

No. 01

**STUDY REPORT
ON
THE PROJECT
FOR
THE IMPROVEMENT OF SANITARY CONDITION
IN
THE MUNICIPALITY OF CHITUNGWIZA
IN
THE REPUBLIC OF ZIMBABWE**

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PREFACE

In response to a request from the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a basic design study on the Project for the Improvement of Sanitary Condition in The Municipality of Chitungwiza and entrusted the Japan International Cooperation Agency (JICA) to conduct the study with the assistance of the Japan International Cooperation System (JICS).

JICA sent to Zimbabwe a study team from the 6th November to the 30th November, 1996.

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

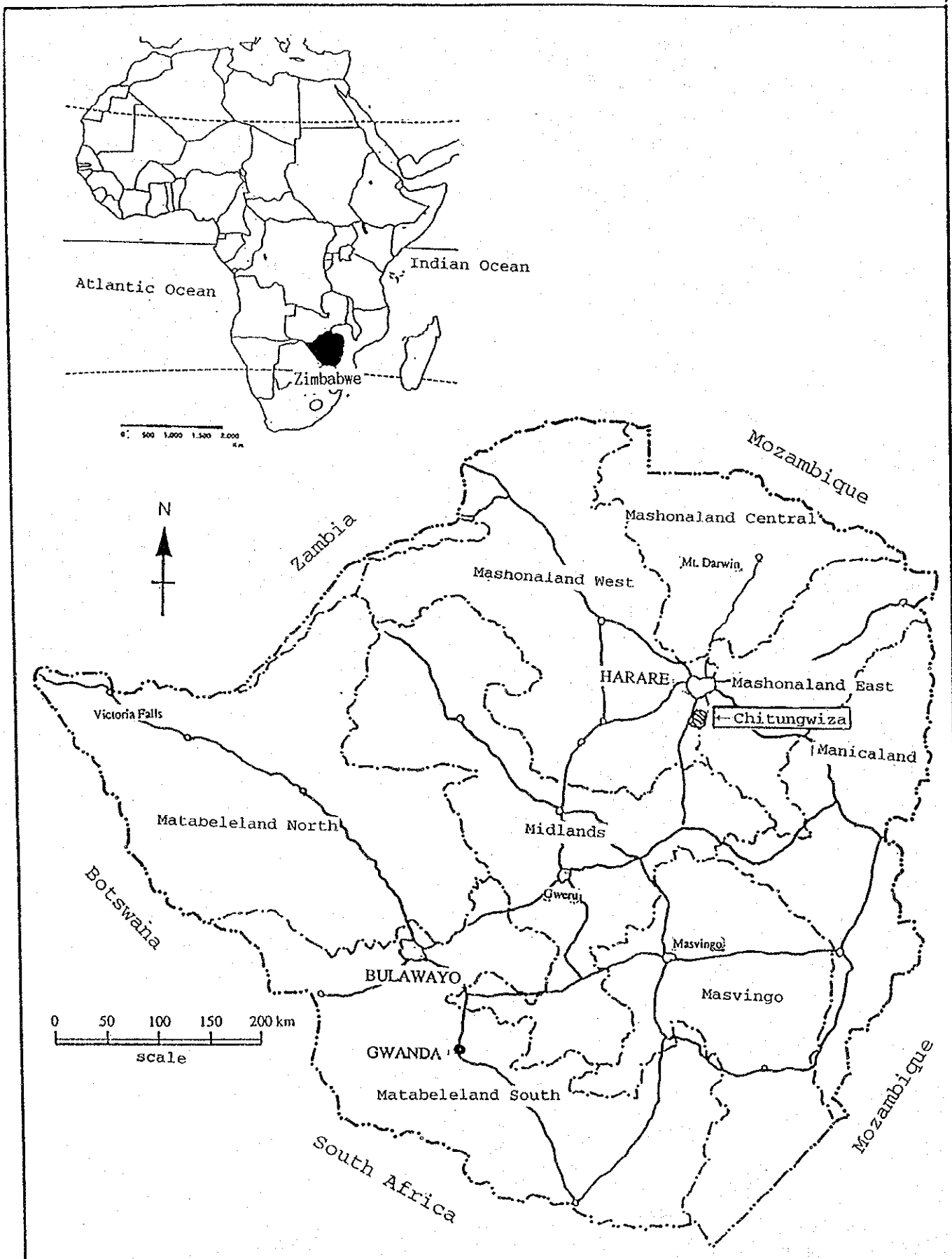
I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Zimbabwe for their close cooperation extended to the team.

