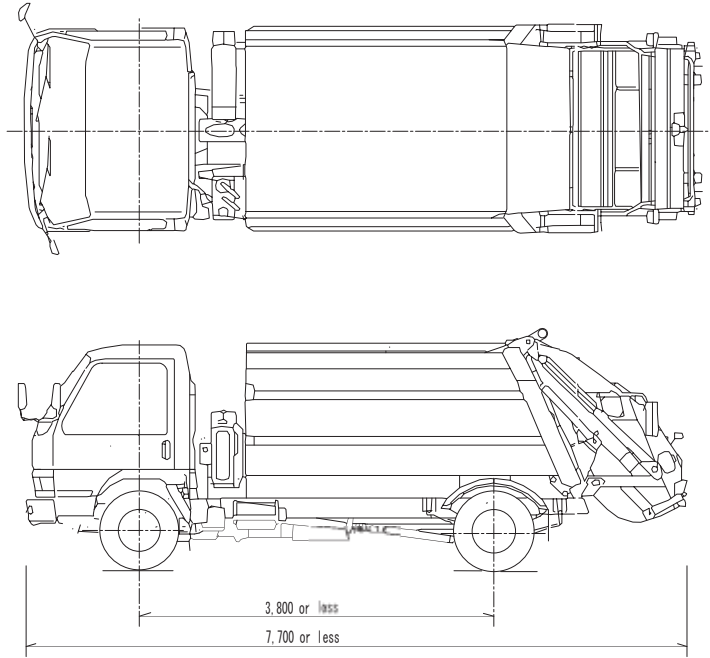


Fig. 2.2.3-2 Typical Drawings of Inter City Compactor (Medium)

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABARI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of the Compactor Truck			
DATE	SCALE	NO. IN NO.	REVISION
Dec 2004	1:1	1-1-2	0
<b>yeo</b>		FWZHI YTE ENGINEERING	CO., LTD. AND ARCHITECTS

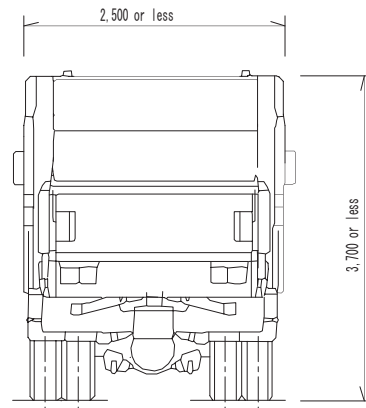
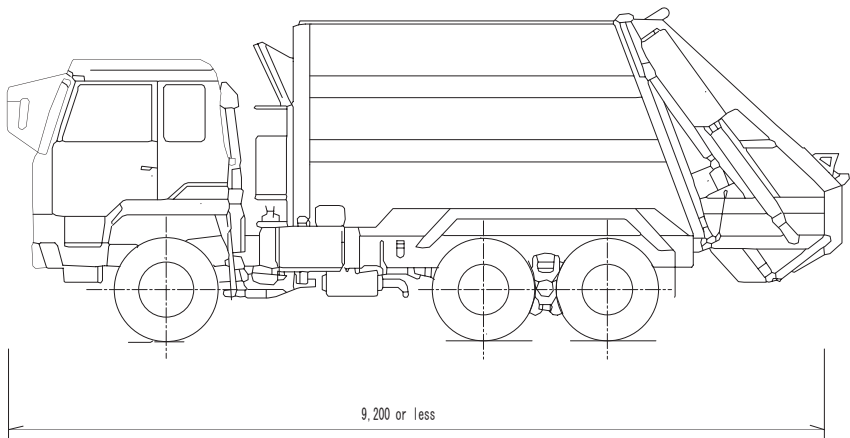
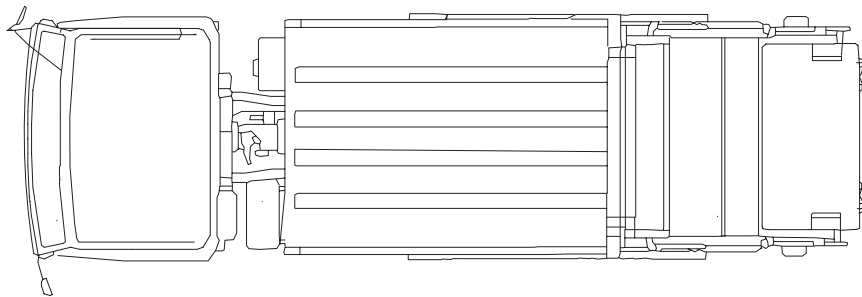
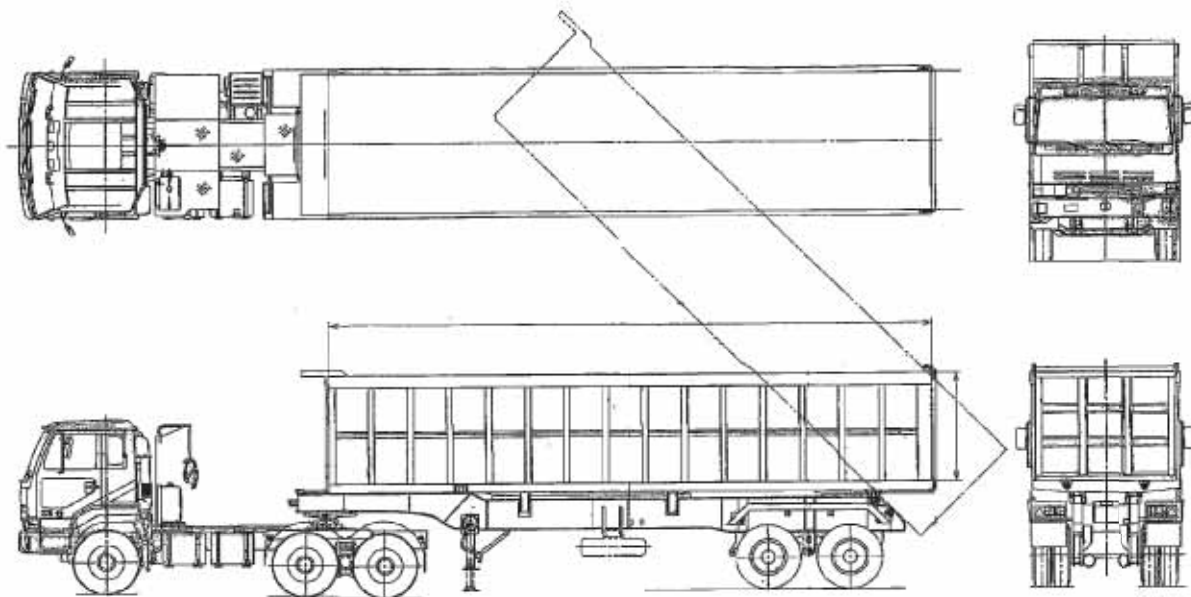


Fig. 2.2.3-3 Typical Drawings of Inter City Compactor (Large)

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABARI IN THE HASHEMITE KINGDOM OF JORDAN				
Standard Figure of 150 Compactor Truck				
DATE	SCALE	NO.	REVISED	REVISION
Nov 2004	1:1	1-1-3		0
<b>yec</b>		FWZ 1716 1000111001	ENR ENGINEERING S.A. MEYER AND ARCHITECTS	CO., LTD.

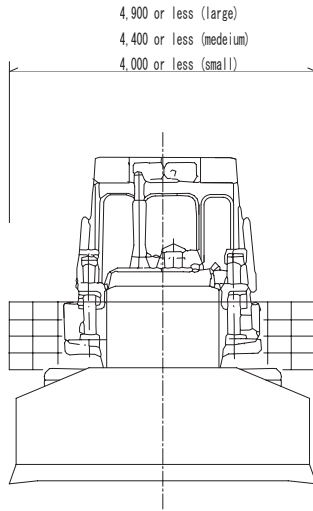


Tractor Head for Open-type Trailer

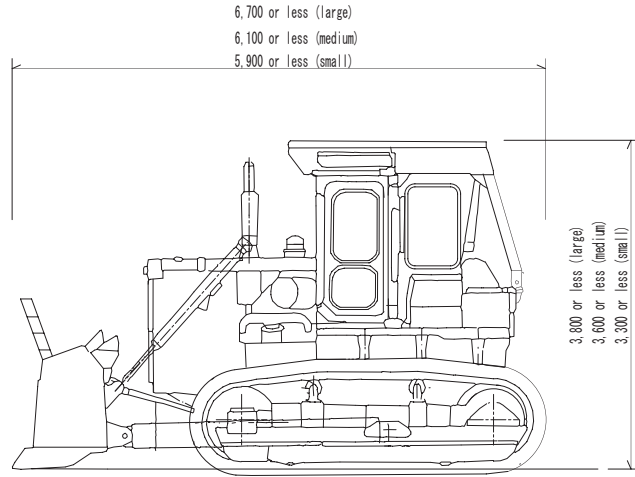
Long Chassis Open-type Trailer

Fig. 2.2.3-4 Typical Drawings of Long Chassis Open-type Trailer and Tractor Head

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABARI IN THE HASHEMITE KINGDOM OF JORDAN				
Standard Figure of Trailer & Tractor Head				
DATE	NO.	REV.	NO.	REVISION
10.2004	001	1-2-1 & 1-2-2		0
<b>yeo</b>		PROJECT ENGINEERING	CO., LTD.	
		CONSULTING	AND	ARCHITECTS



4,900 or less (large)  
 4,400 or less (medium)  
 4,000 or less (small)



6,700 or less (large)  
 6,100 or less (medium)  
 5,900 or less (small)

3,800 or less (large)  
 3,600 or less (medium)  
 3,300 or less (small)

Fig. 2.2.3-5 Typical Drawings of Bulldozer (Small, Medium and Large)

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASSEMETE KINGDOM OF JORDAN			
Standard Figure of Bulldozer (180, 220 & 320 HP)			
DATE	DRAWN	SCALE	REVISION
Nov 2004	Nov	2-1-1, 2-1-2 & 2-2-1	0
yeo		ENGINEERING	CO., LTD.
CONSULTANTS		AND ARCHITECTS	

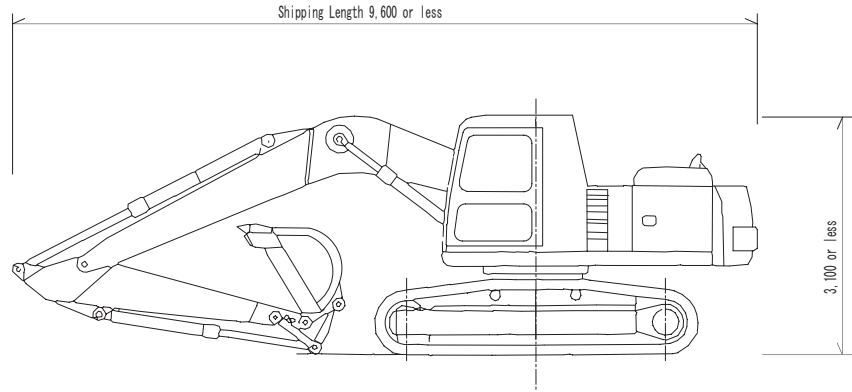
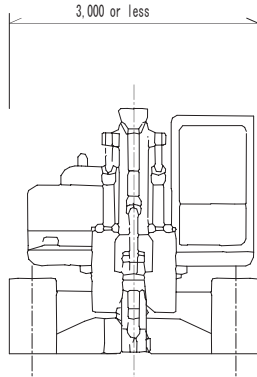


Fig. 2.2.3-6 Typical Drawings of Backhoe

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABWI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of 0 in Class Backhoe			
DATE	SCALE	REVISED	REVISION
2-2-2	1:1	2-2-2	0
<b>yao</b>		ENGINEERING CO., LTD. ENGINEERS AND ARCHITECTS	

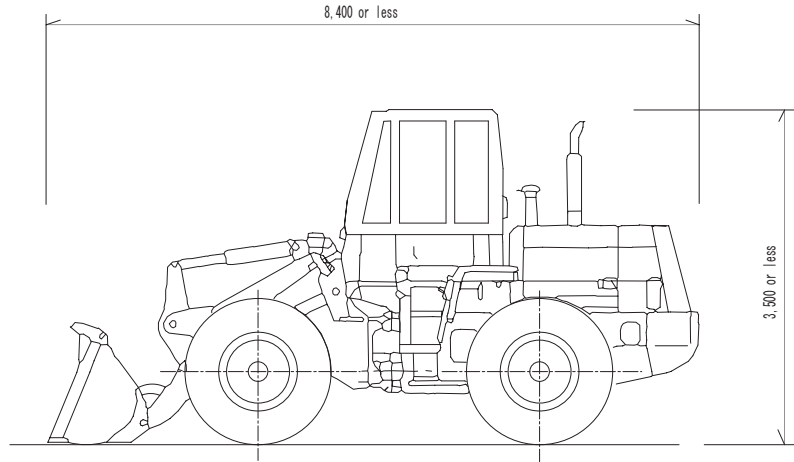
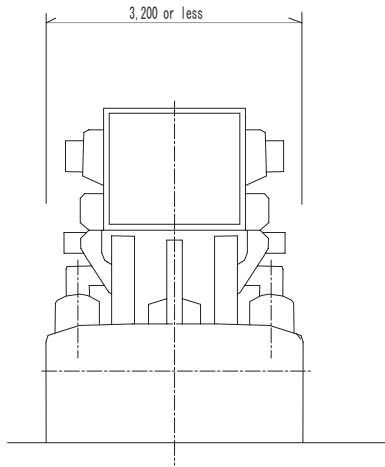


Fig. 2.2.3-7 Typical Drawings of Wheel Loader

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of 3.5t Class Wheel Loader			
NO. 1	SCALE	NO. 1/1	REVISION
Rev. 2024	Rev.	2-2-3	0
<b>yeo</b>	YASHIYU ENGINEERING	CO., LTD.	ARCHITECTS

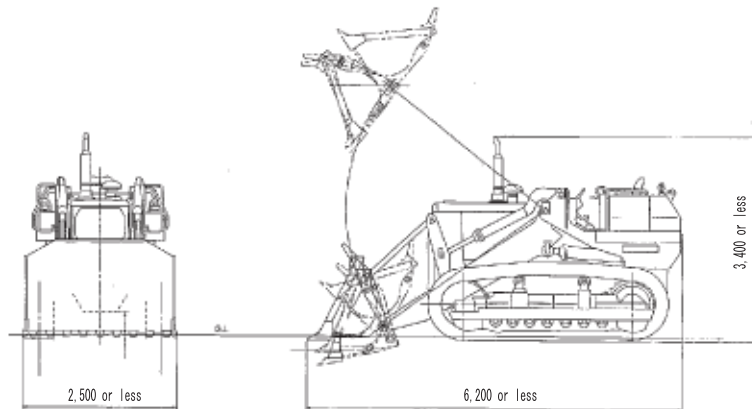


Fig. 2.2.3-8 Typical Drawings of Dozer Shovel

THE PROJECT OF SUPPLYING EQUIPMENT  
FOR NEW LANDFILL SITE  
OF MADONA-GHABANI  
IN THE HASHEMITE KINGDOM OF JORDAN

Standard Figure of 1. In Class Size (Shovel)

SHEET	SCALE	NO. NO.	REVISION
NO. 004	1:1	2-2-4	0

**yeo** FAJRIYE ENGINEERING CO., LTD.  
CONSULTING ENGINEERS AND ARCHITECTS



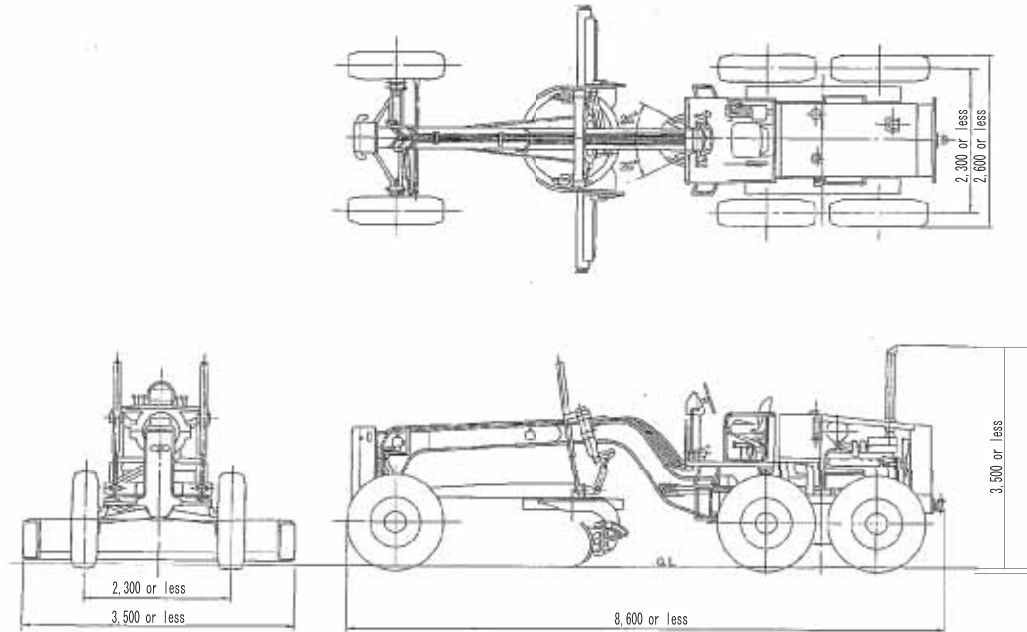



Fig. 2.2.3-9 Typical Drawings of Motor Grader

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASHEMITE KINGDOM OF JORDAN			
<b>Standard Figure of Motor Grader</b>			
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10/2000	Yao	2-2-5	0
 YAOH TO ENGINEERING CO., LTD. CONSULTING ENGINEERS AND ARCHITECTS			

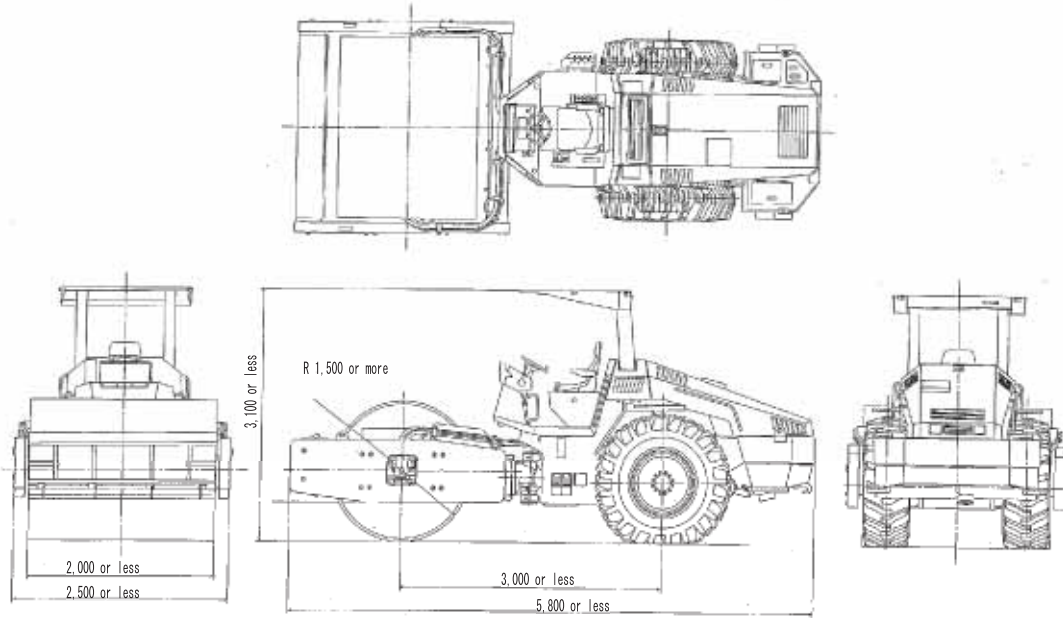


Fig. 2.2.3-10 Typical Drawing

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LA BUREAU SITE OF MONTREAL IN THE BUREAU OF TRANSPORTATION			
Standard Figure of Vibratory Roller			
DATE	SCALE	REV. NO.	REVISION
Dec 2001	1:10	2-2-6	D
yco		SAINT-YVES ENGINEERING	CO., LTD.
		CONTRACTING	ARCHITECTS