MARCH 1997

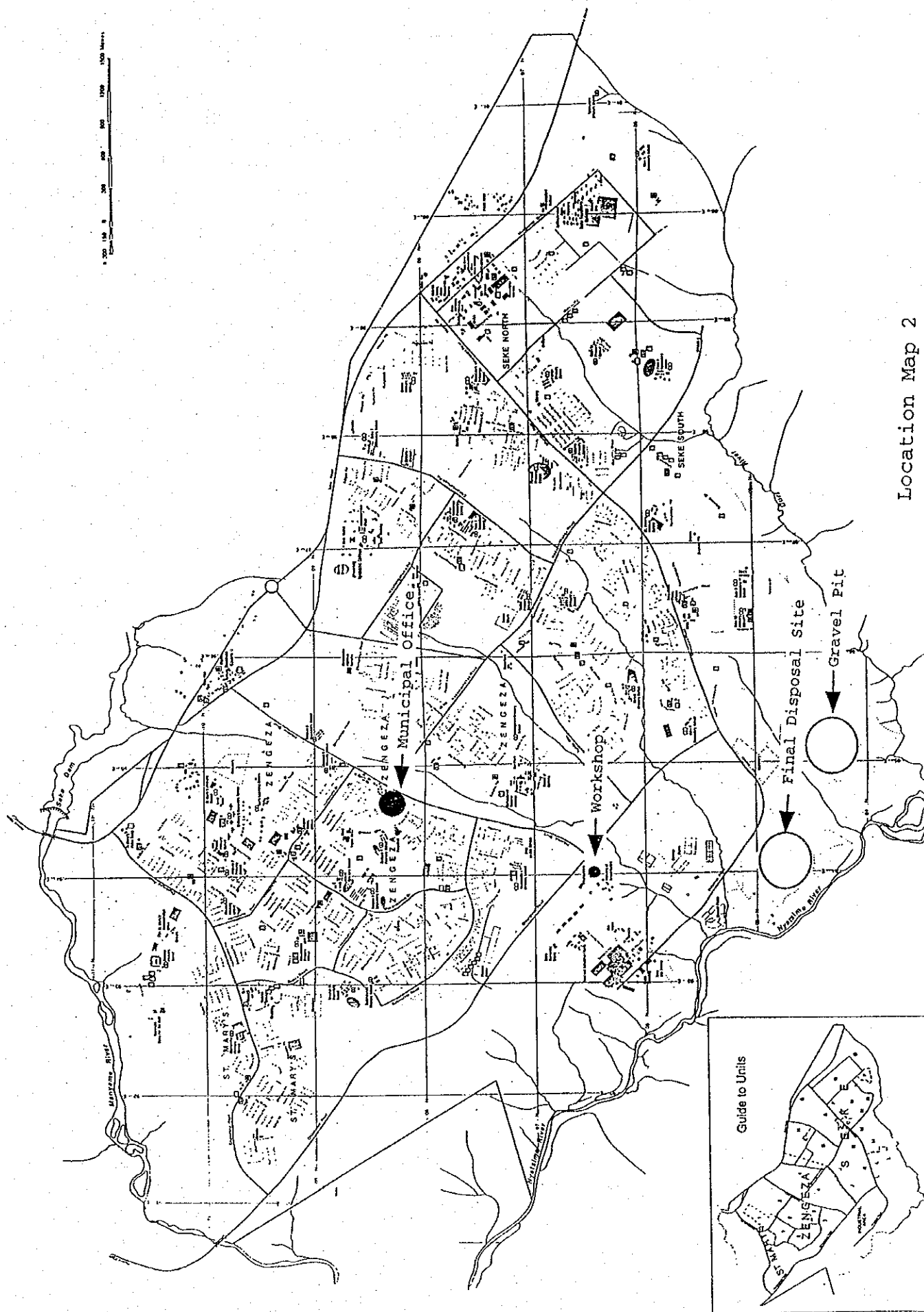
Kimio Fujita

President

Japan International Cooperation Agency



Location Map 1



Location Map 2

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Chapter 1 Background of the Request

The Republic of Zimbabwe (hereinafter referred to as Zimbabwe), located in the south of the African Continent between S. Lat. 15.5-22.5° and E. Long. 22.5-33.0°, is a landlocked country bordered by the Republic of South Africa to the south, the Republic of Botswana to the west and the Republic of Mozambique to the east. The national land area is 390,757 km² and the population is 10,410,000 (1992). Zimbabwe has a tropical, semi-arid climate and seasons consist of the rainy season between November and March and the dry season between May and August. The average temperature is coolest in July at 13.1 C and warmest in October when it is 20.6 C. More than 90% of the annual rainfall falls in the rainy season months and the annual rainfall varies between 300-1,200 mm according to district.

Zimbabwe gained independence from Britain in 1980, and has made use of its abundant mineral reserves and agricultural productive resources to develop a manufacturing infrastructure second only to that of South Africa among African countries south of the Sahara. In the 1980s, economic activity was slow because the government adopted a controlled economy policy, however, following the changeover to a free market economic system since 1989, the economy has been developing positively. The per capita GNP is 520 US \$ (1993).

Chitungwiza Municipality, the target area of the Project, is located approximately 25 km south of the capital Harare and has an estimated population of 400,000. The solid waste that is generated in the municipality is collected and carried away by Chitungwiza Municipal Council (hereinafter referred to as CMC). The total work force of CMC is 1,633, of which 133 staff belong to the solid waste management department. The overall annual budget of CMC is 360,000,000 Z \$ (1 US \$ = 10.8212 Z \$ as of November 1996), and the portion of this allotted to the solid waste management department is 15,000,000 Z \$.

373 m³/d of solid waste is generated in Chitungwiza every day, and this is collected and carried away by one Detachable Containre Truck and six tractors with trailers (of which one tractor is with a Detachable Containre Truck) each making three or four round trips daily. However, because it is not possible to collect all the generated solid waste due to an absolute shortage of collection vehicles, waste is being thrown away onto vacant land and into water channels, and this is having a detrimental effect on the living environment in the city.

It was against this background that the Government of Zimbabwe compiled the Project for the Enhancement of Solid Waste Management Equipment, designed to improve public sanitation in Chitungwiza, and in 1994 requested the Government of Japan to provide grant aid for the implementation of the Project.

Chapter 2 Contents of the Project

2-1 Objectives of the Project

The Municipality of Chitungwiza intends to prevent deterioration of the living environment caused by the unlawful disposal of general waste, by raising the solid waste collection rate (which has fallen to as low as 50% due to insufficient equipment) to 80%, and it also aims to carry out the proper sanitary landfilling of solid waste at the final disposal site in order to prevent a detrimental effect being had on the surrounding environment. The objective of the Project is to expedite the attainment of these goals through the procurement of currently lacking solid waste collection and disposal equipment and maintenance tools.

2-2 Basic Concept of the Project

The Project intends to procure equipment for the general waste management utility in Chitungwiza Municipality with the aims of 1) raising the solid waste collection rate, which has fallen to 50% due to deterioration-induced equipment shortages, to 80%, and 2) enabling the final disposal site, which is currently only able to carry out landfilling at weekends again due to equipment shortages, to carry out the landfilling of solid waste on the same day it is brought to the site.

The composition and quantities of the Project equipment have been determined based on the data indicated below, with consideration given to the implementation setup, etc. on the Zimbabwe side. Incidentally, the direct beneficiaries of the Project are all the citizens of Chitungwiza Municipality, estimated to number around 400,000 as of 1996.

2-2-1 Setting of the Solid Waste Collection Target

Because estimates concerning the current population of Chitungwiza vary greatly, sometimes by as much as 100,000, there is little reliability in estimating the amount of generated solid waste based on population. It is considered more realistic to estimate the amount of generated solid waste by adopting the number of households targeted by the municipal budget for the collection of charges. Consequently, this figure shall be adopted as the basis for estimating the amount of generated solid waste in the Project. Moreover, the units of solid waste generation in each district, based on actual measurements, shall be 1) 0.02 m³ per household in the Residential District, 2) 7 m³ per containre and 0.21 m³ per drum bin in the Market District, and 3) 7 m³ per containre in the Industrial District. Based on these conditions, the amount of solid waste that is generated every day is estimated as follows.

(1) Residential District

31,134 (households) x 0.02 m³ (capacity of plastic bag) x 2/7
(weekly frequency of waste discharge) ÷ 178 m³

(2) Market District

29 (number of existing and Projected containres) x 7 m³ (containre capacity) x 4/7 (weekly frequency of waste discharge) = 116 m³

1,086 (number of drum bins) x 0.21 m³ (drum bin capacity) x 2/7 (weekly frequency of waste discharge) = 65 m³

(3) Industrial District (non-industrial waste)

7 (number of existing and Projected containres) x 7 m³ (containre capacity) x 2/7 (weekly frequency of waste discharge) = 14 m³

Therefore, the combined amount of waste generated every day is estimated as 373 m³.

With respect to this estimated amount of generated solid waste, the Project aims to secure a collection rate of 80%, which is close to the figure of 85% the municipality is said to have maintained in the past (according to the Zimbabwe Urban Solid Waste Management Study Report of August 1995).