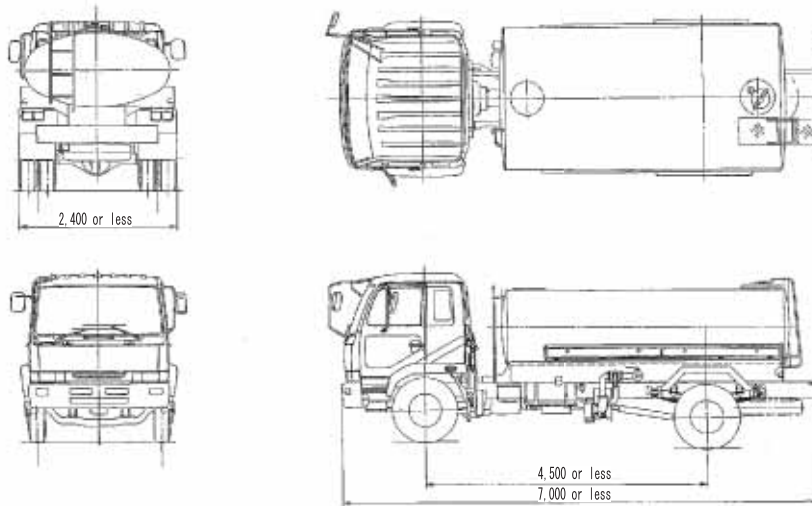


Fig. 2.2.3-11 Typical Drawings of Water Tanker

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of the Water Tanker			
DATE	SCALE	JOB NO.	REVISION
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<b>yec</b>	YASIR YEH CONSULTING	ENGINEERING FOR ARCHITECTS	CO., LTD. AND ARCHITECTS

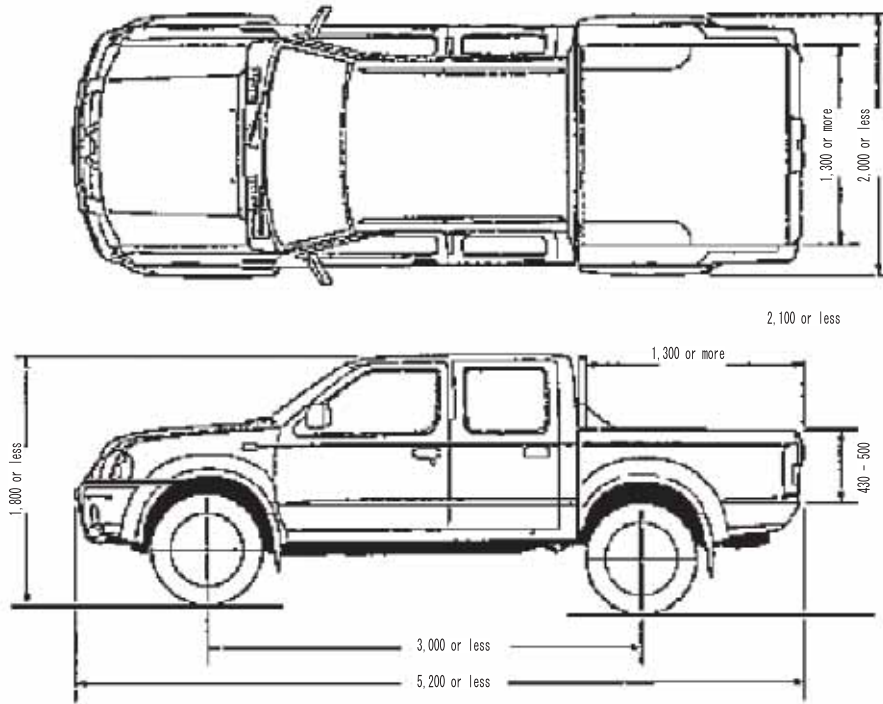


Fig. 2.2.3-12 Typical Drawings of Double Cab Pickup

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASHEMITE KINGDOM OF JORDAN				
Standard Figure of Double Cab Pickup				
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		YAO JIN YU ENGINEERING CO., LTD. CONSULTING ENGINEERS AND ARCHITECTS		

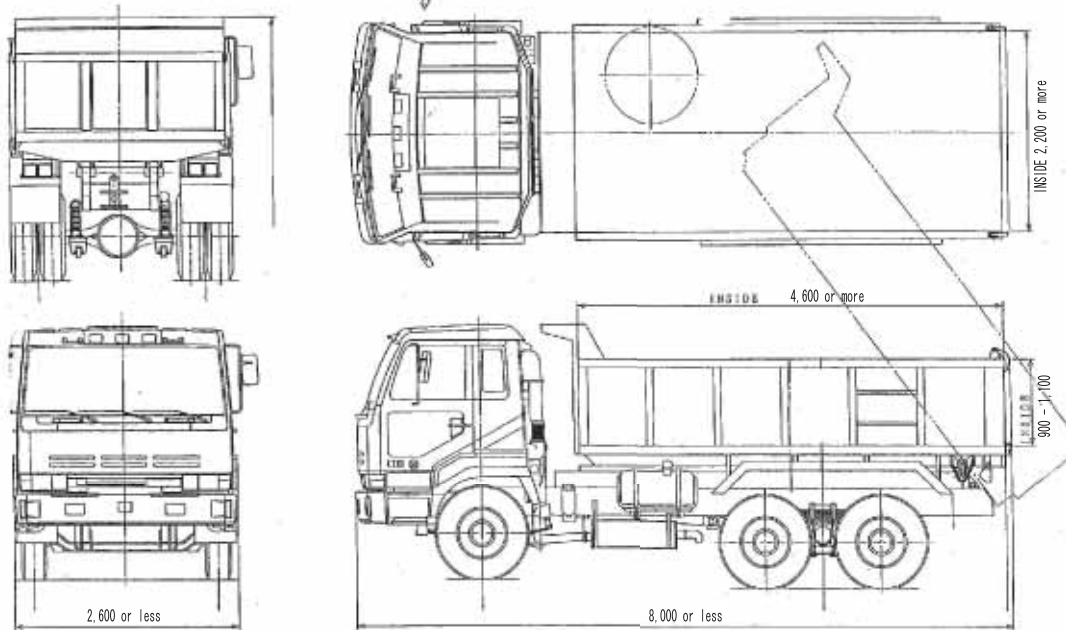


Fig. 2.2.3-13 Typical Drawings of Dump Truck

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASSEMETE KINGDOM OF JORDAN			
Standard Figure of Dump Truck			
REV.	DATE	BY	REVISION
Rev. 001	Rev.	3-D	0
yeo		YASIR YFE ENGINEERING CONSULTING	CO., LTD. ENGINEERS AND ARCHITECTS

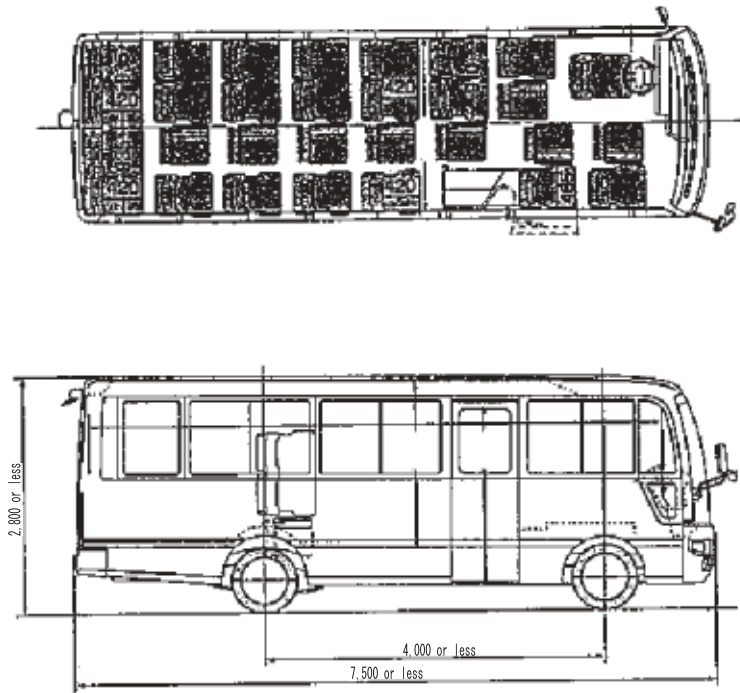


Fig. 2.2.3-14 Typical Drawings of Passenger Bus

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-QADAMI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of Passenger Bus			
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yec YASRIYO ENGINEERING CO., LTD. CONSULTING ENGINEERS AND ARCHITECTS			

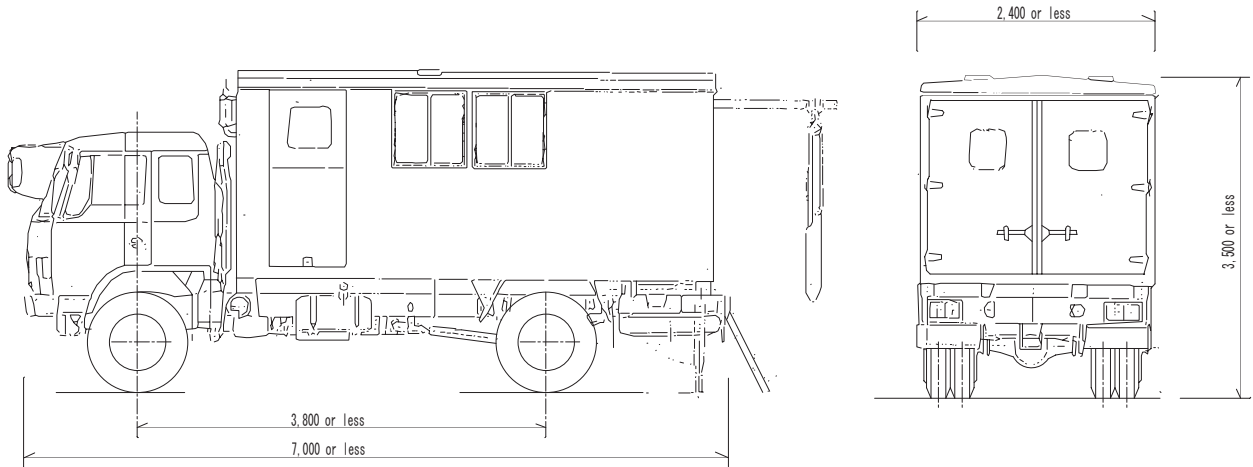


Fig. 2.2.3-15 Typical Drawings of Mobile Workshop

THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABANI IN THE HASHEMITE KINGDOM OF JORDAN			
Standard Figure of Mobile Workshop			
REV.	DATE	BY	REVISION
Rev. 2004	Rev	J-E	0
<b>yeo</b>		FAHITTE ENGINEERING CONSULTING	CO., LTD. AND ARCHITECTS

## **2.2.4 Implementation Plan**

### **2.2.4.1 Implementation Policy**

The Project will be implemented within the framework of Japan's grant aid system and will formally commence with the Exchange of the Notes (E/N) between both Japan and Jordan upon approval of the Project by the Government of Japan. The Government of Jordan will then select the Consultant (a Japanese firm) which will proceed with the detailed design work. With the completion of the tender documents based on the detailed design results, a tender will be held to select the Contractor (a Japanese firm) which will then supply the vehicles and equipment. The basic principles and points to note for the implementation of the Project are explained below.

#### **(1) Project Implementing Body**

The implementing body for the Project on the Jordanian side will be the Municipality of Greater Amman (MOGA). It will be necessary for the Jordanian side to appoint a key person responsible for the implementation of the Project in order to maintain close communication and consultation with the Japanese Consultant and Contractor to ensure the Project's successful progress.

This key person must ensure that all the parties concerned with the Project successfully fulfill their responsibilities by explaining and answering their questions and provide all possible assistance for the smooth progress of the Project.

#### **(2) Consultant**

The Consultant (a Japanese firm) selected by the Jordanian side will enter into a design and work supervision agreement with the Jordanian side to conduct the detailed design and procurement supervision of the vehicles and equipment to be provided under the Project. The Consultant will prepare the tender documents for the equipment to be procured under the Project and will conduct the tender process in accordance with the contract between the Jordanian side and the Consultant.

#### **(3) Contractor**

The Contractor, a Japanese firm, selected by open tender according to the procedure of Japan's grant aid system, will procure and supply the vehicles and equipment. The Contractor will also provide the following training for staff nominated by the Jordanian side to improve their maintenance capability.



- a. Training of mechanics at authorized dealers of the manufacturers
- b. Training of operator and mechanics at the time of delivery

As the vehicles and equipment will require the supply of spare parts and the provision of after-service in the case of breakdown following the completion of the Project, the Contractor should pay close attention to the need to establish communication links between the recipient side and the Contractor after the delivery of the equipment.

#### (4) Necessity for Dispatch of Japanese Engineers

The Project consists of the procurement of equipment, consisting of collection vehicles and disposal site equipment, to be supplied to the implementing body of the Project and, therefore, no installation work is involved. However, it will be necessary to dispatch engineers for the training of staff of the implementing body at the time of delivery for approximately one month to ensure the smooth implementation of solid waste management using the procured vehicles and equipment in the post-project period. Under this training, lectures will be given on appropriate disposal methods at landfill sites and on the operation and maintenance of collection vehicles and heavy machinery and practice will be conducted. Details of the dispatch of engineers are given in Section 2.5.

### **2.2.4.2 Implementation Conditions**

#### (1) Procurement Conditions in Jordan

The procurement conditions of vehicles and heavy equipment in Jordan are as follows.

- 1) As none of the main equipment under the Project, i.e. waste collection vehicles, transfer vehicles and landfill equipment, are manufactured in Jordan, they must be procured in Japan and/or a third country.
- 2) The procurement sources of the existing vehicles are Germany (Mercedes), Sweden (Volvo) and Japan, together accounting for 97% of all vehicles. Vehicles manufactured in these countries were selected because of their high quality, ease of obtaining spare parts and good after-service. In the case of smaller vehicles, the MOGA has designated Japan as the procurement source.
- 3) Most of the existing heavy equipment is manufactured by a few major manufacturers.

- 4) Spare parts for Mercedes vehicles are not only supplied by the local agent but are also available in the open market. In the case of vehicles manufactured in other third countries, the spare parts supply situation is similar to that for Japanese vehicles.
- 5) Local agents of the manufacturers of vehicles and heavy equipment have their own workshops and, therefore, are capable of providing sufficient after-care, including on-site emergency response.

(2) Points to Note

- 1) As the vehicles and equipment to be procured under the Project are not locally manufactured, they must be procured from Japan or a third country.
- 2) The selection of the same model from a single manufacturer should be considered for the procurement of each type of vehicle/equipment where practically possible to facilitate post-project maintenance.
- 3) In regard to the procurement of vehicles, the procurement of smaller vehicles will be procured in Japan while the procurement of medium size and large vehicles will be made from third countries to ensure competition among possible suppliers.
- 4) In regard to the procurement of heavy equipment, Japanese equipment will be given priority. However, equipment made by third countries will also be included on the short list depending on the type of equipment to ensure competition among possible suppliers.
- 5) Given the fact that the Jordanian side will be responsible for the procurement of spare parts, the procurement priority will be given to those manufacturers with a proven record in Jordan which offer good after-service, including the supply of spare parts, from the viewpoint of ensuring the proper maintenance of the vehicles and equipment.

### **2.2.4.3 Scope of Work**

The division of work between the Japanese side and Jordanian side is as follows.

(1) Work by Japanese Side

- 1) Procurement of collection vehicles

- 2) Procurement of trailers for transfer stations
- 3) Procurement of equipment for landfill site
- 4) Procurement of vehicles for operation and maintenance

(2) Items to be conducted by Jordanian Side

- 1) Construction and operation and maintenance of (three) new transfer stations
- 2) Construction of the second cell at the Madona-Ghabawi landfill site
- 3) Construction of a leachate treatment facility at the Madona-Ghabawi landfill site
- 4) Implementation of environmental monitoring at the Madona-Ghabawi landfill site
- 5) Procurement of spare parts for the vehicles
- 6) Procurement of vehicles and equipment to be purchased by the Jordanian side
- 7) Arrangement of staff for collection, transfer station, and the Madona-Ghabawi landfill site
- 8) Budget allocation for the above-mentioned construction and operation and maintenance

#### **2.2.4.4 Consultant Supervision**

In accordance with the Japan's grant aid scheme, the Consultant will organize a project team to conduct the preparation of the tender documents and work supervision, taking all the basic design principles into consideration. At the work supervision stage, the consultant will also dispatch an engineer to provide advice on follow-up work to be conducted by the recipient country.

(1) Basic Principles of Consultant Supervision

The consultant will adopt the following principles to fulfill his responsibility to supervise and guide the Contractor in view of the punctual and safe completion of the Project related work within the planned period. The scope of work for the Consultant is shown in Table 2.2.4.4-1

**Table 2.2.4.4-1 Contents of Consultancy Work for the Project**

1.	Pre-supply stage	Preparation of tender documents Assistance for tender process Evaluation of tender results Contract work assistance
2.	Supply stage	Supervision of procurement Inspection Report preparation, etc.

1) Schedule Control

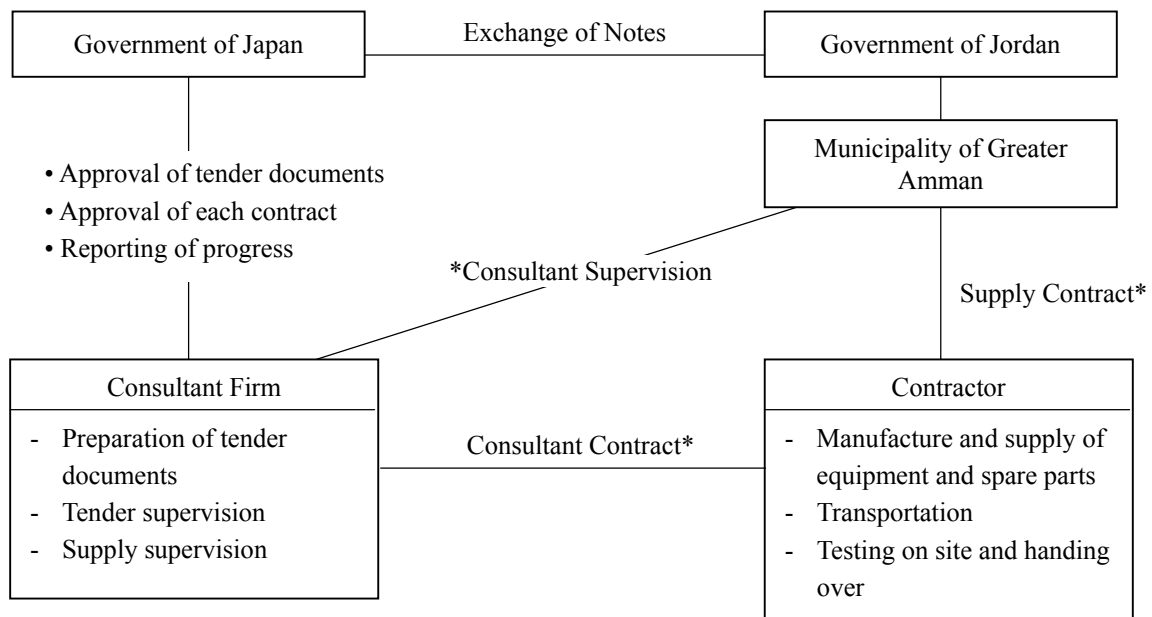
- a) The Consultant shall ensure that the Contractor always checks the progress of the manufacture and delivery of the equipment against the original plan to ascertain the state of work progress.
- b) The Consultant shall control each work item on a monthly basis to ensure that the Contractor adheres to the contracted work schedule.

2) Quality Control

- a) The Consultant shall confirm that the specifications and quality of the equipment and materials to be procured meet the requirements specified in the detailed design documents.
- b) The Consultant shall witness the quality inspection and various performance tests in connection with the equipment to be procured at the completion of manufacturing work.