2-2-2 Basis for Selection of Each Item

(1) Collection and Carrying Equipment

General solid waste in the Market and Industrial Districts is currently collected by two Detachable Containre Trucks, while waste in the Residential District is collected by six tractors with trailers. The Detachable Containre Trucks are preferred by the local staff in that they can quickly and easily place and replace containres and are easy to handle when disposing of solid waste, etc. 26 uncovered containres, which cannot prevent solid waste from scattering around during haulage, for use with the Detachable Containre Trucks are in place in the Market and Industrial Districts (six in the Industrial District), but the lack of Detachable Containre Trucks means that the collection of these containres cannot keep up with the pace of solid waste generation. In order to deal with this situation, newly procured Detachable Containre Trucks shall be used with the existing ones to collect and carry away general waste that is discharged in the existing containres and newly procured covered-type containres in these districts. For this reason, 10 covered-type containres shall be newly placed for general waste collection in the Market and Industrial Districts. The use of covered-type containres will prevent waste from scattering around during haulage. Moreover, the adoption of covered-type containres is effective in terms of sanitation and transportation safety, because the cover makes it impossible for containre overloading to occur. As was mentioned earlier, solid waste from the Market District is collected by two Detachable Containre Trucks (one of which is pulled by tractor). 20 Detachable Containre Truck containres of 7 m³ capacity are placed in the large market and they are used by residents to discharge large amounts of waste meat, fish and other unsanitary items that quickly go rotten. With a view to preventing

the decay of such raw waste and the outbreak of harmful insects and odor, CMC has made it a goal to collect containres in the Market District four times per week, however, the absolute shortage of Detachable Containre Trucks makes it difficult to keep up with this schedule. Furthermore, nine areas within the large market area are not provided with containres and badly need them. Judging from the collection situation and the amount of uncollected solid waste in the large market area, it is estimated that the said area generates 116 m³ of solid waste every day.

Incidentally, because data relating to population and rate of population increase, which usually provide the basis for deciding the numbers of solid waste collection vehicles, are unreliable in this case and much sand and dirt tends to mix in with the waste when it is discharged, it has been decided not to adopt the per capita amount of solid waste discharge commonly adopted in developing countries. The expression used to obtain the amount of solid waste discharge is as follows:

$$116 \text{ m}^3 = 29 \times 7 \times 4/7$$

The thinking behind the parameters adopted in this expression is as follows:

29: combined total of existing containres and new containres considered to be required
7: estimated containre capacity (m ³)
4/7: weekly frequency of solid waste discharge

Furthermore, CMC has placed 1,086 drum bins (capacity 0.21 m³) in the Market District for use by the small market and local stores. The authorities would like to use Detachable Containre Trucks to quickly collect solid waste from these drum bins but, again because of the shortage of Detachable Containre Trucks, tractors often need to be relied on to provide support. Judging from the current collection conditions, it is estimated that the small market area generates 65.1 m³ of solid waste every day.

The expression used to obtain the amount of solid waste discharge is as follows:

$$65.1 \text{ m}^3 = 1,086 \times 0.21 \times 2/7$$

The thinking behind the parameters adopted in this expression is as follows:

1,086: existing drum bins (taken from the CMC charge collection ledger)
0.21: actually measured drum bin capacity (m ³)
2/7: weekly frequency of solid waste discharge

In the Industrial District, CMC has installed six Detachable Containre Truck containres and these are used by workers to throw away general waste (food leftovers, etc.). However, increases in the number of workers employed in the district have recently led to a rise in the unlawful discharge of solid waste. Therefore, it is planned to add one extra containre in the area where unlawful solid

waste discharge is most conspicuous. The authorities would like to use Detachable Containre Trucks to carry out the fast collection of solid waste in the Industrial District, however, because of the shortage of Detachable Containre Trucks, tractors often need to be relied on to provide support. Judging from the current collection conditions, it is estimated that the Industrial District generates 14 m³ of solid waste every day.

The expression used to obtain the amount of solid waste discharge is as follows:

$$14 \text{ m}^3 = 7 \times 7 \times 2/7$$

The thinking behind the parameters adopted in this expression is as follows:

7: combined total of existing containres plus the new containre considered to be required
7: estimated containre capacity (m³)
2/7: weekly frequency of solid waste discharge

The amount of solid waste generated by the Market and Industrial Districts is estimated to be 195 m³ per day. In order to achieve the Project goal of 80% collection by means of Detachable Containre Truck, it will be necessary to collect approximately 156 m³ of solid waste from these two districts every day.

Moving on to Detachable Containre Truck capacity, if it is assumed that the capacity of a Detachable Containre Truck containre is 5.0 m³, the daily number of round trips is four and the operating and work efficiency is 0.8, it works out that one Detachable Containre Truck can collect and haul 16 m³ of solid waste every day. If the daily solid waste collection target is divided by this figure, it is possible to calculate the number of Detachable Containre Trucks that are required. By doing this, it works out that 10 Detachable Containre Trucks are needed, however, after subtracting the two that are currently in use, the examination comes to revolve around the procurement of eight new Detachable Containre Trucks.