(2) Work Supervision System

The system to supervise the actual procurement process and the involvement of the related organizations are shown in Figure 2.2.4.4-1.



\*Note: The Consultant Contract and Supply Contract require the official approval of the Government of Japan

**Fig.2.2.4.4-1 Project Implementation System**

## 2.2.4.5 Procurement Plan

### (1) Procurement Plan

Given the fact that the Jordanian side will be responsible for the procurement of spare parts for the Project, the procurement priority will be given to those manufacturers with a proven record in Jordan which offer good after-service, including the supply of spare parts, from the viewpoint of ensuring the proper maintenance of the vehicles and equipment.

In regard to the procurement of vehicles, the procurement of smaller vehicles will be procured in Japan while the procurement of medium size and large vehicles will be made from third countries to ensure competition among possible suppliers.

In regard to the procurement of heavy equipment, Japanese equipment will be given priority. However, equipment made by third countries will also be included on the short list depending on the type of equipment to ensure competition among possible suppliers.

The supply sources of the vehicles and equipment to be procured under this project are shown in Table 2.2.4.5-1.

**Table 2.2.4.5-1 Equipment Supply Sources**

Vehicles and Equipment	Source Country		
	Jordan	Japan	Third Country
Inter city compactor (small)		○	
Inter city compactor (medium)		○	○
Inter city compactor (large)		○	○
Long chassis open type trailer		○	○
Tractor head for trailer		○	○
Bulldozer (small)		○	
Bulldozer (medium)		○	
Bulldozer (large)		○	○
Backhoe		○	
Wheel loader		○	
Dozer shovel		○	○
Motor grader		○	
Vibratory roller		○	○
Water tanker		○	
Double cab pick-up		○	
Dump truck		○	○
Passenger bus for the landfill staff		○	
Mobile workshop		○	

**(2) Transport Plan**

The vehicles and equipment to be procured under the Project will be shipped from their countries of origin, including Japan. After landing at Port Aqaba, they will be transported inland to their final destinations in MOGA. The expected mode of inland transportation is self-propelled transportation for vehicles and trailer transportation for small vehicles and heavy equipment.

**(3) Installation Work Plan**

As all of the vehicles and equipment to be procured under the Project will be simply handed over to the Jordanian side, no installation work will be involved.

**(4) Adjustment and Trial Operation Plan**

As all of the vehicles and equipment to be procured under the Project will be simply handed over to the Jordanian side, no on-site adjustment or trial operation will be involved.

(5) Initial Operation Guidance Plan

As all of the vehicles and equipment to be procured under the Project will be simply handed over to the Jordanian side which has experience of operating similar vehicles and equipment provided under the Phase I Project, no initial operation guidance will be required.

(6) Operation Guidance Plan

It is believed that operation guidance will be required as part of the Project on the following two matters and the introduction of a soft component will be planned to provide such guidance. A more detailed description of this soft component is given in 2.5.

- a. Technical guidance on the landfill method
- b. Technical guidance on operation of collection/transportation vehicles

(7) Inspection Plan

1) Inspections

The following inspections will be conducted to verify the functions and amounts of the vehicles and equipment to be procured.

a. Factory Inspection/Pre-Shipment Inspection

Factory inspection will be conducted for all medium size and large collection vehicles to ensure the proper functioning of the container lifting device. In addition, the inspection reports submitted by the manufacturers will be checked to confirm the compliance of other inspection items.

b. Pre-Loading Verification by Third Party Inspection Body

This verification will be conducted in accordance with the Project Cost Estimation Guidelines (Equipment, April, 2004) of the JICA.

2) Acceptance Inspection

At the time of the handing over of the vehicles/equipment in Jordan, acceptance inspection will be conducted by means of confirming their proper functioning and checking the contents of the delivery documents

#### **2.2.4.6 Implementation Schedule**

In the case of the Project's implementation with grant aid provided by the Government of Japan, the actual procurement will be conducted in two stages following the signing of E/N, i.e., (i) tender process and signing of the supply contract, and (ii) actual procurement.

##### **(1) Tender and Contract**

As soon as the E/N is signed, the Japanese Consultant will conclude a consultant agreement with the Jordanian side and commence preparation of the tender documents for procurement.

The Consultant will announce the tender, hold a tender explanation meeting and distribute the tender documents to prospective bidders on behalf of the Jordanian side. Upon receipt of the bid prices and application documents, the Consultant will promptly examine them to facilitate the contract between the Jordanian side and a Japanese contractor. The tender will be witnessed by all applicants and representatives of related organizations. If the contents of the bid with the lowest price are assessed as being appropriate, the bid will be accepted and the bidder will conclude a contract with the Jordanian side.

The time required from tender announcement to the signing of the procurement contract is expected to be 1.5 months.

##### **(2) Procurement of Equipment**

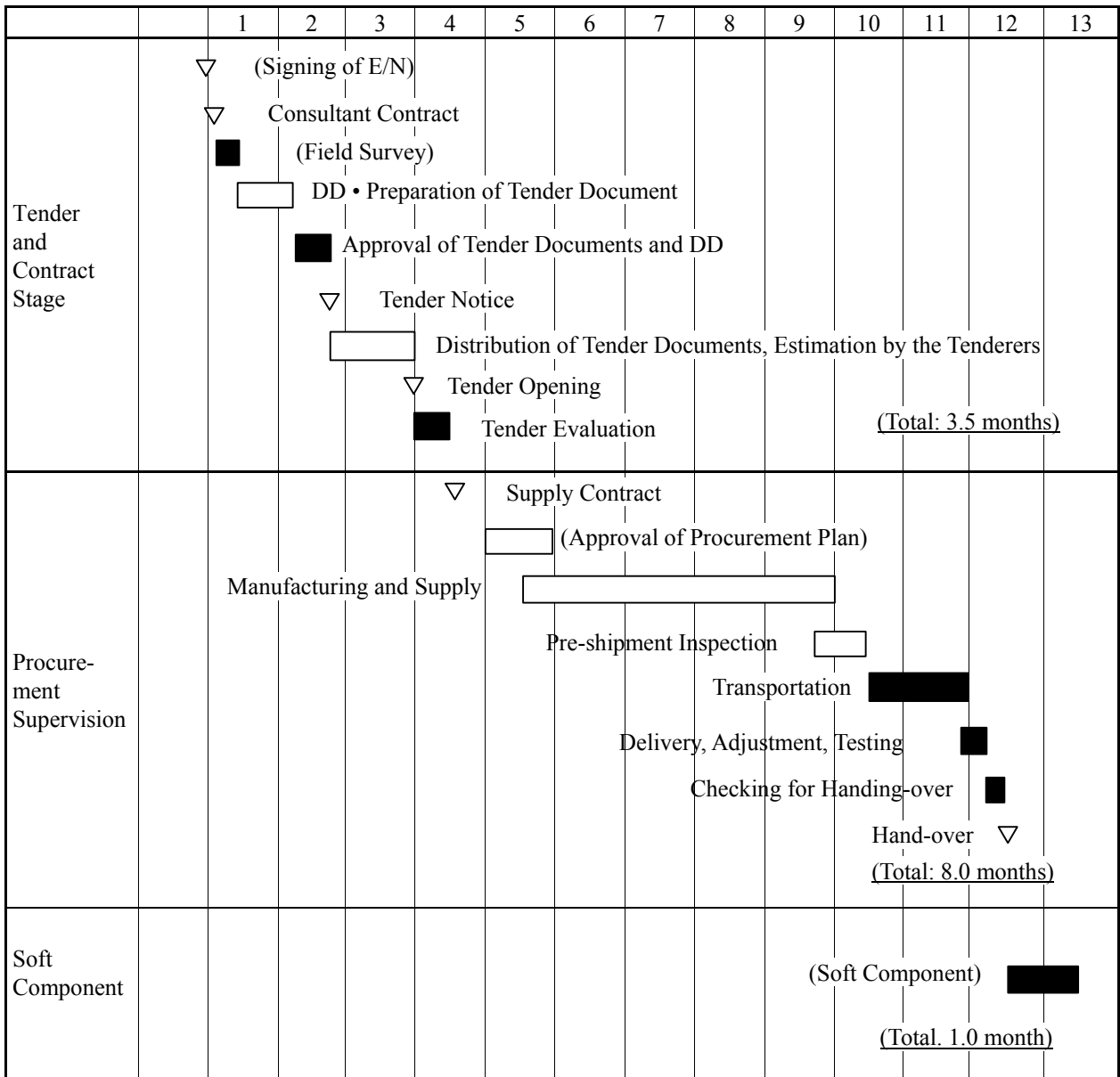
Following the signing of the supply contract and its official approval by the Government of Japan, the Contractor will commence the procurement work. Given the size of the Project, it is estimated that eight months will be required if the procurement of equipment and work to be conducted by the Jordanian side are smoothly carried out.

The Consultant will make detailed arrangements prior to the commencement of the procurement work and will supervise the Contractor in regard to the manufacture and transportation of the equipment and work schedule, etc. The Consultant will also enforce schedule control, as well as quality control, in order to complete the entire work within the period stipulated in the E/N.

As far as "Soft Component" is concerned, it will take 1.0 month to complete after the handing over of the equipment.

The expected Project implementation schedule is shown in Fig. 2.2.4.7-1.





**Fig. 2.2.4.7-1 Project Implementation Schedule**

## **2.3 Obligations of Recipient Country**

The various undertakings by the Jordanian side are outlined below.

### **2.3.1 Undertakings by the Jordanian Side Confirmed in the M/D**

#### (1) Construction of New Transfer Stations

##### 1) Acquisition of Land for Planned New Transfer Stations

Three new transfer stations will be constructed in the following districts. As the planned site in the Jubeiha District is currently privately owned, it will be necessary for the MOGA to purchase the land.

- Jubeiha District
- Wadi Sir District
- Zahrain District

##### 2) EIA for the Construction of New Transfer Stations

For the construction of the new transfer stations, it will be necessary for the MOGA to prepare a draft EIA report by the end of December 2004 for its approval by the Reviewing Committee.

##### 3) Construction of New Transfer Stations

It will be necessary for the MOGA to construct a transfer station with a transportation capacity of approximately 400 tons/day at each of the three sites by November, 2005 when the vehicles and equipment procured under the Project will have been handed over.

#### (2) Construction of No. 2 Cell at Madona-Ghabawi Landfill Site

It will be necessary for the MOGA to construct the No. 2 cell which is capable of receiving 3,519 tons of solid waste a day (in 2010) at the Madona-Ghabawi Landfill Site within one year from November, 2005 when the vehicles and equipment procured under the Project will have been handed over.

#### (3) Construction of Leachate Water Treatment Facility at Madona-Ghabawi Landfill Site

The MOGA plans to complete the construction of the leachate water treatment facility using aeration, sedimentation and filtering processes at the Madona-Ghabawi Landfill Site by the end of December, 2004 in view of the expected increase of the solid waste to be disposed of at the site in the coming years.

(4) Environmental Monitoring at Madona-Ghabawi Landfill Site

The MOGA plans to conduct environmental monitoring of the following from the end of 2004 at the latest in preparation for landfill operation at the Madona-Ghabawi Landfill Site.

- 1) Groundwater quality
- 2) Generated gases
- 3) Soil erosion, settlement and quality
- 4) Noise level
- 5) Leachate water

(5) Stocking of Spare Parts

Under the Project, the Jordanian side is responsible for the procurement of spare parts and should stock spare parts in accordance with the list of recommended spare parts which will be provided at the time of concluding the supplier contract.

(6) Procurement of Vehicles and Equipment for Construction other than those procured by Japan

- |  |     |
|--|-----|
| 1) 40 m <sup>3</sup> open type trailers                        | : 1 |
| 2) Tractor heads for 40 m <sup>3</sup> open type trailers      | : 3 |
| 3) 50m <sup>3</sup> compacting type trailers                   | : 6 |
| 4) Tractor heads for 50m <sup>3</sup> compacting type trailers | : 6 |
| 5) Dump truck  | : 2 |

(7) Deployment of Required Staff for Collection, Transfer and Landfill Operations

It will be necessary for the MOGA to plan and execute the deployment of staff for the solid waste collection and disposal facilities which will be required with the implementation of the Project.

(8) Arrangement of Necessary Budget for Construction and Operation Described Above

It will be necessary for the MOGA to arrange the required budget for the construction work as well as for the operation and maintenance of the vehicles and equipment as planned under the Project.

### **2.3.2 Other Undertakings**

- (1) To provide information and data required for the Project
- (2) To ensure the prompt unloading, customs clearance and tax exemption of goods for the Project
- (3) To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contracts such facilities as may be necessary for their entry into Jordan and stay therein for the performance of their work
- (4) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Jordan with respect to the supply of products and services under the verified contracts and to take the necessary measures for such tax exemption
- (5) To bear the bank commission charged by a foreign exchange bank in Japan for services relating to the opening of an account and payment advice, etc.
- (6) To bear all expenses required for the implementation of the Project other than those to be borne by the Japanese grant aid
- (7) To appoint engineers/technicians who will receive training on operation and maintenance technologies/techniques as part of the Project
- (8) To maintain the vehicles and equipment procured with Japanese grant aid in an appropriate and effective manner
- (9) To prepare and install containers from which the compactors (8 m<sup>3</sup> and 16 m<sup>3</sup>) procured under the Project will collect solid waste

## 2.3.3 Estimated Project Cost

### 2.3.3.1 Estimated Project Cost

The total project cost is estimated to be ¥1,686.56million if the project is implemented. The breakdown of the total project cost based on the share of expenses by the both Governments is shown below. The estimation conditions are described in (3) below.

#### (1) Expenses of the Japanese Side

Estimated Project Cost: ¥742.67 million

Item		Estimated Cost (million yen)			
Procurement of Equipment	Procurement Cost	Equipment	656.00	699.42	720.40
		Packing and Transportation	41.67		
		Installation	0.00		
		Procurement supervision	1.75		
	General Administration			20.98	
Detailed Design, Construction/ Procurement Supervision, Technical Instruction	Detailed Design	13.82	16.52	22.27	
	Procurement Supervision	2.70			
	Soft Component				5.75

This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

(2) Expenses of the Recipient Side

The total cost borne by the Jordanian side is estimated to be ¥943.89 million as shown in Section 3.3 of Chapter 3 “Obligations of Recipient Country”. In more detail, the breakdown is shown in Appendix-2 “Cost Estimation borne by the Recipient Country”.

Estimated Project Cost: 943.89 million yen

Organization	Item	Project Cost (million yen)	
Municipality of Greater Amman	Construction of new transfer stations	269.27	943.89
	Construction of 2 <sup>nd</sup> cell	400.06	
	Implementation of Environmental Monitoring	18.46	
	EIA for New Transfer Stations	20.00	
	Construction of Leachate Treatment Facility	16.93	
	Spare Parts	33.21	
	Vehicles and Equipment for Construction	185.96	

Following the implementation of the Project, it will be necessary for the MOGA to provide larger funding than Japanese side as described in the above tables. The scale of the required funding is believed to be within its funding capability given the facts that the MOGA has official expressed in writing its commitment to providing such funding and that the MOGA has appropriate an adequate budget in the past (in 2001, the MOGA secured some ¥900 million for investment in the solid waste management sector).

**(3) Estimation Conditions**

Estimation Point: July 2004

Exchange Rate: 1US\$ = ¥108.51 (Average of the last 6 months from 30th June, 2004)

1 EUR = ¥133.12 (Average of the last 6 months from 30<sup>th</sup> June 2004)

1 JD = ¥153.87 (Average of the last 6 months from 1st July 2004)

Project Period : The period for tendering work and procurement shall be as shown in Fig. 2.2.4.7-1.

Others : The Project will be implemented in accordance with the grant aid scheme of the Government of Japan

**2.3.3.2 Operation and Maintenance Cost**

The operation and maintenance cost in the post-project period is described in Section 2.4 “Operation and Maintenance Plan for the Project”.

**2.4 Project Operation Plan**

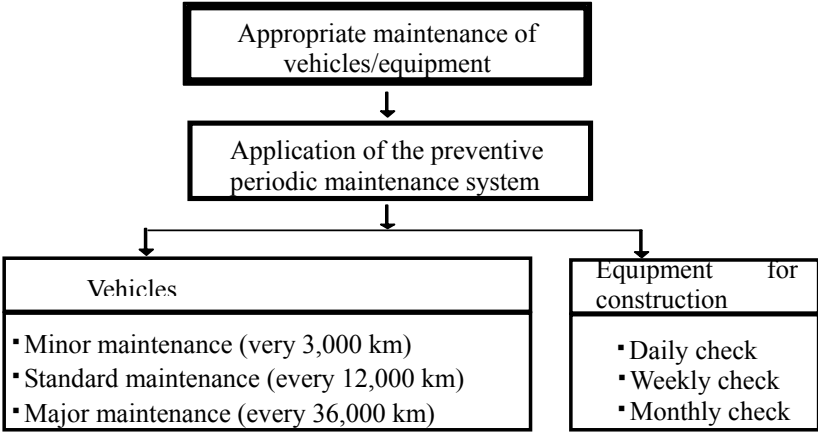
**2.4.1 Basic Policies**

The current maintenance system for the existing vehicles consists of monthly inspection and the periodic exchange of engine oil (at approximately every 3,000 km for compactors) and repair work is conducted at the workshop following a report of malfunctioning or breakdown by the drivers.

In short, neither statutory inspection and maintenance nor preventive maintenance equivalent to the annual motor inspection practiced in Japan are in place in Jordan.

The objective of periodic inspection is to maintain vehicles in good working order by means of discovery the early signs of breakdown to prevent such breakdown and to maintain vehicle damage at a minimum level. The preventive maintenance system will be introduced after the introduction of the newly procured vehicles to ensure the good working order of these vehicles. Technical guidance will be provided on preventive maintenance techniques to look after the new vehicles and equipment in addition to the provision of maintenance manuals.

The basic concept of maintenance of the new vehicles and equipment procured under the Project is shown in Fig. 2.4.1-1.



**Fig. 2.4.1-1 Basic Concept of Maintenance of the New Vehicles and Equipment procured under the Project**

## 2.4.2 Contents of Maintenance Work

In Japan, vehicles are subject to the statutory inspection and maintenance rules set forth by the Ministry of Transport and the detailed items for monthly, quarterly and annual maintenance are stipulated. These rules will basically be used for the Project to determine the contents of the maintenance work in view of the fact that the new vehicles and equipment will be used for the solid waste management service which is a public service. However, because of the different operating conditions for each type of vehicle/equipment, the maintenance requirements will be based on mileage rather than on a set time interval.

### (1) Vehicles

The desirable contents of vehicle maintenance work are shown in Table 2.4.2-1.

**Table 2.4.2-1 Vehicle Maintenance Work**

No.	Type of Maintenance	Mileage	Contents
1	Minor Maintenance	every 3,000 km	Oiling/greasing and inspection of the proper functioning of the power line, hydraulic systems, electrical installations, suspension and wheels; this kind of preventive inspection and maintenance is quite important.
2	Standard Maintenance	every 12,000 km	Standard maintenance is conducted approximately every 12,000 km although the occurrence of the abrasion, deformation, cracks and damage, etc. of various components are not uniform depending on the particular work conditions of each type of vehicle; adjustment, repair and/or the replacement of parts are conducted for the engine, drive-train, suspension and wheels, etc; because of the need to use special equipment, the vehicles must be taken to the workshop to undergo such inspection and maintenance work; adjustment/repair of the hydraulic systems, body repair and paint work may also be necessary.
3	Major Maintenance	every 36,000 km	While the required work is essentially the same as that for standard maintenance, special attention is paid to the brakes and clutch linings and the suspension.



## (2) Heavy Equipment

In the case of such heavy equipment as the bulldozer, excavator and tractor loader, etc., periodic inspection will be required every 50 hours and every 250 hours in addition to daily checking. This inspection/checking and maintenance work must be conducted in accordance with the set maintenance rules. Table 2.4.2-2 shows the prospective contents of the landfill equipment maintenance work.