Detachable Containre Trucks work capacity: $16 = 5 \times 4 \times 0.8$
Number of required Detachable Containre Trucks: $10 = 156/16$
Number for examination: $8 = 10 - 2$

Note: the containre capacity for the purposes of the Project has been set at 5 m³ because the study team considered that overloading would be prevented due to the procurement of covered-type containres and the improved collection frequency brought about by the increase in the number of Detachable Containre Trucks. Regarding the number of haulage trips, the maximum figure from CMC data has been assumed. As for the operating and work efficiency, this has been set at 0.8 (80%) in consideration of vehicle servicing and puncture repairs, etc. and local work capacity levels.

10 Detachable Containre Truck containres shall be installed in accordance with the CMC installation plans. Moreover, Detachable Containre Trucks will need to carry an additional eight empty containres to enable the smooth retrieval and replacing of

containres at solid waste discharge sites and thus maintain smooth collection and haulage efficiency levels. Therefore, a total of 18 containres for use with Detachable Containre Trucks will be required.

Moving on to Detachable Containre Truck specifications, it is normally the case to adopt a chassis of gross vehicle weight (GVW) 9 tons when carrying 5 m³ containres. However, because such Detachable Containre Trucks would not be suited to the poor and badly rutted roads in Chitungwiza, a chassis of GVW 16 tons (next class up) with hydraulic machinery, etc. loaded on board shall be adopted. In consideration of local collection work methods, a gap of around 600 mm shall be provided between the driver's cabin and containre to allow utensils, etc. to be stored and operators to climb up and down during the collecting. As was mentioned previously, the new Detachable Containre Trucks shall be able to collect and carry existing-type containres.

With respect to the Residential District where tractors are currently used to collect solid waste, collections shall be carried out with newly procured Garbage Collection Trucks. It is estimated that changing over to Garbage Collection Trucks will enable the daily number of collection and haulage trips to increase from two or three at present to four, thus improving the solid waste haulage efficiency. Furthermore, whereas waste tends to be scattered profusely from the existing tractor-pulled, open trailers during haulage, the adoption of covered-type Garbage Collection Trucks will prevent such scattering and thus have a beneficial effect in sanitary terms, too. In the site survey, when estimating the amount of solid waste generated by the Residential District to provide a basis for determining the number of collection vehicles, instead of using the highly unreliable data relating to the population and rate of population increase in Chitungwiza Municipality and the district, it was decided to use the number of households (31,314), which is a reliable figure within the CMC data. Based on actually measurements carried out locally, it is estimated that each household discharges 0.02 m³ of solid waste by plastic bag two times per week. From this, it is estimated by the following expression that the daily amount of solid waste discharge in the Residential District is 177.9 m³.

Amount of waste discharge: $177.9 \text{ m}^3 = 31,134 \times 0.02 \times 2/7$

The thinking behind the parameters adopted in this expression is as follows:

31,134: current number of households (from the CMC charge collection ledger)
0.02: actually measured plastic bag capacity (m ³)
2/7: weekly frequency of solid waste discharge

From this expression it is estimated that the total amount of solid waste generated by the Residential District is 177 m³. In order to achieve the Project goal of 80% collection by means of Garbage Collection Truck, it will be necessary to collect approximately 142 m³ of solid waste from the Residential District every day.

Moving on to Garbage Collection Truck capacity, if it is assumed that the capacity of the load-carrying platform of a truck is 7.0 m³, the daily number of round trips is four and the operating and work efficiency is 0.8, it works out that one Garbage Collection Truck can collect and haul 22.4 m³ of solid waste every day. If the daily solid waste collection target is divided by this figure, it works out that six Garbage Collection Trucks are needed.

Garbage collection truck work capacity: $22.4 = 7 \times 4 \times 0.8$ Number of required Garbage Collection Trucks: $6 = 142.3/22.4$
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Note: the containre capacity for the purposes of the Project has been set at 7 m³ because the load-carrying platforms of the Garbage Collection Trucks will need to be modified. Regarding the number of haulage trips, the maximum figure from CMC data has been assumed. As for the operating and work efficiency, this has been set at 0.8 (80%) in consideration of vehicle servicing and puncture repairs, etc. and local work capacity levels.

Moving on to Garbage Collection Truck specifications, as with the Detachable Containre Trucks, a gap of around 600 mm shall be provided between the driver's cabin and containre to allow utensils, etc. to be stored and operators to climb up and down during the collecting. It was originally intended to adopt a chassis of gross vehicle weight (GVW) 9 tons, however, because such trucks would not be suited to the poor and badly rutted roads in Chitungwiza, a chassis of GVW 16 tons (next class up) with the hydraulic machinery and load-carrying platform loaded on board shall be adopted. By making the Garbage Collection Truck chassis the same as that of the Detachable Containre Trucks, parts control will be made easier because the variety of required maintenance parts will be reduced and there will be more common use of parts. It is intended to increase the degree of service efficiency at the workshop by adopting the same chassis model.