**Table 2.4.2-2 Landfill Equipment Maintenance Work**

No.	Type of Maintenance	Contents
1	Daily Inspection and Maintenance	Mechanical check, adjustment, cleaning, replenishing of the cooling water, refuelling, oil and greasing by each operator at the end of daily operation
2	Weekly Inspection and Maintenance (every 50 hours)	Inspection and adjustment beyond the scope of daily inspection, replacement of oil and various elements, oiling and greasing
3	Monthly Inspection and Maintenance (every 250 hours)	Inspection, adjustment and replacement of parts and consumables which are not included in the weekly inspection

### 2.4.3 Spare Parts Plan

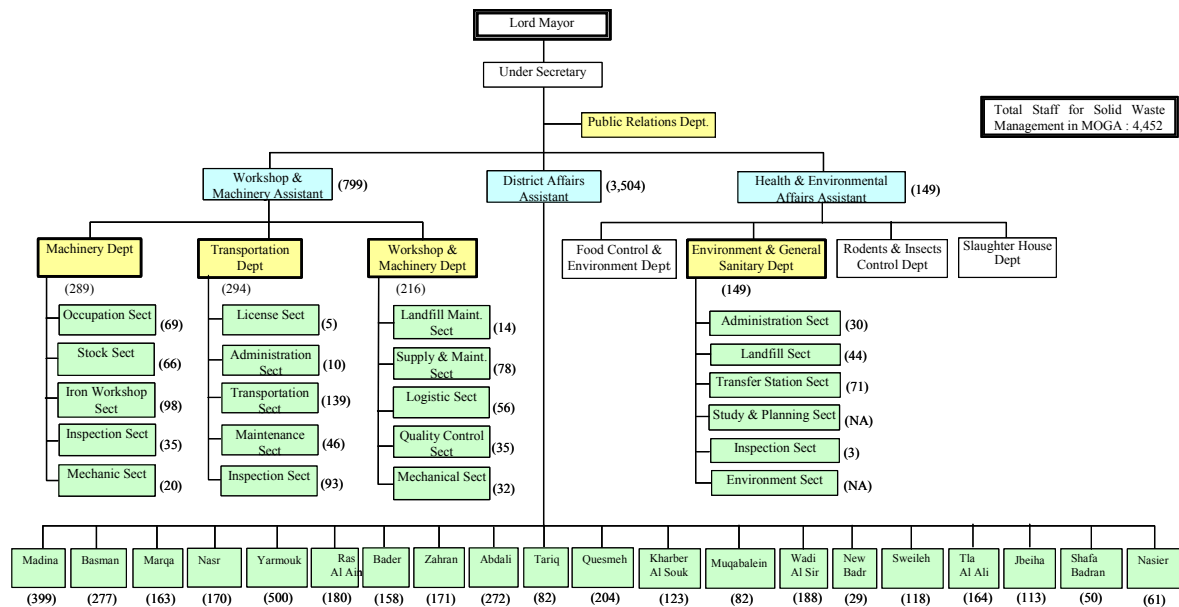
Spare parts for the vehicles and equipment to be procured under the Project will be procured by the implementing body, i.e. the MOGA. Accordingly, the tender document will include a clause which demands that the equipment supplier indicate the spare parts required for proper maintenance by the implementing body. The following points must be clearly stated in the tender documents for the selection of spare parts.

- It will be necessary for the spare parts for the planned vehicles and equipment to be classified into those for regular replacement based on mileage and those required when the expected life is reached or when a malfunction or breakdown occurs. The range and quality of the spare parts should be compatible with the planned regular inspection cycle.
- Among the vehicles to be newly procured, the compactors will suffer from heavy abrasion of the engine, clutch and brake-related parts, mainly because of the frequency of starting and stopping. The items and quantity of the spare parts for the compactors should, therefore, take such operating conditions into consideration.

The annual procurement cost of spare parts is expected to be approximately 5% of the vehicle/equipment price. It is necessary for the MOGA to secure the required budget for the procurement of the required spare parts.

## 2.4.4 Operation and Maintenance System

The organizational structure of solid waste management in the MOGA is shown in Fig. 2.4.4-1. A total of 4,452 persons are employed, including some 3,300 workers responsible for collection and road cleansing, etc.



**Fig. 2.4.4-1 Organizational Structure of Solid Waste Management in MOGA**

The responsibility of each department is described in Table 2.4.4-1.

**Table 2.4.4-1 Responsibility of Solid Waste Management Departments in MOGA**

Bureau	Department	Responsibility
Health and Environment Affairs	Environment and General Sanitary Department	Responsible for solid waste management operation, including the management of the landfill site and transfer stations
Workshop and Machinery Affairs	Workshop and Machinery Department (216 employees) currently called the Heavy Machinery Workshop)	Responsible for the ownership and maintenance of all heavy machinery owned by the MOGA, including heavy equipment and large vehicles, for solid waste management operation
	Machinery Department (289 employees) (commonly called the Central Workshop)	Responsible for the maintenance of the vehicles owned by the MOGA, excluding heavy machinery and large vehicles but including collection vehicles, for solid waste management operation
	Transportation Department (294 employees)	Responsible for the control of collection vehicle deployment
District Affairs	20 districts (3,504 employees)	Responsible for the collection of general waste and the cleansing of roads and parks, etc. in each district

The operation and maintenance system for solid waste management operation by type of vehicle/equipment is shown in Table 2.4.4-2.

**Table 2.4.4-2 Operation and Maintenance System for Solid Waste Management**  
**Operation**

Type of Equipment	Overall Control (incl. Equipment Renewal)	Vehicle Deployment	Operation	Maintenance
Collection Vehicles Cleansing Equipment	Environment and General Sanitary Department	Transportation Department	Each District	Machinery Department
Transfer Vehicles	Environment and General Sanitary Department	Environment and General Sanitary Department	Environment and General Sanitary Department	Workshop and Machinery Department
Heavy Landfill Equipment	Environment and General Sanitary Department	Environment and General Sanitary Department	Environment and General Sanitary Department	Workshop and Machinery Department
Support Equipment for Landfill Operation (Water Sprinklers, etc.)	Environment and General Sanitary Department	Environment and General Sanitary Department	Environment and General Sanitary Department	Machinery Department

Following the implementation of the Project, the number of collection vehicles, transfer vehicles, landfill equipment and management vehicles will increase. However, the number of people working for solid waste management in the MOGA of some 4,500 could be described as slightly excessive and the MOGA plans to meet the required manpower to operate these vehicles and equipment by means of the reassignment and new training of existing personnel.

#### **2.4.5 Operation and Maintenance Cost**

The operation and maintenance cost in the post-project period is estimated based on the assumption that it will increase in proportion to the increased amount of solid waste until 2010 as shown in Table 2.4.5-1. The basis for this estimation is the operation and maintenance cost in 2003.

**Table 2.4.5-1 Estimation Conditions for Operation and Maintenance Cost in Post-Project Period**

Item	Estimation Conditions
1. Amount of Solid Waste	
• 2003	2,520 tons/day
• 2010	3,482 tons/day
• Annual Increase Rate	4.9%
2. Breakdown of Operation Cost *1	Ratio of Each Cost Item to Total Operation Cost
• Administrative and Miscellaneous Cost	5%
• Collection and Cleansing Cost	85% (83% from 2006)
• Transfer Cost	1% (3% from 2006) *2
• Landfill Cost	9%
3. Increase Rate of Operation Cost	
• Increase Rate	4.9% (in proportion to the amount of waste)
4. Other Conditions	<ul style="list-style-type: none"> <li>•No increase of the collection charge until 2010</li> <li>•Inflation and wage increases are not considered</li> </ul>

\*1 The breakdown of the operating cost is based on the actual results in the MOGA.

\*2 It is assumed that the amount of waste transferred from the transfer stations will treble by 2006, thereby reducing the collection cost.

The estimated operation and maintenance cost in the post-project period until 2010 is shown in Table 2.4.5-2.

**Table 2.4.5-2 Operation and Maintenance Cost in Post-Project Period (Unit: 1,000 JD)**

Item	2003	2006	2007	2008	2009	2010
A. Income						
A1 Income for Solid Waste Management Operation	6,388	7,593	7,965	8,355	8,764	9,194
A2 Subsidy from Municipal Budget	7,812	6,468	6,650	6,841	7,040	7,250
Sub-Total	<b>14,200</b>	<b>14,061</b>	<b>14,615</b>	<b>15,195</b>	<b>15,805</b>	<b>16,444</b>
B. Expenditure						
B1 Operation Expenditure	10,070	11,301	11,855	12,435	13,045	13,684
Administrative and Miscellaneous Cost	(504)	(565)	(593)	(622)	(652)	(684)
Collection and Cleansing Cost	(8,560)	(9,380)	(9,839)	(10,321)	(10,827)	(11,358)
Transfer Cost	(101)	(339)	(356)	(373)	(391)	(411)
Landfill Cost	(906)	(1,017)	(1,067)	(1,119)	(1,174)	(1,232)
B2. Investment	4,130	2,760	2,760	2,760	2,760	2,760
Sub-Total (B1 + B2)	<b>14,200</b>	<b>14,061</b>	<b>14,615</b>	<b>15,195</b>	<b>15,805</b>	<b>16,444</b>
Balance (A – B)	0	0	0	0	0	0

Assuming that the income from solid waste management operation steadily increases in proportion to the amount of waste collected, the size of the subsidy from the municipal budget for solid waste management operation in 2010 will be similar to the present size of the subsidy (2003) as shown in the above table. The fact that the financial burden on the MOGA budget will not be increased means that the implementation of the Project will not disrupt solid waste management operation in the city in the post-project period.

## **2.5 Soft Component Plan**

### **(1) Background for Planning of Soft Component**

The introduction of a soft component relating to technical assistance on the final disposal methods and operation of collection/transportation vehicles is necessary under the Project as technical assistance to ensure the smooth implementation of the solid waste management work in the post-project period using the procured vehicles and equipment. The background necessitating the inclusion of a soft component in the Project is described below.

#### **1) Technical Assistance on Final Disposal Methods**

As the covering soil used at the Madona-Ghabawi Landfill Site is fine clayey silt, bulldozers are required to use this type of soil for efficient landfill operation using the pushing-up cell method. At present, there is only one bulldozer at this landfill site and its extensive deterioration means a very low operating ratio (currently less than 40%). Therefore, it cannot be sufficiently used as compacting equipment. For this reason, the existing landfill compactors used to be used for the levelling and compacting of the covering soil. As the wheels of these landfill compactors, which were designed as travelling vehicles for a landfill site, tended to become stuck in the covering soil, their levelling and compacting were never satisfactory, resulting in the suspension of pushing-up cell type landfill operation. The originally intended pushing-up cell type landfill operation was, therefore, replaced by dumping from a height of 6 m and this dumping method is still used today. The dumping method has such problems as insufficient compaction and a high risk of accidents due to slope collapses. As it is now essential that this landfill site establish and employ technologies associated with the pushing-up cell type landfill method using the newly procured equipment, the provision of technical assistance is necessary with full understanding and evaluation of the specific characteristics of this landfill site, including the soil properties.

#### **2) Technical Assistance on Operation of Collection/Transportation Vehicles**

The situation of solid waste collection and transportation and the maintenance situation of vehicles in the MOGA are relatively good at present. Such collection and transportation are often planned and conducted with reliance on the experience of those in charge and workers in the city. While collection and transportation based on experience can be very flexible when serving a small area, this practice is not optimal, i.e. there is room for improvement, for the MOGA which is a large city requiring the

efficient as well as effective selection of the shortest collection routes, collection hours which avoid traffic jams, decisions on appropriate vehicles corresponding to the amount of solid waste generation and the selection of the number of collection workers and solid waste collection methods. As such, the efficiency of collection and transportation is suffering from work practices relying on experience. The conventional planning and decision-making processes based on experience have limited scope for improvement of the collection efficiency in the face of the need to effectively operate the expanded fleet due to the arrival of new collection vehicles under the Project and to properly handle the increasing amount of waste caused by population growth and the resulting over-crowding of the city. One major problem for the MOGA in terms of conducting solid waste management using the newly procured vehicles in the coming years is the lack of a properly established planning method based on the findings of a study to identify the collection and transportation problems. In addition, the transfer plan must be examined afresh in view of the planned construction of three new transfer stations. For this reason, advice and technical assistance are required for the formulation of an adequate collection and transportation plan and a transfer plan using the new vehicles procured under the Project and also for the smooth operation of these vehicles.

## (2) Goals of Soft Component

The proposed soft component has two goals. One is the smooth commencement of solid waste management operation (collection, transportation and disposal) by the MOGA with the effective use of the newly procured vehicles under the Project. The other is successful technical assistance to ensure the sustained application of techniques by solid waste management personnel on the Jordanian side who will have to learn such techniques by the time of the completion of the Project. Through this soft component, the MOGA will become capable of periodically reviewing its solid waste management operation without external assistance in the post-project years and will have the prospect of conducting further self-reliant development as an independent solid waste management operator. The target technical level is that at which the collection efficiency can continually meet the Project's target level of 95% or higher and the final disposal technology involved in pushing-up cell type landfill operation can be continually maintained.

## (3) Outcomes of Soft Component

The soft component is expected to produce the following outcomes upon its completion.

- The technical aspects of landfill operation using the pushing-up cell technique with the newly procured equipment will be learned for application to the Madona-Ghabawi Landfill Site.
- The optimal collection/transportation and transfer route plans will be formulated.
- The study techniques to determine the optimal collection/transportation and transfer routes will be transferred to the Jordanian side.

#### (4) Methods to Confirm the Outcomes

The expected outcomes described in (3) above can be confirmed by the following.

- A: daily records of landfill operation
- B: collection/transportation route map
- C: manual for studying the optimal collection/transportation routes; number of training sessions held; number of participants in the training sessions

#### (5) Activities under Soft Component (Input Plan)

##### 1) Technical Assistance on Landfill Method, etc.

- Technical assistance will be provided on the handling method of covering soil using bulldozers at the landfill site (amount of covering soil to be used, mixing method of the covering soil with the water content of solid waste if necessary and others) and also on the specific features of pushing-up cell type landfill operation, such as levelling and compacting, to firmly establish the pushing-up cell type landfill method using the equipment procured under the Project.
- One Japanese engineer with detailed knowledge of the landfill technique will be selected.
- The subject persons for technology transfer will be senior MOGA officials in charge of solid waste management, the manager of the Madona-Ghabawi Landfill Site and the person responsible for actual landfill operation. Appropriate persons will be selected for training depending on the training components.
- The field technical assistance under the Project will start immediately after the handing over of the new equipment as such equipment will be required to provide the assistance and will last for one month.
- An English manual for the established pushing-up cell type landfill operation will be prepared as an outcome of the soft component and its contents will be explained.



- Practical guidance (on the handling of covering soil, sequence of landfill operation, levelling and compacting methods, equipment operation, amount of covering soil to be used and desirable slope gradient, etc.) will be provided on pushing-up cell type landfill operation.

## 2) Technical Assistance on Operation of Collection/Transportation Vehicles

- Technical transfer will be conducted on the TAM survey\* method which is effective for the formulation of a collection and transportation plan as well as an optimal container distribution plan for densely populated residential areas and also on the feeding back of the TAM survey results to these plans.
- Techniques to evaluate the collection and transportation route plan to formulate an optimal plan (including the selection of routes which avoid left turns as vehicles drive on the right-hand side of the road) will be transferred in view of the necessity for such a plan because of the opening of new transfer stations in the near future.
- Training and practical guidance will be provided to transfer survey and evaluation techniques in connection with the TAM survey.
- One Japanese engineer with detailed knowledge of the planning of waste collection and transportation will be selected.
- The target persons for technology transfer will be senior MOGA officials responsible for solid waste management and district solid waste collection and transportation managers and transfer station managers (of the existing and new transfer stations) will also be invited to participate if necessary.
- This field technical assistance under the soft component will start immediately after the handing over of the collection vehicles as these vehicles will be required to provide the assistance and will last for 0.8 months.
- As an outcome of the soft component, a manual on collection and transportation surveys will be prepared, compiling the contents of the provided training and practical guidance, and how this manual should be used will be explained to the subject persons of the technical transfer.

### \* TAM Survey (Time and Motion Survey)

In order to clarify the current problems of solid waste collection which require improvement and to obtain information for a new plan, the movements of waste collection vehicles are followed to establish the time required to conduct waste collection work and the reality of the physical motions involved in the work.

### (6) Detailed Activity Plan

The plan indicating the assumed activities under the soft component of the Project is shown in Table 2.5-1 while the PMD indicating the status of the soft component in the Project is shown in Table 2.5-2.

**Table 2.5-1 Detailed Soft Component-Related Activities Plan: (1) Technical Assistance on Landfill Operation**

	Component	Activities	Target Persons	Method	Outcome	Required Input	
1	Technical assistance on landfill operation	Demonstration test and final evaluation of cell type landfill operation	<ul style="list-style-type: none"> <li>• Manager of the landfill site</li> <li>• Persons responsible for landfill operation</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration at the landfill site</li> <li>• Evaluation of the present state of landfill operation (types of solid waste delivered, covering soil and other matters)</li> </ul>	<ul style="list-style-type: none"> <li>• Summary report on practical guidance on cell type landfill operation</li> <li>• Summary report on the present state of landfill operation</li> </ul>	Japanese engineer (1 x 0.4 m)	Japanese engineer (1 x 1.0 m)
		Preparation of a manual for cell type landfill operation	<ul style="list-style-type: none"> <li>• Senior MOGA officials responsible for solid waste management</li> <li>• Manager of the landfill site</li> <li>• Persons responsible for landfill operation</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of the manual</li> <li>• Meeting to explain the contents of the manual</li> </ul>	<ul style="list-style-type: none"> <li>• Cell type landfill operation manual (in English)</li> </ul>	Japanese engineer (1 x 0.3 m)	
		Practical guidance on cell type landfill operation	<ul style="list-style-type: none"> <li>• Manager of the landfill site</li> <li>• Persons responsible for landfill operation</li> </ul>	<ul style="list-style-type: none"> <li>• Field guidance at the landfill site</li> <li>1) Technology transfer on levelling and compacting using the pushing-up cell type landfill operation method</li> <li>2) Guidance on equipment operation for pushing-up cell type landfill operation</li> </ul>	<ul style="list-style-type: none"> <li>• Summary report on practical guidance on cell type landfill operation</li> <li>• Cell type landfill operation records</li> </ul>	Japanese engineer (1 x 0.2 m)	
		Technical assistance on the final process of dumping landfill operation	<ul style="list-style-type: none"> <li>• Manager of the landfill site</li> <li>• Persons responsible for landfill operation</li> </ul>	<ul style="list-style-type: none"> <li>• Development of a process to switch from dumping landfill operation to cell type landfill operation and field guidance</li> </ul>	<ul style="list-style-type: none"> <li>• Summary report on technical assistance on the final process of dumping landfill operation</li> </ul>	Japanese engineer (1 x 0.1 m)	

**Table 2.5-1 Detailed Soft Component-Related Activities Plan: (2) Technical Assistance on Equipment Operation**

Component	Activities	Target Persons	Method	Outcome	Required Input	
2 Technical assistance on operation of collection / transportation vehicles	(1) Implementation of a TAM survey					
	<ul style="list-style-type: none"> <li>• Training on TAM survey techniques and evaluation method</li> </ul>	<ul style="list-style-type: none"> <li>• Senior MOGA officials responsible for solid waste management</li> <li>• District waste collection managers</li> <li>• (Existing and new) transfer station managers</li> </ul>	<ul style="list-style-type: none"> <li>• Classroom training</li> <li>1) Training on TAM survey techniques (objectives, targets and measuring methods, etc.)</li> <li>2) Training on TAM evaluation techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Training on TAM evaluation techniques and a list of the participants</li> </ul>	Japanese engineer (1 x 0.15 m)	Japanese engineer (1 x 0.8 m)
	<ul style="list-style-type: none"> <li>• Practical guidance on the TAM survey method</li> </ul>	<ul style="list-style-type: none"> <li>• District waste collection managers</li> <li>• (Existing and new) transfer station managers)</li> </ul>	<ul style="list-style-type: none"> <li>• Field guidance on TAM survey techniques (implementation of a TAM survey)</li> </ul>	<ul style="list-style-type: none"> <li>• Summary report on the practical guidance and a list of the participants</li> </ul>	Japanese engineer (1 x 0.2 m)	
	<ul style="list-style-type: none"> <li>• Technical assistance on the evaluation of TAM survey results</li> </ul>		<ul style="list-style-type: none"> <li>• Classroom training</li> <li>1) Data analysis method (collection efficiency calculation method, etc.)</li> <li>2) Application of the survey results (setting up of standard values for planning)</li> </ul>	<ul style="list-style-type: none"> <li>• Training on TAM evaluation techniques and a list of the participants</li> </ul>	Japanese engineer (1 x 0.2 m)	
	<ul style="list-style-type: none"> <li>• Preparation of a TAM survey manual</li> </ul>	<ul style="list-style-type: none"> <li>• Senior MOGA officials responsible for solid waste management</li> <li>• District waste collection managers</li> <li>• (Existing and new) transfer station managers)</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of the manual</li> <li>• Meeting to explain the contents of the manual</li> </ul>	<ul style="list-style-type: none"> <li>• Manual on equipment operation and survey techniques (in English)</li> </ul>	Japanese engineer (1 x 0.1 m)	

**Table 2.5-1 Detailed Soft Component-Related Activities Plan: (2) Technical Assistance on Equipment Operation (Continued)**

	Component	Activities	Target Persons	Method	Outcome	Required Input
2	Technical assistance on operation of collection / transportation and transfer route plans of vehicles	(2) Advice on the formulation of optimal collection/ transportation and transfer route plans				
		<ul style="list-style-type: none"> <li>• Training on planning techniques and evaluation method</li> </ul>	<ul style="list-style-type: none"> <li>• Senior MOGA officials responsible for solid waste management</li> <li>• District waste collection managers</li> <li>• (Existing and new) transfer station managers)</li> </ul>	<ul style="list-style-type: none"> <li>• Classroom training</li> <li>1) Training on plan formulation techniques (collection/transportation plan and optimal deployment plan, etc.)</li> <li>2) Training on plan evaluation techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Summary report on the transfer of planning techniques for collection/transportation and transfer plans</li> </ul>	Japanese engineer (1 x 0.15 m)
		<ul style="list-style-type: none"> <li>• Evaluation of the above plans and transfer of the relevant techniques</li> </ul>	<ul style="list-style-type: none"> <li>• District waste collection managers</li> <li>• (Existing and new) transfer station managers)</li> </ul>	<ul style="list-style-type: none"> <li>• Classroom training</li> <li>Guidance on evaluation of the plans and the relevant techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Records of draft plan formulation work</li> </ul>	

**Table 2.5-2 PDM for Soft Component of the Project**

Project Outline	Indicators	Means to Obtain Indicator Data	External Conditions	
<b>Project Goal</b> <ul style="list-style-type: none"> <li>• Solid waste management (collection, transportation, transfer and disposal) using the newly procured vehicles and equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Collection rate (95%)</li> <li>• Working ratio of collection vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• Records collected solid waste amount</li> <li>• Calculation sheet of generated solid waste amount</li> <li>• Operating records of collection and transportation vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• No major change of the solid waste management operation of the MOGA</li> </ul>	
<b>Soft Component Goals</b> <ul style="list-style-type: none"> <li>• Implementation of cell type landfill operation</li> <li>• Formulation of new collection/transportation and transfer plans</li> </ul>	<ul style="list-style-type: none"> <li>• Amount of solid waste disposed at the landfill</li> <li>• Draft collection and transportation plan (Collected amount at each district)</li> <li>• Draft transfer station plan (Transferred amount at each transfer station )</li> <li>• Number of staff employed at transfer stations</li> </ul>	<ul style="list-style-type: none"> <li>• Operation records of the landfill site</li> <li>• Collection and transportation records</li> <li>• Operating records of transfer stations</li> <li>• Employment records of transfer stations</li> <li>• Drawings of new transfer stations</li> </ul>	<ul style="list-style-type: none"> <li>• Continual solid waste management operation by the MOGA</li> <li>• Operation of the new transfer stations as planned</li> </ul>	
<b>Soft Component Outcomes</b> <ul style="list-style-type: none"> <li>• Learning of techniques to implement cell type landfill operation</li> <li>• Transfer of techniques relating to the planning of collection, transportation and transfer</li> </ul>	<ul style="list-style-type: none"> <li>• Number of days of practical guidance</li> <li>• Number of participants in practical guidance</li> <li>• Cell type landfill operation manual</li> <li>• Number of training</li> <li>• Number of participants in training</li> <li>• Collection and transportation operation manual (including drawings of routes)</li> </ul>	<ul style="list-style-type: none"> <li>• Practical guidance records</li> <li>• Inventory sheet of operation manual</li> <li>• Training records</li> <li>• Inventory sheet of operation manual</li> <li>• Document of the collection and transportation plan</li> </ul>	<ul style="list-style-type: none"> <li>• Cooperation by staff for the implementation of pushing-up cell type landfill operation</li> <li>• Availability of training venues</li> </ul>	
<b>Activities Under Soft Component</b> <ul style="list-style-type: none"> <li>• Technical assistance for cell type landfill operation as a final disposal method</li> <li>• Technical assistance for the planning of collection, transportation and transfer</li> </ul>	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <b>Inputs</b>                      [Japanese Side]                      Two Japanese engineers                      Landfill Engineer                      1 x 1.0 months                      Operation of Collection /                      Transportation of Vehicles                      Engineer                      1 x 0.8 months                 </td> <td style="width: 50%; vertical-align: top;">                     [Jordanian Side]  <ul style="list-style-type: none"> <li>• One senior official of the MOGA responsible for solid waste management</li> <li>• Manager of the landfill site</li> <li>• Manager of collection and transportation operation in each district (total of 20)</li> <li>• Manager of each existing or new transfer station (6 in total)</li> </ul> </td> </tr> </table>	<b>Inputs</b> [Japanese Side] Two Japanese engineers Landfill Engineer 1 x 1.0 months Operation of Collection / Transportation of Vehicles Engineer 1 x 0.8 months	[Jordanian Side] <ul style="list-style-type: none"> <li>• One senior official of the MOGA responsible for solid waste management</li> <li>• Manager of the landfill site</li> <li>• Manager of collection and transportation operation in each district (total of 20)</li> <li>• Manager of each existing or new transfer station (6 in total)</li> </ul>	Construction of the new transfer stations as planned Preconditions: All of the target personnel for technology transfer, including the counterparts, cooperate with the soft component of the Project.
<b>Inputs</b> [Japanese Side] Two Japanese engineers Landfill Engineer 1 x 1.0 months Operation of Collection / Transportation of Vehicles Engineer 1 x 0.8 months	[Jordanian Side] <ul style="list-style-type: none"> <li>• One senior official of the MOGA responsible for solid waste management</li> <li>• Manager of the landfill site</li> <li>• Manager of collection and transportation operation in each district (total of 20)</li> <li>• Manager of each existing or new transfer station (6 in total)</li> </ul>			










(7) Procurement Method of Implementation Resources for Soft Component

As solid waste management is a relatively new field in Jordan, the utilisation of local resources is difficult. Accordingly, application of the direct assistance type using Japanese consultants is judged to be appropriate.

(8) Implementation Schedule for Soft Component

The assumed implementation schedule for the soft component of the Project is shown in Table 2.5-3.

**Table 2.5-3 Soft Component Implementation Schedule (Draft)**

Type of Engineer	Number	Activity	Work Schedule (Monthly)	
			1	2
Landfill (1.0 person/m)	1	Verification and evaluation of cell-type landfill	▽ Handling over of equipment	
			 (0.4)	
		Preparation of a manual for cell-type landfill		 (0.3)
		Practical guidance on cell-type landfill		 (0.2)
		Technical guidance on landfill completion process, etc.		 (0.1)
Operation of Collection / Transportation Vehicles (0.8 person/m)	1	Training on TMS evaluation technique	 (0.15)	
		Practical guidance on TMS	 (0.2)	
		Training on planning of collection and transfer of waste using TMS results		 (0.2)
		Preparation of manuals on survey method, etc.		 (0.1)
		Advice on planning of collection and transfer operations		 (0.15)
Progress Report			△	
Completion Report				△

Notes 1) TMS (Time and Motion Study)

- 2) The Staffing Plan includes the days for transfer of engineers between Japan and Jordan.
- 3) Training and practical guidance include a preparation period for each activity.
- 4) Practical guidance will be implemented by grouping the districts into approximately three groups

(9) Outcomes of Soft Component

The expected outcomes of the soft component of the Project are shown in Table 2.5-4 by type of technical assistance to be provided.

**Table 2.5-4 Outcomes of Soft Component**

Technical Assistance	Guidance and Training, etc.	Manual
1. Landfill Method	<ul style="list-style-type: none"> <li>• Summary report on the technical assistance for cell type landfill operation; list of participants, records of cell type landfill operation</li> <li>• Summary report on the technical assistance for the ending process of dumping landfill operation</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of a cell type landfill operation manual, arrangement of the results of the demonstration and evaluation of cell type landfill operation</li> </ul>
2. Operation of Collection / Transportation Vehicles	<ul style="list-style-type: none"> <li>• Summary report on training on the TMS evaluation method and practical guidance; list of participants</li> <li>• Summary report on training on the planning of collection and transfer operations; list of participants</li> <li>• Summary report on advice provided for the formulation of the collection/transportation and transfer route plans; records of draft plan formulation process</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of equipment operation and survey techniques, etc; arrangement of the contents of the training and practical guidance described in the left-hand column</li> </ul>

(10) Estimated Cost of Soft Component

The estimated cost of the soft component of the Project is shown in Table 2.5-5.

**Table 2.5-5 Estimated Cost of Soft Component**

Cost Item	Estimated Cost (¥)
Direct Personnel Cost	1,350,000
Direct Cost	2,670,741
Indirect Cost	1,728,000
Total Estimated Cost	5,748,741

(11) Obligations of the Recipient Country

In addition to the successful outcome of the soft component, continual cell type landfill operation and equipment operation by the competent authority of the MOGA in line with the technical assistance provided will be required to achieve the goals of the soft component. Table 2.3.5-6 shows the feasibility, obstructive factors and necessary measures for the competent authority of the MOGA to perform its obligations for continual landfill and equipment operation.

Each of the items shown in Table 2.5-6 (Obligations of the Recipient Country) will be clearly



indicated in the relevant manuals and suitable advice will be provided for the competent authority of the MOGA so that the planned responses regarding the necessary personnel and organizational system (relevant plans, etc.) are submitted.

**Table 2.5-6 Obligations of the Recipient Country**

	1. Cell Type Landfill Operation	2. Operation of Collection/Transportation Vehicles
Feasibility	<ul style="list-style-type: none"> <li>The reasons for switching from the original cell type landfill operation to dumping operation were (i) the technical evaluation results of the covering soil and (ii) the inappropriate landfill equipment</li> <li>Fresh evaluation of the covering soil and the appropriate use of the landfill equipment following the technical assistance under the soft component will make the continual implementation of cell type landfill operation feasible.</li> </ul>	<ul style="list-style-type: none"> <li>The current collection, transportation and transfer operations often rely on past experience.</li> <li>The survey and evaluation techniques transferred under the soft component are much more rational than reliance on experience. As the contents of the technical guidance can be implemented with the technical level involved by the current operation, the formulation of continual collection/transportation and transfer plans using the newly acquired survey and evaluation techniques will be feasible.</li> </ul>
Obstructing Factors	<ul style="list-style-type: none"> <li>If the cell type landfill operation encounters any unexpected problems, landfill operation can easily revert to dumping operation.</li> <li>If technical guidance on cell type landfill operation is not provided for new staff at the time of change of staff, cell type landfill operation may not be properly conducted thereafter.</li> </ul>	<ul style="list-style-type: none"> <li>Guidance on survey and evaluation techniques will require a balanced approach to theory and practice (experience or empirical rules). If unbalanced collection/transportation and transfer plans are formulated, reversion to empirical rules and/or a decline of efficiency may result.</li> <li>If technical guidance on the survey and evaluation techniques is not provided for new staff at the time of a change of staff, the appropriate planning and implementation of collection/transportation and transfer will not materialise.</li> </ul>
Necessary Measures	<ul style="list-style-type: none"> <li>Selection of an engineer(s) exclusively working for the MOGA to deal with the problems of cell type landfill operation in an appropriate manner</li> <li>Organizational arrangements to improve cell type landfill operation and its manual periodically as well as when ever a problem emerges</li> <li>Training and technical guidance for staff at regular intervals as well as when ever a problem emerges</li> </ul>	<ul style="list-style-type: none"> <li>Selection of a person exclusively working for a district to deal with problems regarding the survey and evaluation techniques</li> <li>Organizational arrangement to improve the operation manual periodically as well as when ever a problem emerges</li> <li>Training and technical guidance for staff at regular intervals as well as when ever a problem emerges</li> <li>Implementation of periodic evaluation/adjustment of the collection/transportation plans between districts</li> </ul>

## **CHAPTER 3 Project Evaluation and Recommendations**

## Chapter 3 Project Evaluation and Recommendations

### 3.1 Project Effect

The present situation and problems in the project area, improvement measures under the Project and the project effects and degree of improvement are outlined in Table 3.1-1 below.

**Table 3.1-1 Degree of Effects and Improvement of the Project**

Solid Waste Management Item	Present Situation and Problems	Improvement Measures Under the Project (Grant Aid Project)	Project Effects and Degree of Improvement
Collection and Transportation	<ul style="list-style-type: none"> <li>• While areas of low income people, including Palestinian refugee camps, require small compactors because of the narrow roads, the insufficient number of such vehicles in operation means an inadequate solid waste collection service</li> <li>• The deterioration of vehicles and the longer transportation distance to the landfill site mean inadequate secondary collection (transportation to the landfill site).</li> <li>• The existing fleet cannot deal with the expected increase of solid waste in the coming years.</li> </ul>	Procurement of the following compactors: <ul style="list-style-type: none"> <li>• 20 small compactors (4 m<sup>3</sup>)</li> <li>• 4 medium compactors (8 m<sup>3</sup>)</li> <li>• 5 large compactors (16 m<sup>3</sup>)</li> </ul>	<ul style="list-style-type: none"> <li>• The solid waste collection ratio for the entire MOGA will improve from the current 92% (2003) to 95% in the target year of 2010. In Palestinian refugee camps and areas of low income people in particular, the solid waste collection ratio will greatly improve from the current some 60% to 90% in the target year.</li> </ul>
Transfer	<ul style="list-style-type: none"> <li>• While there are currently three transfer stations, the construction of three new stations by 2010 is in progress to reduce the solid waste disposal cost and to deal with the increased amount of solid waste for disposal. The current fleet of transfer station vehicles is totally inadequate to efficiently operate all six stations, making the introduction of new transfer station vehicles essential.</li> </ul>	Procurement of the following transfer station vehicles: <ul style="list-style-type: none"> <li>• 8 transfer trailers (open type; 40 m<sup>3</sup>)</li> <li>• 6 tractor heads</li> </ul>	<ul style="list-style-type: none"> <li>• The handling capacity at transfer stations will increase from the present 900 tons/day to 2,300 tons/day.</li> </ul>
Landfilling	<ul style="list-style-type: none"> <li>• Because of the absence of</li> </ul>	Procurement of the following	<ul style="list-style-type: none"> <li>• The newly procured</li> </ul>

Solid Waste Management Item	Present Situation and Problems	Improvement Measures Under the Project (Grant Aid Project)	Project Effects and Degree of Improvement
	<p>such heavy equipment as bulldozers which is suitable for compaction operation, solid waste is currently dumped. The resulting inadequate compaction may well shorten the life of a landfill site. In addition, the dumping of waste at the bottom of a landfill cell some 6 m below has the danger of vehicles and heavy equipment falling over or falling down.</p> <ul style="list-style-type: none"> <li>• The landfill equipment at the Madona-Ghabawi Landfill Site which was opened in 2003 is old equipment from the former landfill site and its state of deterioration means inefficient levelling and soil cover operation.</li> <li>• Despite the plan to commence the construction of the No. 2 cell at the Madona-Ghabawi Landfill Site at the end of 2005, there is no prospect of procuring the necessary construction machinery.</li> </ul>	<p>landfill site equipment:</p> <p>[Landfilling]</p> <ul style="list-style-type: none"> <li>• 2 small bulldozers (180 HP)</li> <li>• 2 medium bulldozers (220 HP)</li> </ul> <p>[Soil Excavation]</p> <ul style="list-style-type: none"> <li>• 1 large bulldozer (320 HP)</li> <li>• 2 backhoes (0.8 m<sup>3</sup>; 125 HP)</li> <li>• 3 wheel loaders (3.5 m<sup>3</sup>; 200 HP)</li> <li>• 2 dozer shovels (1.8 m<sup>3</sup>; 135 HP)</li> <li>• 1 motor grader (3.5 m; 155 HP)</li> <li>• 1 vibratory roller (133 HP)</li> </ul>	<p>equipment will make pushing-up cell type landfilling, which is the proper landfilling method, possible, allowing sufficient compaction to prolong the life of the landfill site and safer operation.</p> <ul style="list-style-type: none"> <li>• As the MOGA can construct the No. 2 and No. 3 cells without external assistance, landfill operation can be properly planned and implemented.</li> </ul>
Operation and Maintenance Vehicles	<ul style="list-style-type: none"> <li>• The aging of the existing vehicles and the greater distance to the new landfill site, etc. have created a shortage of operation and maintenance vehicles, hampering the solid waste management work.</li> </ul>	<p>Procurement of the following vehicles:</p> <ol style="list-style-type: none"> <li>① 2 water tankers (6 m<sup>3</sup>; 180 PS)</li> <li>② 6 dump trucks (10 m<sup>3</sup>; 15 tons)</li> <li>③ 1 passenger bus for landfill staff (30 seats; 4 x 2)</li> <li>④ 1 mobile workshop (4 x 2; 160 PS)</li> </ol>	<p>The procurement of new operation and maintenance vehicles will have the following effects.</p> <ol style="list-style-type: none"> <li>① Improvement of the hygiene conditions at the landfill site</li> <li>② Speedy and more extensive patrols to monitor the situation of solid waste collection</li> <li>③ Improved efficiency of the transportation of soil, etc. at the landfill site</li> <li>④ Secured means of commuting for some 70 landfill site workers and management staff</li> <li>⑤ Quicker response to break downs of the operation and maintenance vehicles as</li> </ol>

Solid Waste Management Item	Present Situation and Problems	Improvement Measures Under the Project (Grant Aid Project)	Project Effects and Degree of Improvement
			well as heavy equipment

### 3.2 Recommendations

#### 3.2.1 Collection and Transportation

While the solid waste collection ratio in the MOGA was as high as 92% in 2003, the collection service is insufficient in areas of low income people, including Palestinian refugee camps, as there is a shortage of small compactors which are suitable for the narrow roads in these areas.

Even in the city centre where solid waste collection is adequately conducted, the insufficient number of containers results in the over-spilling of waste from containers at certain times, causing the scattering of waste in some places. The present solid waste collection system is, therefore, not ideal, making its review necessary.

Meanwhile, the MOGA is planning to construct three new transfer stations to triple the transfer capacity by 2010 together with the planned improvements under the Project. Under these circumstances, transfer station vehicles will be procured in the light of the construction of new transfer stations. Accordingly, the formulation of a new collection and transportation system, taking the new transfer stations into consideration, is essential.

The Project also plans the introduction of a soft component under which a time and motion study will be conducted to transfer techniques to staff members in charge of collection and transportation to formulate an optimal collection and transportation plan for solid waste management in the MOGA. It is anticipated that such transfer of techniques will improve the capacity of the MOGA to operate solid waste management.

### **3.2.2 Landfill Technologies**

The Madona-Ghabawi Landfill Site commenced operation in May, 2003 as a general waste landfill site in the MOGA. At first, it was planned to employ the pushing-up cell method which is generally recognised as the best landfill method. However, the site has been forced to rely on the dumping method where solid waste is dumped from ground level to the bottom of the landfill cell due to the lack of heavy equipment, such as bulldozers, suitable for compaction operation.