(2) Workshop Equipment

The CMC workshop, which is responsible for maintaining and controlling the collection and haulage equipment, is capable of carrying out a tire service, specification checks, quick servicing, minor repairs and other basic maintenance work. However, the overall work capacity (equipment and engineers) of the workshop is not enough and it is unable to sufficiently carry out heavy overhauls requiring special skills and also representative maintenance and repairs, welding, cutting, plating and surface finishing, etc. by means of machine tooling, which is the most commonly adopted means of carrying out such maintenance work. In view of these conditions, examination was carried out on equipment to enable the workshop to carry out the minimum required level of maintenance and repair work.

(3) Trailer Truck for Hauling Heavy Machinery

The procurement of one Trailer Truck for hauling heavy machinery was

examined. This could be used for transferring the Bulldozer that is used at the disposal site and quarry. By transporting the Bulldozer between these two sites in this way, damage that would otherwise be caused to roads by the weight and track shoes of the Bulldozer can be prevented. The trailer truck could also be used for transferring new and existing landfill compactors and broken down vehicles to the workshop for servicing and repairs. In particular, because landfill compactors are not kept in a place served by a power supply, it is necessary for them to be driven to repair facilities in cases where servicing that requires electric welding and high pressure air supply is needed. At the present, because there is no haulage equipment, the landfill compactors have to be driven to nearby facilities that possess a power supply. If landfill compactors were to be driven to the CMC workshop, their steel wheels would tear up simple paved arterial roads and well-prepared city roads alike. In view of these circumstances, the procurement of one Trailer Truck for haulage is necessary.

A Trailer Truck that is capable of carrying heavy equipment of up to 25 tons shall be selected. The trailer shall be a three-axle type in accordance with the local road traffic law, and the floor shall be made from steel plate to prevent the floor from being damaged when carrying landfill compactors.

(4) Work Supervision Vehicles

This equipment is important for supervising work progress at collection points and the disposal site and for quickly responding in cases where equipment breakdowns occur. Chitungwiza Municipality has so far divided the solid waste collection area into three districts and used three work supervision vehicles to allow district foremen to monitor and control work conditions. However, because two of these vehicles have not been in use due to deterioration since last year, the work of solid waste collection and treatment has been somewhat hindered. For example, as a result of insufficient site management at the collection points and disposal site, one often sees operators who should be collecting in the afternoon waiting for long periods at the disposal site, or operator deficiencies arising in collection areas, and so on.

Furthermore, because the existing vehicles have been in use for more than 10 years, superchargers and air inhalation systems are not functioning properly, causing engine revolutions to fluctuate suddenly, and it is judged that the continued use of such vehicles poses a risk. The vehicles are in such a bad state that they have to be push-started whenever engine failures occur, so it is only a matter of time before the vehicles are scrapped. In view of these circumstances, CMC requested the procurement of three work supervision vehicles and, as a result of carrying out consultations, it has been decided that two vehicles are needed straight away not only for the supervision of solid waste collection and disposal work but also to enable fast repairs to be carried out whenever breakdowns occur on site.

(5) Quarry Equipment

The Bulldozer, Wheel Loader and Dump Trucks to be newly procured will be used in the quarrying and haulage of earth to be used for covering. The Bulldozer will break up (excavate) and pile the ground earth and the Wheel Loader will collect and load the earth onto the Dump Trucks. At the moment, a Bulldozer, Wheel Loader and Dump Trucks borrowed from the roads department are used to carry out this work on Saturdays and Sundays, however, because it is practically impossible to break, pile and haul earth to the disposal site in just two days each week, the work is often unable to keep up with the earth requirement. In particular, the Dump Trucks (6 m³ load-carrying platform) are overused in making between 40-50 trips on these two days, in which time they carry approximately 490 m³ (70 m³ per day) of earth to the disposal site.

The expression below shows that it is possible to carry the required 70 m³ of earth per day to the disposal site by procuring three Dump Trucks under the Project and using them to make just five trips per day. Moreover, because the number of trips will be greatly reduced as a result of this, it will become possible to carry in earth for rehabilitation of the access roads, which have until now been too busy to allow such work to be carried out.

The expression used to calculate the earth haulage capacity is as follows:

$$72 \text{ m}^3 = 6 \text{ m}^3 \text{ (Vessel capacity)} \times 5 \text{ (trips)} \times 0.8 \text{ (work efficiency)} \times 3 \text{ (trucks being considered)}$$

Regarding the truck specifications, engine output shall be between 180-200 Hp and the dump Trucks shall be the four-wheel and rear-wheel-drive earth-carrying type similar to Dump Trucks that are used locally. Load-carrying platforms of 5-6 m³ are considered appropriate.