As this work involves the dumping of solid waste from ground level to the cell bottom some 6 m below, it has the inherent risk of the falling over or falling down of heavy equipment. Moreover, the impossibility of conducting sufficient compaction (compacting) may well shorten the life of this landfill site which is expected to continually receive solid waste for landfill for some 24 years. It is, therefore, essential to use the heavy equipment to be procured under the Project for pushing-up cell type landfill operation.

Technical assistance on the introduction of pushing-up cell type landfill operation will be provided for municipal staff members of the landfill site as part of the soft component of the Project. This guidance is expected to ensure the application of the proper landfill method, to improve the working conditions and to prolong the life of the landfill site.

### **3.2.3 Equipment Maintenance**

The situation of vehicle and equipment maintenance in the MOGA is judged to be reasonably good given the fact that small compactors procured by Japan under the Phase 1 Project in 1994 are still in good working order after nine years of use. However, the reality of vehicle and equipment maintenance is essentially that regular inspections are conducted every month or so and that no preventive maintenance is conducted. The introduction of a regular preventive maintenance system will, therefore, be crucial for the efficient long-term use of the new vehicles and equipment to be procured under the Project.

# **APPENDICES**

**APPENDIX–1 Member List of  
the Study Team**



## 1. Members of the Study Team

### (1) Basic Design Study Team

Name	Assignment	Current Position / Company
Mr. Shinsaku FUKAZAWA	Leader	Water and Sanitation Team Project Management Group I Grant Aid Management Department Japan International Cooperation Agency
Mr. Masahiro TAKEUCHI	Chief Consultant / Solid Waste Management Planner	Yachiyo Engineering Co., Ltd.
Mr. Kiyoshi SHIMIZU	Solid Waste Management Equipment Planner	Ditto
Mr. Kenji IGARASHI	Environmental and Social Consideration Expert	Ditto
Mr. Takuro NUKAZAWA	Procurement Planner / Cost Estimator	Ditto

### (2) Draft Report Explanation Team

Name	Assignment	Current Position / Company
Mr. Naoyuki OCHIAI	Leader	Deputy Resident Representative Japan International Cooperation Agency Jordan Office
Mr. Masahiro TAKEUCHI	Chief Consultant / Solid Waste Management Planner	Yachiyo Engineering Co., Ltd.
Mr. Kiyoshi SHIMIZU	Solid Waste Management Equipment Planner	Ditto

## **APPENDIX–2 Study Schedule**

## 2. Study Schedule

### (1) Basic Design Study

No	Date	Day	Weather	Stay	Movement	Contents of Work
1	Jun. 12	Sat	Fine	In flight	JL703 Depart from Tokyo 15:45 Arrive in Bangkok 20:15 RJ183 Depart from Bangkok 23:15	Depart from Tokyo (JICA: Fukazawa; Consultant: Takeuchi, Shimizu and Nukazawa) Arrive in Bangkok Depart from Bangkok
2	Jun. 13	Sun	Fine	Amman	Arrive in Amman 03:55	Arrive in Amman - Courtesy call on Embassy of Japan, JICA, Ministry of Planning and International Cooperation, Municipality of Greater Amman Municipality (MOGA)
3	Jun. 14	Mon	Fine	Amman		- Visit Al Shaar T/S - Visit Madona-Ghabawi landfill site - Meeting with MOGA on IC/R
4	Jun. 15	Tue	Fine	Amman		- Survey of condition of waste collection at Al Hussein Refugee Camp - Visit Basman District Office - Visit new proposed T/S (5 sites) - Survey of activity of recycling (Visit Jordan Environmental Society)
5	Jun. 16	Wed	Fine	Amman		- Meeting with MOGA
6	Jun. 17	Thu	Fine			- Signing of M/D - Report to the Embassy of Japan and JICA
7	Jun. 18	Fri	Fine		Amman to Syria	Depart from Amman (JICA: Fukazawa)
				Amman	JL703 Depart from Tokyo 15:45 Arrive in Bangkok 20:15 RJ183 Depart from Bangkok 23:15	Depart from Tokyo (Consultant: Igarashi) - Internal meeting, and arrangement of the collected data
8	Jun. 19		Fine	Amman	Arrive in Amman 03:55	Arrive in Amman (Consultant: Igarashi) - Data collection of solid waste management - Survey for environmental and social consideration - Survey for procurement plan (vehicles)
9	Jun. 20	Sun	Fine	Amman		- Data collection of solid waste management - Investigation of specifications of equipment - Survey for procurement plan (vehicles)
10	Jun. 21	Mon	Fine	Amman		- Data collection of solid waste management - Survey of existing T/S - Meeting with Ministry of Environment (JICA Exper), survey for EIA system, IEE study for candidate sites of new transfer stations - Survey for procurement plan (vehicles/Equipment)
11	Jun. 22	Tue	Fine	Amman		- Meeting with MOGA (discuss answers to questionnaires) - Survey for refugee camp - Time and motion survey - Survey for procurement plan (transportation)

No	Date	Day	Weather	Stay	Movement	Contents of Work
12	Jun. 23	Wed	Fine	Amman		<ul style="list-style-type: none"> <li>- Analysis of answers to questionnaires</li> <li>- Survey for equipment planning (discuss with Machinery dept. and transport dept.)</li> <li>- IEE study for candidate sites for new transfer station), site visit to Marka closed landfill site</li> <li>- Survey for procurement plan (vehicles)</li> </ul>
13	Jun. 24	Thu	Fine	Amman		<ul style="list-style-type: none"> <li>- Data collection of solid waste management</li> <li>- Survey for equipment planning (discuss with Workshop &amp; Machinery dept.)</li> <li>- IEE survey of new T/Ss</li> <li>- Survey for procurement plan (vehicles)</li> </ul>
14	Jun. 25	Fri	Fine	Amman		<ul style="list-style-type: none"> <li>- Arrangement of the collected data</li> </ul>
15	Jun. 26		Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Survey for Equipment Plan</li> <li>- Evaluation of screening &amp; scoping of new T/S</li> <li>- Survey for procurement plan (transportation)</li> </ul>
16	Jun. 27	Sun	Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Survey of Waste Collection at Refugee Camp</li> <li>- Data collection of activities for environmental and social consideration</li> <li>- Survey for procurement plan (transportation)</li> </ul>
17	Jun. 28	Mon	Fine	Amman		<ul style="list-style-type: none"> <li>- Investigation of specifications of equipment</li> <li>- Collecting information and data on donor agencies</li> <li>- Preparation of Field Report (F/R)</li> <li>- Discuss with Ministry of Environment (JICA Expert)</li> <li>- Survey for cost estimation (request for quotation)</li> </ul>
18	Jun. 29	Tue	Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Meeting with Ministry of Planning and International Cooperation (Development of National Solid Waste Management Works)</li> <li>- Collection of relevant information on EIA</li> <li>- Survey for cost estimation (request for quotation)</li> </ul>
19	Jun. 30	Wed	Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Inspection on number of equipment</li> <li>- Data collection of Environmental Monitoring</li> <li>- Survey for cost estimation (request for quotation)</li> </ul>
20	Jul. 1	Thu	Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Inspection on number of equipment</li> <li>- Data collection of Environmental Monitoring</li> <li>- Supplementary survey for facilities for environmental management</li> </ul>
21	Jul. 2	Fri	Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> </ul>
22	Jul. 3		Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Formulation of waste management plan and supplementary survey</li> <li>- Inspection on number of equipment</li> <li>- Collection of relevant information on EIA</li> <li>- Survey for procurement plan (request for quotation)</li> </ul>
23	Jul. 4	Sun	Fine	Amman		<ul style="list-style-type: none"> <li>- Preparation of Field Report (F/R)</li> <li>- Supplementary survey of transfer stations and landfill site</li> <li>- Collection of relevant information on EIA</li> </ul>

No	Date	Day	Weather	Stay	Movement	Contents of Work
						- Discussion with Cities & Villages Development Bank (for collection of information of procurement plan)
24	Jul. 5	Mon	Fine	Amman		- Preparation of Field Report (F/R) - Discussion with environmental expert of UNDP (Movement of other donor agencies and NGOs) - Collection of relevant information on EIA - Collection of information on procurement plan
25	Jul. 6	Tue	Fine	Amman	RJ182 Depart from Amman 08:35 Arrive in Bangkok 15:15 JL718 Depart from Bangkok 22:15	Depart from Amman (Consultant: Igarashi) - Discussion with MOGA (F/R ) - Collection of information on procurement plan
26	Jul. 7	Wed	Fine	Amman	Arrive in Tokyo 06:15	Arrive in Tokyo (Consultant: Igarashi) - Meeting with MOGA (Explanation of F/R) - Signing of F/R
27	Jul. 8	Thu	Fine	Amman		- Courtesy visit and report to MOGA - Courtesy visit and report to Embassy of Japan and JICA
28	Jul. 9	Fri	Fine	In flight	RJ182 Depart from Amman 08:35 Arrive in Bangkok 15:15 JL718 Depart from Bangkok 22:15	Depart from Amman (Consultant: Takeuchi, Shimizu and Nukazawa)
29	Jul. 10	Sat	Fine	-	Arrive in Tokyo 06:15	Arrive in Tokyo (Consultant: Takeuchi, Shimizu and Nukazawa)

## (2) Draft Report Explanation

No	Date	Day	Weather	Stay	Movement	Contents of Work
1	Sep. 2	Thu	Fine	In a plane	JL1319 Depart from Tokyo 20:40 Arrive in Osaka 21:55 JL5099 Depart from Osaka 23:20	Departure of Study Team from Tokyo (Consultant: Takeuchi and Shimizu)  Arrive in Osaka  Depart from Osaka
2	Sep. 3	Fri	Fine	Amman	Arrive in Dubai 05:15 EK903 Depart from Dubai 14:00 Arrive in Amman 15:55	Arrive in Dubai Depart from Dubai Arrival of Study Team in Amman
3	Sep. 4	Sat	Fine	Amman		<ul style="list-style-type: none"> <li>- Meeting and discussion with JICA,</li> <li>- Meeting and discussion with Municipality of Greater Amman Municipality (MOGA): Discussion on study schedule, and draft basic design report (DBD)</li> <li>- Making supplementary document for DBD</li> </ul>
4	Sep. 5	Sun	Fine	Amman		<ul style="list-style-type: none"> <li>- Courtesy call on Ministry of Planning and International Cooperation, and explanation of draft basic design report</li> <li>- Courtesy call on Embassy of Japan, and explanation of draft basic design report</li> <li>- Site visit (Madona-Ghabawi landfill site, Al Shaar T/S, three new proposed T/S)</li> </ul>
5	Sep. 6	Mon	Fine	Amman		<ul style="list-style-type: none"> <li>- Supplementary survey of site visit</li> <li>- Meeting with MOGA (Specifications of equipment)</li> </ul>
6	Sep. 7	Tue	Fine			<ul style="list-style-type: none"> <li>- Meeting with MOGA (Specifications of equipment)</li> <li>- Discussion on Minutes</li> </ul>
7	Sep. 8	Wed	Fine	Amman		<ul style="list-style-type: none"> <li>- Discussion on Minutes</li> <li>- Signing of M/D</li> </ul>
8	Sep. 9	Thu	Fine	Amman		<ul style="list-style-type: none"> <li>- Report the results of explanation and discussion of draft basic design report to the Embassy of Japan and JICA</li> </ul>
27	Sep. 10	Fri	Fine	In flight	EK904 Depart from Amman 08:35 Arrive in Dubai 21:10	Depart from Amman (Consultant: Takeuchi and Shimizu)
29	Sep. 11	Sun	Fine		JL5090 Depart from Dubai 02:30 Arrive in Osaka 17:00 JL1316 Depart from Osaka 18:40 Arrive in Tokyo 20:15	Depart from Dubai  Arrive in Osaka Depart from Osaka Arrive in Tokyo (Consultant: Takeuchi and Shimizu)

**APPENDIX– 3 List of Parties Concerned  
in the Recipient Country**

### 3. List of Parties Concerned in Recipient Country

#### (1) Basic Design Study Period

Agency and Position	Name
<b>Ministry of Planning and International Cooperation</b>	
Head of Asian Relations Section, Japan Desk Water & Environment Section, Project Directorate	Ms. Wafa Al Saket Mr. Saif Bani Atla Mr. Ahmad Al Jazzar
<b>Ministry of Municipal Affairs</b>	
Head of Development Projects Unit	Mr. Nart N. B. Naguer
<b>Municipality of Greater Amman</b>	
Under Secretary Assistant for Health & Environmental Affairs Head of Environment & General Sanitary Department Manager of Madona-Ghabawi Landfill Office Head of Transfer Station Section Director / Manager of Basman District Head of Health Section Head of Clean Section Manager of Transportation Department Inspector of Transportation Department Maintenance Chief of Transportation Department Operational Chief of Transportation Department Head of Stock Section, Machinery Department Heavy Duty Workshop Manager, Workshop & Machinery Department Head of Tendering Department	Dr. Hussein Zaki Said Dr. Jihad Abu Shawareb Mr. Al Nusair Mr. Foaz Abo Rishe Mr. Noufan M. Theeb Dr. Jamal Al Ghoal Mr. Kalad Jrawhlt Mr. H. Abu Shattal (Eng) Mr. Ebraheem Hassan Mr. Ali Abu Jamoos (Eng) Mr. A. Habarneh Mr. Al-Dmour Emad Mr. Fayez Arar  Mr. Mutasem Hidawi
<b>Jordan University of Science &amp; Technology</b>	
Professor Assistant Professor	Dr. Fayez A. Abdulla Dr. Hani A. Abu Qdais
<b>Royal Scientific Society</b>	
Director of Environmental Research Center	Dr. Bassam O. Hayek



Agency and Position	Name
<b>Cities &amp; Villages Development Bank</b>	
Assistant General Manager of Technical Affairs Head of Studies and Statistics Division	Dr. Mohammad Krieshan Ms. Shadia Nassar
<b>United Nations Development Programme</b>	
Practice Manager, Energy and Environment Group, Bureau for Development Policy Environmental Analyst	Mr. Irad Abumoghli  Ms. Helena Naber
<b>Jordan Environment Society</b>	
Executive Director Project Director of Hazardous Waste Project	Mr. Ahmed Al-Kofahi Mr. Haitham Wahdan
<b>Embassy of Japan in Jordan</b>	
First Secretary Second Secretary	Mr. Tetsuro Endo Mr. Takayuki Ikeda
<b>JICA Jordan Office</b>	
Deputy Resident Representative Assistant Resident Representative JICA Expert Senior Program Officer	Mr. Naoyuki Ochiai Mr. Yoshimasa Takemura Mr. Hiroyuki Hagiwara Mr. Hani H. Alkurdi

## (2) Draft Report Explanation Period

Agency and Position	Name
<b>Ministry of Planning and International Cooperation</b>	
Head of Asian Relations Section Japan Desk Water & Environment Section, Project Directorate	Ms. Wafa Al Saket Mr. Saif Bani Ataa Mr. Ahmad Al Jazzar
<b>Municipality of Greater Amman</b>	
Under Secretary Assistant for Health & Environmental Affairs Head of Environment & General Sanitary Department Manager of Madona-Ghabawi Landfill Office Head of Transfer Station Section Manager of Environment & General Sanitary Department Head of Stock Section, Machinery Department Heavy Duty Workshop Manager, Workshop & Machinery Department	Dr. Hussein Zaki Said Dr. Jihad Abu Shawareb Mr. Ali Nusair Mr. Foaz Abo Rishe Mr. Bunni Fadi Mr. Al-Dmour Emad Mr. Fayeze Arar
<b>Embassy of Japan in Jordan</b>	
First Secretary	Mr. Tetsuro Endo
<b>JICA Jordan Office</b>	
Resident Representative Deputy Resident Representative Assistant Resident Representative	Mr. Hideo Morikawa Mr. Naoyuki Ochiai Mr. Yoshimasa Takemura

## **APPENDIX– 4 Minutes of Discussions**

4. Minutes of Discussions

(1) Basic Design Study

MINUTES OF DISCUSSIONS  
ON THE BASIC DESIGN STUDY  
ON THE PROJECT OF SUPPLYING EQUIPMENT  
FOR NEW LANDFILL SITE OF MADONA-GHABAWI  
IN THE HASHEMITE KINGDOM OF JORDAN

Based on the results of the Preliminary Study, the Government of Japan decided to conduct a Basic Design Study on THE PROJECT OF SUPPLYING EQUIPMENT FOR NEW LANDFILL SITE OF MADONA-GHABAWI (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to THE HASHEMITE KINGDOM OF JORDAN ( hereinafter referred to as " Jordan ) the Basic Design Study Team (hereinafter referred to as "the Team" ), which is headed by Shinsaku Fukazawa, Water and Sanitation Team, Project Management Group I , Grant Aid Management department, and is scheduled to stay in the country from June 13, to July 9, 2004.

The Team held discussions with the officials concerned of the Government of the Jordan and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Amman, June 17, 2004

深澤 晋作

Shinsaku Fukazawa

Leader

Basic Design Study Team

Japan International Cooperation Agency

Japan

H. Zaki Said

Dr. Hussein Zaki Said

Under Secretary Assistant for Health  
& Environmental affairs

Municipality of Greater Amman

The Hashemite Kingdom of Jordan

## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to improve the capacity for solid waste management through supplying equipment for operation of new Madona-Ghabawi landfill site, and vehicles for smooth collecting and transportation of solid waste in Greater Amman city.

### 2. Project sites

The Project sites are Greater Amman city and surrounding areas consisting of a part of Zarqa, Balqa and Madaba Governorates including refugee camps as shown in Annex- I .

The operation area of the requested collection vehicles and transfer station equipments is Greater Amman city.

Madona-Ghabawi landfill where the requested dumping machinery and solid waste disposal machinery are operated receives solid waste from a part of Zarqa, Balqa and Madaba Governorates besides Greater Amman city.

### 3. Responsible and Implementing Agency

3-1. The Responsible Agency is Ministry of Planning.

3-2. The Implementing Agency is Municipality of Greater Amman (MOGA).

### 4. Items requested by the Government of Jordan.

After discussions with the Team, the items described in Annex- II were finally requested by the Jordanian side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

### 5. Japan's Grant Aid Scheme

The Jordanian side has understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of the Jordan as explained by the Team and described in Annex-2 and Annex-3 of the Minutes of Discussions signed by both parties on the 4<sup>th</sup> of March 2004.

### 6. Schedule of the Study

6-1. The consultant members of the team will proceed to further studies in Jordan until July 9, 2004.

6-2. JICA will prepare a draft report in English and dispatch a mission in order to explain its contents in September 2004.

6-3. In case that the contents of the report are accepted in principle by the Government of Jordan, JICA will complete the final report and send it to the Government of Jordan by November 2004.

### 7. Other relevant issues

7-1. Both side agreed that the target year of the Project is 2010. Therefore design population and

design generated waste amount for the Project shall be set for the year 2010.

7-2. Both side agreed that the target of the waste collection rate of the project site is 95% by the target year.

7-3. Both side agreed that the Jordanian side shall secure the spare parts with their own budget for the vehicle and equipments provided under the Project, in case that the Project is implemented.

7-4. The Jordanian side explained to the Team that the construction plans of the new transfer stations as attached in Annex-III. The Jordanian side also explained that they will fix the place of the three new transfer stations and inform the Team not later than 8<sup>th</sup> of July, 2004. The Japanese side confirmed the explanation of the Jordanian side.

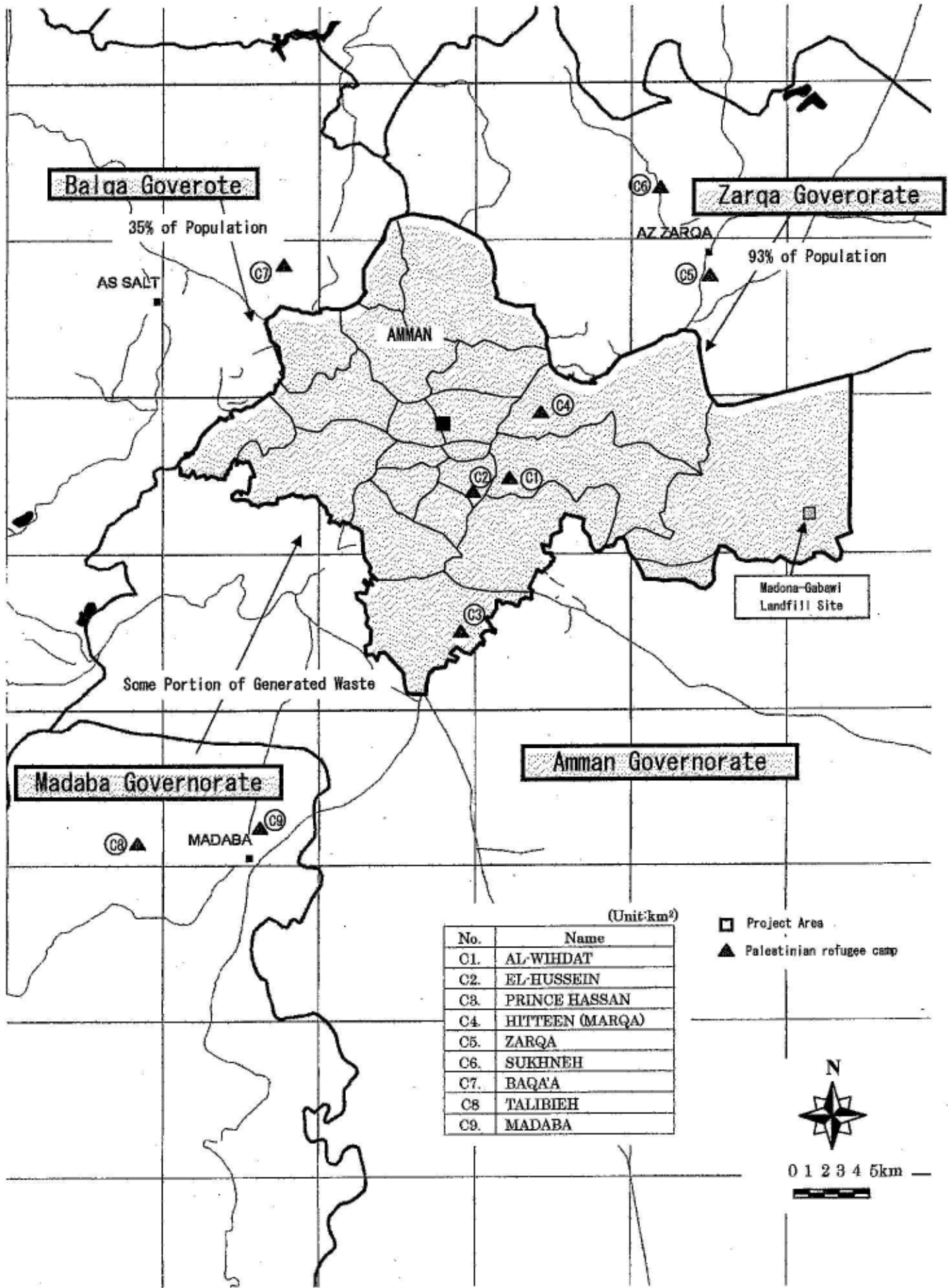
7-5. The Jordanian side explained that the operators of the new transfer stations and drivers of the procured vehicles should be secured by redeployment of staff within MOGA. The Japanese side confirmed the explanation of the Jordanian side.

7-6. The Jordanian side explained the monitoring plan at the Madona-Ghabawi landfill site as attached in Annex-IV. The Japanese side confirmed the explanation of the Jordanian side.

7-7. The Jordanian side explained that the construction of the leachate treatment facility at the Madona-Ghabawi landfill site will be built before October 2004 as shown in Annex-III. The Japanese side confirmed the explanation of the Jordanian side.

7-8. The Jordanian side explained that the construction plan of second cell of the Madona-Ghabawi landfill site is as shown in Annex-III and the Japanese side confirmed that the Jordanian side will secure the budget for the construction.

Annex I



*B*

*F*

## Annex-II

## Requested Items

Classification	Items	Specifications or Equivalence	Initial Request	
Waste Collection Vehicle	- Inter City Medium Size Compactor	4 – 8 m <sup>3</sup>	20	
	- Inter City Large Compactor	8 – 16 m <sup>3</sup>	10	
Transfer Station Vehicle	- Long Shassis Compacting Trainl	30 – 50m <sup>3</sup>	8	
	- Tractor Head for Trail		6	
Equipment for Final Landfill Site	<u>Garbage Disposal Machinery</u>			
	- Bulldozer (Small)	180 HP	2	
	- Bulldozer (Middle)	220 HP	2	
	- Landfill Compactor	30 – 40 Ton	1	
	- Wheel Loader	215 HP + Bucket	3	
	- Dozer Shovel	135 HP + Bucket	2	
	- Backhoe	125 HP	2	
	<u>Soil Excavation Machinery</u>			
	- Bulldozer (Large)	320 HP	1	
	- Motor Grader	155 HP	1	
- Vibratory Roller	133 HP	1		
Vehicle for Operation and Maintenance	- Water Tanker (Sprinkler truck)	6 – 8 m <sup>3</sup>	3	
	- Double Cab Pick Up		2	
	- Dump Truck	8 – 10 m <sup>3</sup>	6	
	- Passenger Bus for the Landfill Staff	20 Seat	1	
	- Mobile Workshop	Alminum Van Body, 4 x 4, 9 ton	1	





Ref.

Date 16/6/2004

To :

**JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)**  
**BASIC DESIGN TEAM**  
**YACHIYO ENGINEERING CO. , LTD.**

As you noticed during our discussion that Greater Amman Municipality annual total budget is above 95 million J.D ( J.D is eq. 1.3 U.S Dollar ), which gives the Municipality the ability to continue its Global solid waste management system.

So the Municipality is committed strongly to finance the following :-

1) **Design conditions :-**

To continue and finance the conditions after the target year 2010 of the project, and set the population design and waste, generation of solid waste amount and to maintain the collection ratio 95% . In addition to other items, like soil covering ratio not less than 10% of volume of waste disposed and vehicles and equipment ratio .

2) **Transfers station :-**

As agreed before the Municipality is committed to build up and operate three transfer station in the suitable areas in Amman. At the moment, the land possession under ongoing process. which will followed by design, construction and operation.

The proposed areas for transfers stations as following :-

- 1- Yagus station ( Al- Jabuha district ).
- 2- Wadi Al-sir ,two land position understudy at this moment .
- 3- Al Ruseifeh area ( Between three major cities Amman, Balgaa and Al Zarka city .
- 4- Abdoun station ( Zahran district )

Our proposed schedule to construct three out of them will be less than one year from now and after MOGA technical team will complet their design.

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3) **The second cell construction :-**

As mentioned during our discussion about the flexibility of the capacity of operating first cell design and its life span to continue receiving solid waste for more than two years. So Municipality is committed to finance and construct the second cell. on early 2006 from its budget.

4) **The second cell construction :-**

As mentioned during our discussion about the flexibility of the capacity of operating first cell design and its lifespan to continue receiving solid waste for more the two years. So Municipality is committed to finance and construct the second cell . On early 2006 from its budget.

5) **Leachate treatment facility :-**

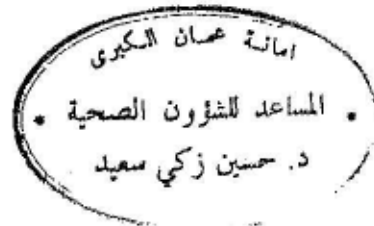
Refer to the design of Ghabawi landfill and Environment impact assessment the MOGA is committed to build a Leachate treatment plan at site before October 2004

*Thank you.*

*Dr. Hussein Zaki*

*H. Zaki*

**Under Secretary Assistant For  
Health & Environmental Affairs**





بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

أمانة عمان الكبرى

Municipality of Greater Amman



Ref.

Date 16/6/2004

To :

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
BASIC DESIGN TEAM  
YACHIYO ENGINEERING CO., LTD.

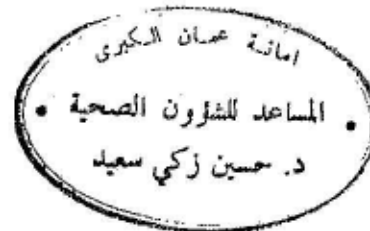
*Attached with this letter a proposed monitoring report.  
Which is now under ongoing discussion with one of Jordan  
universities to do a contract and regular schedule for  
monitoring Ghabawi operation process.*

*This will be completed according to EIA report and other  
local and international standards in the future, before the end of  
this year 2004.*

*Thank you.*

Dr. Hussein Zaki

Under Secretary Assistant For  
Health & Environmental Affairs



Ref.

Date

## ENVIRONMENTAL MONITORING PLAN FOR ALGHABAWY LANDFILL OPERATIONS

Environmental monitoring refers to periodic inspections and testing performed to assess impacts of the Alghabawi landfill on its surrounding environment.

Environmental monitoring plan should cover the following elements:

1. Groundwater quality.
2. Gaseous emissions.
3. Erosion and sedimentation and soil quality.
4. Noise level
5. Leachate treatment.

### 1. Groundwater Quality

Groundwater quality monitoring serves two purposes:

1. to demonstrate that the landfill is not causing significant degradation of groundwater
2. to evaluate the character, magnitude and extent of contamination, in case such contamination takes place.

To achieve a continuous monitoring of the groundwater, usually groundwater wells are drilled within and around the site area at the upgradient and downgradient of the site. As for Alghabawi site, there is a monitoring at the upgradient side of the site that is excavated at the time of hydrogeological survey evaluation of the site. This well along with the existing wells in the nearby farm can be used as monitoring wells.

Groundwater quality sampling and testing should be performed at intervals throughout the year. Sampling times should be adjusted so as to account for possible variations in water quality related to seasonal fluctuations in the rainfall. The following water quality parameters are common indicators of possible contamination

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by landfill leachate. It is recommended that groundwater samples be collected and analyzed for these constituents at least three times per year.

- pH
- Total dissolved solids
- Alkalinity
- BOD
- COD
- Chlorides
- Manganese
- Nitrate / Nitrite nitrogen
- Total Kjeldhal nitrogen
- Iron
- Sodium
- Sulfate

Analysis for the following parameters should be included in the groundwater quality testing program and should be carried out for at least once a year:

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Total phenols
- Volatile organic compounds

Monitoring results should be compared with The Jordanian Standards of wastewater discharge for groundwater recharge.

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## 2. Gaseous Emissions

Jordan is lacking specific air quality regulations and allowable emissions levels for land disposal facilities. However, the ambient air quality standards from stationary sources can be utilized for the purpose of monitoring and control. As for AlGhabawi landfill, two aspects of gaseous emissions should be considered, namely, odors and methane emissions, regardless of the regulatory status.

For the most part odors should be monitored through the awareness of the landfills workers and by attending to the complaints of neighboring property owners. If odors should become a continuous problem for the affected parties, then problem should be resolved even if that requires the adjustment of landfill operating method.

Land fill gas migration, on the other hand, requires monitoring and assessment. The need for gas migration monitoring derives from the fact that it is flammable and explosive above certain concentration, due to the presence of methane gas. Therefore, the purpose of gas migration is to ensure that landfill does not migrate to and accumulate in on-site structure or to off-site location in a concentration that are hazardous to human health or property.

The landfill gas should be controlled so as to keep within the following limits:

- 100% of the lower explosive limit (LEL) at the property boundary of the facility
- 25% of the LEL in any structure within the landfill facility.

LEL is equivalent to a concentration of 5% methane in air. It should be measured by the use of field- portable combustible gas indicator at various

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distances from the landfill area. The measurement frequency should be at least three times a year.

### 3. Erosion and Sedimentation ( Soil quality )

At any time during the operation of the landfill, large areas of disturbed land likely will be exposed. Thus, the potential exists for substantial problems associated with erosion and sediment deposition if proper control measures are not applied at the landfill site.

Environmental monitoring should include periodic inspection of the landfill surface and drainage systems for indications of excessive erosion or sediment deposition. Sediments that are deposited in drainage channels should be removed promptly. All ponds at the site should be cleaned out from time to time to maintain their design level of performance. Natural waterways that receive runoff from landfill site should be monitored frequently and after each major storm event for any signs of sediments deposition.

### 4. Noise level

With the advancement in the landfilling operations at Al Ghabawi, it is expected that the noise levels will be increased. Therefore, it is recommended to put down a monitoring plan to measure the noise once a month on-site and of-site nearby the residential areas on the highway leading to the landfill. The objective of this monitoring is to ensure that noise levels are within the allowable limits both within site and on the highway to the site.

### 5. Leachate treatment

- Although a good capping system will be implemented, usually Leachate will continue to be generated from landfills after the closure.

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Thus it will be necessary to collect and treat the produced Leachate as it may poses a threat to the groundwater quality.

- The Ghabawi design include a leachat treatment plant, which depend on the high evaporation rate in the area attach with this report the design of this plant.



## Japan's Grant Aid

The Grant Aid scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

### Grant Aid Procedures

Japan's Grant Aid Scheme is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet of Japan)
Determination of Implementation	(The Notes exchanged between the Government of Japan and the Recipient Country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Ministry of Foreign Affairs, the Government of Japan to determine whether or not it is eligible for the Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request.

Secondly, JICA conducts the Basic Design Study, using a Japanese firm.

Thirdly, The Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid program, based on a report of the Basic Design Study prepared By JICA, the results are then submitted to the Cabinet of Japan for an approval.

Fourthly, the project once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Government of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such manner as preparing tenders, contracts and so on.

### Basic Design Study

#### Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study") conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows;

- 
- Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for implementation of the Project.
  - Evaluation of the appropriateness of the project to be implemented under the Grant Aid Scheme from a technical, social and economical point of view.
  - Confirmation of items agreed on by both parties concerning the basic concept of the Project.
  - Preparation of a basic design of the Project.
  - Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design Study of the Project is confirmed considering the guideline of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the project. Such measures must be guaranteed even though they may fall outside of jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

#### **Selection of Consultants**

For smooth implementation of the Study, JICA uses a registered consultant firm. JICA selects a firm based on proposals submitted by interested firms. The selected firm carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consultant firm(s) used for the Study is recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

#### **Japan's Grant Aid Scheme**

##### **(1) Exchange of Notes (E/N)**

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditioned and amount of the Grant Aid, etc., are confirmed.

(2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However, in case of delay in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products and services of a third country.

However the prime contractors, namely consulting constructing and procurement firms, are limited to "Japanese nationals". (The terms "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessary "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Undertakings required to the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is requested to undertake such necessary measures as the followings;

- 1) To secure land necessary for the sites of the project and to clear level and reclaim the land prior to commencement of the construction.
- 2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
- 3) To secure buildings prior to the procurement in case the installation of the equipment.
- 4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
- 5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.
- 6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of the work.

(6) "Proper Use"

The recipient country is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Re-Export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

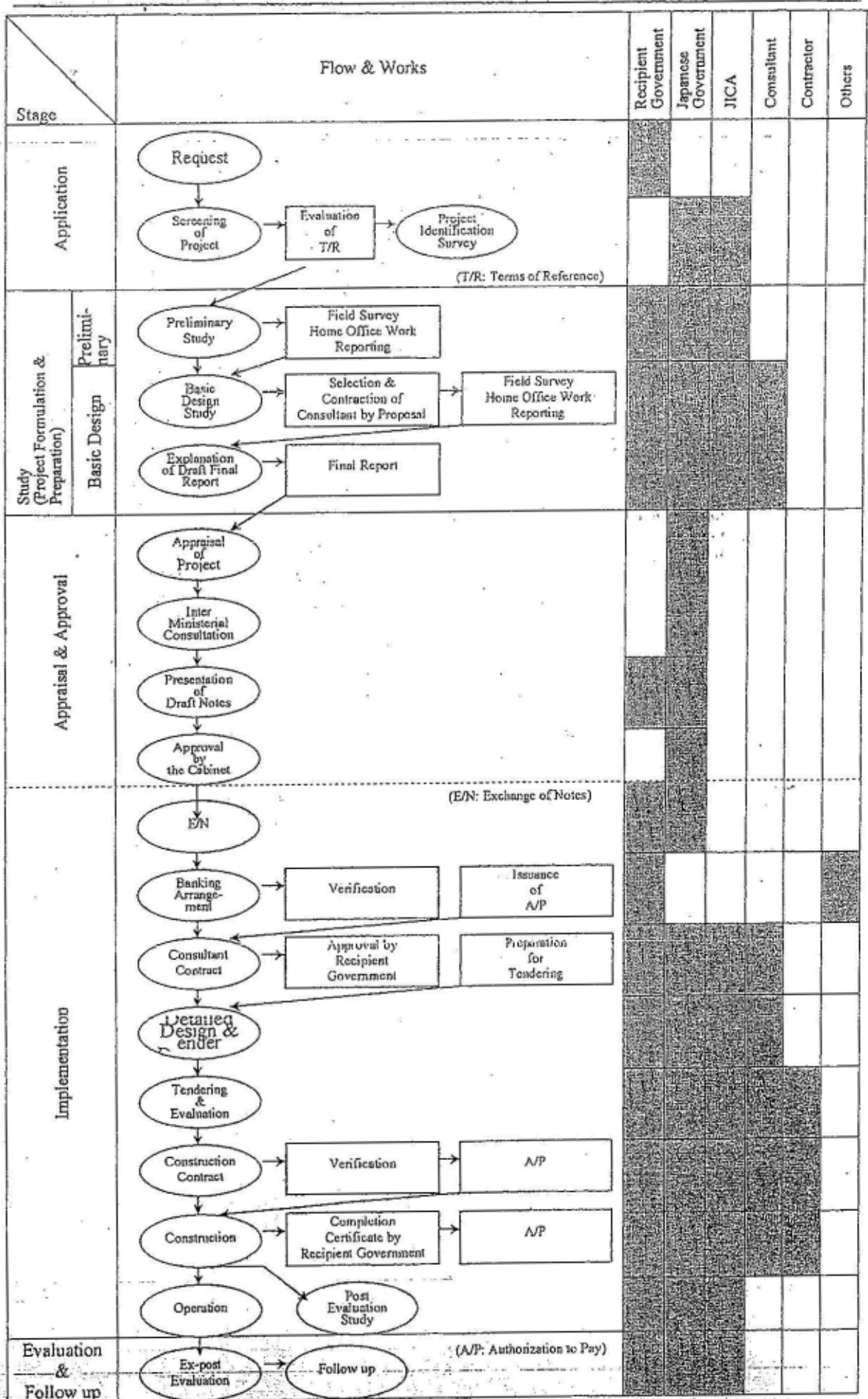
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(8) Banking Arrangement(B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan(hereinafter referred to as "Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under verified contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay(A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.



Flow Chart of Japan's Grant Aid Procedures

*M* *B* *F* *Zell*

ANNEX-3: Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
2	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan the recipient	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
3	To accord Japanese nationals, whose service may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		●
5	To maintain and use properly and effectively the facilities contracted and equipment provided under the Grant Aid		●
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		●

**MINUTES OF DISCUSSIONS**  
**ON**  
**BASIC DESIGN STUDY**  
**ON**  
**THE PROJECT OF SUPPLYING EQUIPMENT**  
**FOR NEW LANDFILL SITE OF MADONA-GHABAWI**  
**IN THE HASHEMITE KINGDOM OF JORDAN**  
**(EXPLANATION ON DRAFT REPORT)**

In June 2004, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project of Supplying Equipment for New Landfill Site of Madona-Ghabawi (hereinafter referred to as "the Project") to the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan"), and through discussions, field survey, and technical examination of the results in Japan, JICA has prepared a Draft Report of the Basic Design Study on the Project.

In order to explain and to consult Jordanian side on the components of the draft report, JICA sent to Jordan the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Naoyuki Ochiai, Deputy Resident Representative, JICA Jordan Office, from September 3 to 10, 2004.

As a result of discussions, both sides confirmed the main items described on the attached sheets.