Moving on to the Wheel Loader, with a view to maximizing work efficiency during loading, it is considered appropriate to have a maximum bucket loading height of 2,000 mm and a bucket capacity of at least 2 m³ to enable a Dump Truck load-carrying platform to be completely filled by three bucket-loads. Moreover, it is necessary to have a Wheel Loader with at least 130 Hp output and a general-purpose bucket that is able to break up sediment and hard earth. A Wheel Loader fitted with a ROPS cabin has been selected in order to secure safety in the event of overturning and to preserve a comfortable working environment for drivers in all weather conditions.

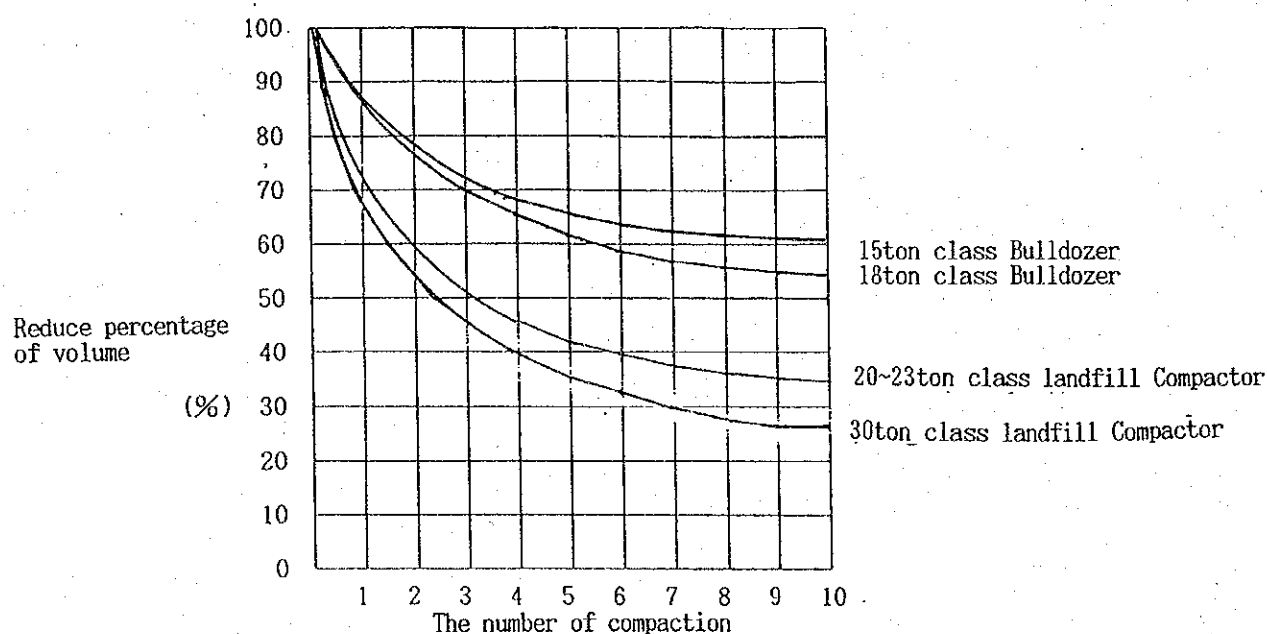
Because the Bulldozer will be used at both the quarry and the final disposal site, the calculation of required capacity, etc. is given later.

(6) Final Disposal Site Equipment

After solid waste has been brought into the final disposal site, the existing landfill compactor (25 tons) carries out rolling compaction around three times. This process of rolling compaction reduces the

volume of the daily collected solid waste from the estimated 373 m³ to approximately 160 m³. Following compaction, the Bulldozer to be procured under the Project will cover the solid waste with earth and flatten the site. The rolling compaction performance curve indicated in Figure 1 shows the rate of change of solid waste cubic volume in relation to the number of rolls by the 25 ton landfill compactor. From this it can be seen that, in the present working conditions, the solid waste can be compacted by roughly 50%, and it can be estimated that the area of land covered by the solid waste every day, assuming the solid waste to be piled to a depth of 0.2 m, is approximately 700 m² (26 m x 26 m).

Figure 1 Rolling Compaction Performance Curve



CMC has issued instructions for Bulldozers to spread earth (70 m³ per day carried in by the aforementioned Dump Trucks) to a depth of 0.1-0.15 m over the solid waste, and in this way is promoting the earth covering treatment that is required for sanitary landfilling. Table 1 shows the earth loads and work hours used to determine the number of Bulldozers that are required. This shows that the combined earth load and total working time (for both ground excavation at the quarry and spreading at the disposal site) have been set at 140 m³ and four hours respectively. The Bulldozer work load (expression 1) was calculated using materials edited by the Construction Economy Department of the Ministry of Construction, and the number of Bulldozers required was obtained by dividing the earth volume by the productivity.