Amman, September 8, 2004



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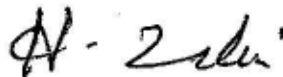
Mr. Naoyuki Ochiai

Leader

Basic Design Study Team

Japan International Cooperation Agency

JICA



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Dr. Hussein Zaki Said

Under Secretary Assistant for Health &  
Environmental Affairs

Municipality of Greater Amman (MOGA)

The Hashemite Kingdom of Jordan

1) Construction of New Transfer Stations by the Jordanian Side

The Jordanian side promised that the Jordanian side will complete the construction of three new transfer stations before the handing-over to the Jordanian side of the equipment for the Project to be provided by the Japanese side.

2) Construction of 2<sup>nd</sup> Cell for Landfill Site

The Jordanian side stated that they will start the construction work for 2nd Cell at the Madona-Ghabawi Landfill Site after they have received the requested construction equipment from the Japanese side.

3) Construction of Leachate Treatment Facility

The Japanese side confirmed that the Jordanian side is now doing design work and will complete the construction of a leachate treatment facility in Madona-Ghabawi Landfill Site by the end of 2004.

4) Environmental Monitoring Program

The Jordanian side explained the environmental monitoring program for Madona-Ghabawi Landfill Site as described in **Annex-III** and they stated that the program will be implemented by the technical assistance of French Government for the year 2005 (the duration of this assistance is one year) as shown in the attached letter as **Annex-IV** or by their own effort. The Jordanian side also explained to the Team that after 2006 they will continue the environmental monitoring program by the technical assistance of foreign countries or their own effort.

(4) Technical Transfer (Soft Component)

The Japanese side proposed in the draft report to conduct technical transfer (hereinafter referred as to "Soft Component") through lecturing and training for the improvement of operating ability for solid waste management departments' staff of MOGA. The Jordanian side requested the Japanese side to implement the Soft Component under the Project.

The Soft Component covers the following areas.

- i. Technical assistance on landfill operation
- ii. Technical assistance on equipment operation

The Jordanian side agreed to appoint operators and trainees in due course of the Soft Component program in accordance with the list and the schedule shown in the draft report. The Jordanian side stated that they will have the appointed staff attend the Soft Component program on a full-time basis.



## Implementation Schedule of Undertakings by the Jordanian Side (MOGA)

(In case the Japan's Grant Aid is extended to the Project)

Year Month	2004					2005												2006				
	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	
Manufacturing, Delivery and Handing-over of the Equipment and Vehicles by the Japanese side (provisional)																	▽ Handing-over					
1. Construction of 3 New Transfer Stations																						
(1) WADI AL SIR Transfer Station*1 (Land owner : private)		Tendering Work	Construction																			
(2) ZAHRAN Transfer Station (Land owner: MOGA)			Design & Tendering Work	Access Road Preparation and Construction																		
(3) AL JBEHA Transfer Station (Land owner: private)						Under negotiation with the land owner	Design and Tendering Work	Construction														
2. Construction of 2nd Cell for Landfill Site																						
3. Construction of Leachate Treatment Facility		Design	Construction																			
4. Environmental Monitoring for Landfill Site																						

Note 1. The land for this transfer station site has already been purchased by MOGA.

Note 2. Land Use Department of Ministry of Municipality Affairs

Ref.

Date

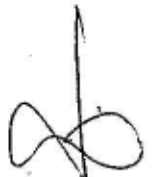
by landfill leachate. It is recommended that groundwater samples be collected and analyzed for these constituents at least three times per year.

- pH
- Total dissolved solids
- Alkalinity
- BOD
- COD
- Chlorides
- Manganese
- Nitrate / Nitrite nitrogen
- Total Kjeldhal nitrogen
- Iron
- Sodium
- Sulfate

Analysis for the following parameters should be included in the groundwater quality testing program and should be carried out for at least once a year:

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Total phenols
- Volatile organic compounds

Monitoring results should be compared with The Jordanian Standards of wastewater discharge for groundwater recharge.



Ref.

Date

distances from the landfill area. The measurement frequency should be at least three times a year.

### 3. Erosion and Sedimentation ( Soil quality )

At any time during the operation of the landfill, large areas of disturbed land likely will be exposed. Thus, the potential exists for substantial problems associated with erosion and sediment deposition if proper control measures are not applied at the landfill site.

Environmental monitoring should include periodic inspection of the landfill surface and drainage systems for indications of excessive erosion or sediment deposition. Sediments that are deposited in drainage channels should be removed promptly. All ponds at the site should be cleaned out from time to time to maintain their design level of performance. Natural waterways that receive runoff from landfill site should be monitored frequently and after each major storm event for any signs of sediments deposition.

### 4. Noise level

With the advancement in the landfilling operations at Al Ghabawi, it is expected that the noise levels will be increased. Therefore, it is recommended to put down a monitoring plan to measure the noise once a month on-site and of-site nearby the residential areas on the highway leading to the landfill. The objective of this monitoring is to ensure that noise levels are within the allowable limits both within site and on the highway to the site.

### 5. Leachate treatment

Although a good capping system will be implemented, usually Leachate will continue to be generated from landfills after the closure.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Annex-IV (1/3)

أمانة عمان الكبرى

Municipality of Greater Amman



Ref. 9-H-20482

Date 18-8-2004

**ADEME International**  
**Mr Bernard FOULLY**  
27, rue Louis Vicat  
75015 PARIS  
FRANCE  
Fax: 00-33-1-47-65-22-29

Object : Expression of interest for the programme of landfills experimental follow-up.

Dear Mr. Fouly,

Cabinet Marlin has assisted the Municipality of Greater Amman (MOGA) from 2000 to 2002 for the solid waste Management Plan and Ghabawi landfill project.

Cabinet Merlin has informed us about your programme " Experimental actions for improvement of technico-economical knowledge on household waste treatment in developing countries" and its landfill component. We found this program very interesting to improve the knowledge of landfills parameters in developing countries and in particular in Amman, in order to improve our landfilling conditions.

MOGA is very interested to make an experimental follow-up of its Ghabawi landfill ( under operation since ay 2003) and would be very glad to benefit from a grant from ADEME to cover the costs for Cabinet Merlin's assistance.

In return for the grant, MOGA is ready to provide local assistance by municipal staff and to finance most of local laboratory analysis and field investigations (to be defined).

Moreover, MOGA intends to implement a monitoring system of the environmental impacts of the landfill (Groundwater quality, gaseous emissions, erosion and sedimentation, noise level, soil quality, Leachate quality). We would be glad if we could include the implementation of this monitoring system in the scope of services to be carried out by Cabinet Meriin. The MOGA would then bear the cost for the related equipment and analysis.

Looking forward to receiving your answer,

Sincerely yours,

Mayor of Amman

*Nidal Hadid*  
Nidal Hadid

CC : Cabinet Merlin  
CC: Dr. Hussien zaki  
Undersecretary Assistant

In return for the grant, ADEME requires a full cooperation from the beneficiary (MOGA) :

- nominating at one MOGA Project Manager, responsible for the relations with ADEME and Cabinet MERLIN (it could be you) and one engineer and/or one technician to take the samples, supervise the analysis and make a pre-analysis of the results (on a part-time job basis)
- participating in the local expenditures (sampling, analysis...).

Earlier this week, I have met Mr Bernard FOULIY who is in charge of the programme in ADEME. He confirmed to me that the grant is available under ADEME's 2004 budget. He would like to initiate the project implementation procedure within the next few weeks.

The first step required by ADEME is an official letter from the Municipality of Greater Amman (Lord Mayor or yourself) expressing MOGA's interest in the project. Please send this letter by fax as soon as possible to :

ADEME International  
 Attention Mr Bernard FOULIY,  
 27, rue Louis Vicat, 75015 PARIS - France  
 Fax : 00-33-1-47-65-22-29

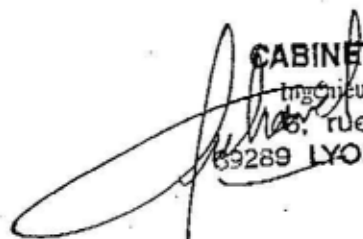
(and copy to me in Cabinet Merlin : Fax : 00-33-4-72-32-57-18)

You will find a model in next page that you may use and that should fit ADEME's requirements on this letter. I can send it to you by e-mail if you have any e-mail address (my e-mail address is [gautrand@cabinet-merlin.fr](mailto:gautrand@cabinet-merlin.fr)).

After receiving this letter from MOGA, ADEME will send you a draft agreement to be validated and signed by MOGA, ADEME and Cabinet Merlin.

I have informed ADEME about your wish to include the monitoring in the scope of work of the grant. They should agree to include some assistance for monitoring of the landfill in the scope of the granted consultancy services to be carried out by Cabinet Merlin, under condition that the related costs of lab analysis and field surveys will be under MOGA's responsibility.

Sincerely yours.

  
**CABINET MERLIN**  
 Ingénieurs-Conseils  
 6, rue Grôlée  
 69289 LYON CEDEX 02

Gregory AUTRAND  
 Project Manager

**APPENDIX–5 Cost Estimation borne by  
the Recipient Country**

5. Cost Estimation borne by the Recipient Country

Estimated Project Cost borne by the Recipient Country

No.	Item	Amount (Thousand Yen)
1	Construction of 2 <sup>nd</sup> cell for Madona-Ghabawi landfill site	
	- Excavation of 1,300,000m <sup>3</sup> of soil	138,483
	- Lining 2mm HDPE bottom and sides membrane with leachate drainage tubes and gas collection system	261,579
	Sub-Total	<b>400,062</b>
2	Environmental monitoring for Madona-Ghabawi landfill site	(for one year)
	- Gas emissions monitoring	
	- Underground water monitoring	
	- Noise monitoring	
	- Dust pollution monitoring	
	- Smell & vision pollution	
	- Any other environment impact	
Sub-Total	<b>18,464</b>	
3	Construction of leachate water treatment facility	
	- Excavation 14,000m <sup>3</sup> of soil	6,155
	- Cement or HDPE lining	6,155
	- Tube connections, landscaping, etc.	4,616
Sub-Total	<b>16,926</b>	
4	Construction of three (3) new transfer stations	
	- Land acquisition for the new transfer station sites	190,799
	- Landscaping	23,081
	- Mechanical, hydraulic compaction	9,232
	- Inside roads, lights, water supply, sewer, telecommunication	15,387
	- Office buildings	30,774
	- Weigh-bridge and computer system	18,464
Sub-Total	<b>269,273</b>	
5	EIA for three (3) new transfer stations	20,003
	Sub-Total	<b>20,003</b>
6	Procurement of Spare Parts for Equipment	33,211
	Sub-Total	<b>33,211</b>
7	Procurement of vehicles and equipment for construction other than those procured by Japan	
	- Long chassis open type trailer (40m <sup>3</sup> ) (1 unit)	11,262
	- Tractor head for open type trailer (3 units)	24,300
	- Long chassis compacting type trailer (50m <sup>3</sup> ) (6 units)	87,843
	- Tractor head for compacting type trailer (6 units)	48,600
	- Dump truck	13,952
Sub-Total	<b>185,957</b>	
Grand Total		<b>943,896</b>

## **APPENDIX-6 Reference**



6. Reference

Reference

Name of Study: The Basic Design Study on the Project of Supplying Equipment for New Landfill Site of Madona-Ghabawi

No.	Name of reference	Form book, video, map, photo, etc.	Original/Copy	Name of government office to be approached or name of issuing government office	Year of publication
1	Cities & Villages Development Bank Nineteenth Annual Report 2000	Book	Original	Cities & Villages Development Bank	2001
2	Cities & Villages Development Bank Twentieth Annual Report 2001	Book	Original	Cities & Villages Development Bank	2002
3	Cities & Villages Development Bank Twenty first Annual Report 2002	Book	Original	Cities & Villages Development Bank	2003
4	Chart for Environment Health Sector in the MPGA Districts	Data	Copy	Municipality of Greater Amman	2004
5	Royal Scientific Society: Promoting technological change	Brochure	Original	Royal Scientific Society	2004
6	National Environmental Impact Assessment For Jordan: Annex 1	Data	Copy	Ministry of Environment	2004
7	Jordanian Guidelines for Environmental Impact Assessment: ANNEX A	Data	Copy	Ministry of Environment	2003
8	Environmental Impact Assessment Law (written in Arabic)	Data	Copy	Ministry of Environment	2003
9	Temporary Law No (1) for the Year 2003 The Environment Protection Law	Data	Copy	Ministry of Environment	2003
10	Royal Scientific Society (RSS) Environmental Research Center (ERC)	Brochure	Original	Royal Scientific Society	2003
11	JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY Queen Rania Al-Abdullah Center for Environmental Science & Technology	Brochure	Original	JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY	2003
12	Jordan Environment Society – (JES)	Brochure	Original	Jordan Environment Society	2003
13	Lessons in Sustainable Development: GEF/SGP Jprdan Ten Years of Partnership with Local Communities	Brochure	Original	United Nations Development Programme	2003
14	Segregation of Household Hazardous Waste Pilot Project	Brochure /Poster	Original	Jordan Environment Society	2003

No.	Name of reference	Form book, video, map, photo, etc.	Original/Copy	Name of government office to be approached or name of issuing government office	Year of publication
15	Recycling Programe	Poster	Original	United Nations Development Programme	2003
16	Municipality of Greater Amman Equipment Department	Data	Copy	Municipality of Greater Amman	2003
17	Workshop Organization Chart	Data	Copy	Municipality of Greater Amman	2003
18	Chart for Sanitary & Environment Department (Written in Arabic)	Data	Copy	Municipality of Greater Amman	2003
19	Organization for Solid Waste Management in MOGA	Data	Copy	Municipality of Greater Amman	2003
20	Budget for Solid Waste Management	Data	Copy	Municipality of Greater Amman	2003
21	Current Operating Costs for Waste Management in Greater Amman	Data	Copy	Municipality of Greater Amman	2003
22	AMOUNT OF WASTE COLLECTED IN YEAR 2000	Data	Copy	Municipality of Greater Amman	2003
23	CALCULATIONS OF PRODUCTION OF WASTE FROM 2002 – 2025 WITH RELATED ANNUAL RATE OF POPULATION GROWTH	Data	Copy	Municipality of Greater Amman	2003
24	Average Monthly Waste Amount From Amman Districts (2004)	Data	Copy	Municipality of Greater Amman	2003
25	Figure of SW Transferred to Ghabawi landfill showing Via direct or transfer station	Data	Copy	Municipality of Greater Amman	2003
26	Daily Weighbridge Measuring Record A Chaa'r transfer station 2004 (Written in Arabic)	Data	Copy	Municipality of Greater Amman	2003
27	Daily Weighbridge Measuring Record At Ghabawi Landfill 2004	Data	Copy	Municipality of Greater Amman	2003
28	Vehicle department SW Vehicles distribution and Model in the Amman Districts For the year 2004	Data	Copy	Municipality of Greater Amman	2003
29	MOGA General Heavy duties workshop design process for Maintenance	Data	Copy	Municipality of Greater Amman	2003
30	Describe existing (usable) equipment and facilities	Data	Copy	Municipality of Greater Amman	2003
31	Cleaning Department Equipment and Labour MOGA Districts	Data	Copy	Municipality of Greater Amman	2003
32	Transfers station Transport Vehicles in The three Transfers stations For the year 2003 – 2004	Data	Copy	Municipality of Greater Amman	2003
33	Heavy Equipment Present at Ghabawi Landfill Dated 7-3-2004	Data	Copy	Municipality of Greater Amman	2003

No.	Name of reference	Form book, video, map, photo, etc.	Original/Copy	Name of government office to be approached or name of issuing government office	Year of publication
34	General MOGA workshop design process for Vehicle Maintenance record	Data	Copy	Municipality of Greater Amman	2003
35	MOGA technical committee for revision of EIA report	Data	Copy	Municipality of Greater Amman	2003
36	Ghabawi Landfill Project May/2003 (Written in Arabic)	Brochure	Original	Municipality of Greater Amman	2003
37	The first solid waste conference 15-16/10/2001 Greater Amman Municipality with Jordan Environment Society	Brochure	Original	Municipality of Greater Amman	2003
38	Odious and Pollution Control regulation No. (1) For the Year 1978	Data	Copy	Ministry of Environment	2003
39	Some of the questionnaire for environmental and social consideration arise in the scoping sessions	Data	Copy	Ministry of Environment	2003
40	Technical Regulation: Pollutants – Ambient air quality stazndards	Data	Copy	Municipality of Greater Amman	2003
41	Direct call for buying SW Vehicle	Data	Copy	Municipality of Greater Amman	2003
42	Announcement bid for buying solid waste vehicle	Data	Copy	Municipality of Greater Amman	2003
43	JS 1210-1: 1999 Containers – Mobile waste containers – Part 1: Containers with 2 wheels with a capacity from 80L to 390L – Dimensions and design	Data	Copy	Municipality of Greater Amman	1999

**APPENDIX–7 Letter for Change of  
Contents of Request**



# أمانة عمان الكبرى

Municipality of Greater Amman



Ref.

Date

8/7/2004

To:

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
BASIC DESIGN STUDY TEAM  
YACHIYO ENGINEERING CO., LTD.**

Regarding the requested transfer station vehicles, we would like to change the type of trailers as follows;

Type of our original request

- **Long Chassis Compacting Trailer : 30 to 50m<sup>3</sup> x 8 units**

Type of trailer to be changed

- **Long Chassis Open Type Trailer : 40m<sup>3</sup> x 8 units**

The reasons for this change are described as follows.

We have a plan to construct three (3) new transfer stations with the function of transferring solid wastes by the combination of compacting type trailers and open type trailers in the same manner as the existing Al Shaar and Ein Ghazal transfer station. As mentioned in the attached plan for the new transfer stations, we will have to secure additional compacting trailers and open type trailers as required.

On the other hand, most of the existing open type trailers are over depreciation period and we intend to discard them as soon as possible because those trailers have many problems in operation every day. In this situation, we are now under the big pressure to put more priority on the open type trailers. Otherwise, our transferring works at the existing transfer stations and the new transfer stations will face many difficulties. Therefore, we would like to request to the Japanese site that the type of requested trailers (8 units, compacting type of 30 to 50m<sup>3</sup>) should be changed to open type trailers with a capacity of 40m<sup>3</sup>.

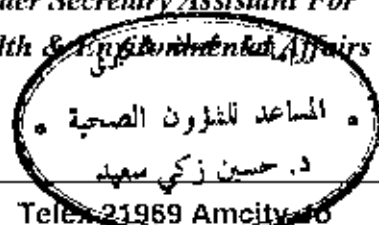
*Thank you.*

*Dr. Hussein Zaki*

*Under Secretary Assistant For  
Health & Environmental Affairs*

Attachment : Plan for New Transfer Stations

App-7-1



Ref.

Date

**Basic Plan of Proposed New Transfer Stations**

**1. Outline**

- 1) Location : Following three (3) sites
  - Zaharan
  - Wadi Al Sir
  - Al.fubcha
- 2) Expected opening date : November 2005
- 3) Area : Approx. 10,000 m<sup>2</sup>
- 4) Capacity : Approx. 400 t/d
- 5) System : Combination of open type trailers and compacting trailers
- 6) Personnel required
  - Staff : 4
  - Operator : 8
  - Driver : 16
  - Sweeper : 28
  - total : 56
- 7) Operation time : 24 hours (3 sifts operation)

**2. Equipment and Facility**

Classification	Item	Number	Remarks
Open type vehicle	Open type trailer (40 m <sup>3</sup> )	4	Existing, one is 30 m <sup>3</sup>
	Tractor head (Approx. 350 HP)	3	
Compacting type vehicle	Compacting type trailer (50 m <sup>3</sup> )	3	Same as existing one
	Tractor head (Approx. 380 HP)	2	
Facility	Weightbridge (60 ton)	2	Coming-in and Going-out
	Loading stage for open type trailer	1	
	Hydraulic type loading equipment	1	
	Gravity type loading chute	2	
	Vehicle washing area	1	
	Waste water treatment facility	1	
	Fence and trees	1	
	Building	Workshop	1
	Administration office	1	
	Guard house	1	

Note) Above mentioned specification and numbers are for each transfer station.