Table 1 Criteria Used in Calculation of Required Number of Bulldozers

Work site	Work contents and volume of earth		Work time	Time for transfer, haulage preparation and arrangement
Quarry Ground	breaking and piling: 70 m ³	—	2 hours	2 hours
Disposal site	—	Spreading: 70 m ³	2 hours	
Total	Productivity to deal with earth volume of 140 m ³		Actual work time is 4 hours	

Calculation of daily Bulldozer productivity (expression 1): $184 \text{ m}^3 \div (60 \times 2.81 \times 1 \times 0.4 \times 4) / 1.465$

Explanation of parameters:

60: coefficient	2.81: volume of earth moved per cycle
1: coefficient	0.4: work efficiency 4: work hours
1.465: required time	

The productivity of a 220 Hp Bulldozer is 184 m³ as shown above, and it is possible for one such Bulldozer to carry out the 140 m³ of earth work required at the quarry and the disposal site. In consideration of the excavation and banking of hard earth at the quarry, a Bulldozer with hydraulic tilt straight blade, whereby the height of the left and right ends of the blade can be adjusted to enable the tip to dig into the ground and thus raise work efficiency, has been selected; that is to say that solid waste disposal site specifications have not been adopted. A ripper shall also be attached to reduce earth moving cycles and raise the work efficiency. Moreover, a Bulldozer fitted with a ROPS cabin has been selected in order to secure safety in the event of overturning and to preserve a comfortable working environment for drivers in all weather conditions.

(7) Access Road Rehabilitation Equipment

The currently used access road between the main road and the disposal site (Access Road 1) is a clay texture. Although this access road is only 700 m long, it turns into mud in the rainy season, thus preventing the passage of solid waste collection vehicles. Thus, in the rainy season, collection vehicles use a separate road (Access Road 2) that is 3,000 m long to reach the disposal site. However, because the part of the disposal site served by this road is only 300 m away from the river, there is a possibility that water may flow into the disposal site and carry solid waste away if the water level of the river should rise. Furthermore, because the access roads become very bumpy in the dry season, damage to the undercarriages, etc. of vehicles traveling on them is accelerated. A Motor Grader is required not only to level the access roads to minimize damage to vehicles, but also to prepare roads that can handle the passage of more than 390 solid waste

collection vehicles per month during the rainy season, by scattering gravel and compacting the road surface and roadbed into a firm structure. The procurement of a Motor Grader would also make it possible to build side ditches, thus expediting the preservation of the roads and preventing the discharge of waste water into the river. The above-mentioned access road work is very important in that it will help extend the service lives of solid waste collection vehicles, raise collection work efficiency and limit drainage of waste water into the river.

A 3.7 m molded board Motor Grader, which CMC has experience of use, has been selected, and this shall be fitted with a three-toothed ripper to make the leveling of uneven ground on hard earth sites easier. An articulated type effective for digging side ditches has been selected, but a frame fixed by lock pin has been chosen rather than a moving frame in order to improve operational flexibility during vehicle running. A water separator shall be added to the fuel system in order to raise the durability of the fuel injection system, and a blade slip clutch or shear pin shall be attached for protection of the molded board, etc. A Motor Grader fitted with an ROPS cabin has been selected in order to secure safety in the event of overturning and to preserve a comfortable working environment for drivers in all weather conditions. Table 2 shows the criteria and work load calculation expression used in calculating the required number of Motor Graders.

Table 2 Criteria Used in Calculation of Required Number of Motor Graders

Work Site	Conditions Now and After Procurement	Rehabilitation Length	Work Load and Work Area
Access Road 1	Because the road becomes muddy in the rainy season, gravel needs to be laid to raise the height of the road surface by approximately 200 mm. The weight of passing solid waste collection trucks will compact the surface. Also, side ditches are to be provided. Widening and road surface rehabilitation shall be carried out around eight times per month to enable collection vehicles to travel along the road quickly and safely.	700m	980 m ³ (calculated by multiplying the length by the road width by the side ditch depth)
Access Road 2	Widening and road surface rehabilitation shall be carried out about once per month to enable collection vehicles to travel along the road quickly and safely. Side ditches shall be provided as necessary.	3,000m	21,000 m ³ (calculated by multiplying length by road width)

Calculation of the Motor Grader work load

Access Road 1: $416 \text{ m}^3 \div (1,000 \times 3.7 \times 5 \times 0.3 \times 0.6 \times 4)/8$

Access Road 2: $1,387 \text{ m}^3 \div (1,000 \times 3.7 \times 5 \times 0.6 \times 4)/8$

Explanation of Parameters:

1,000: coefficient	3.7: molded board size	5: work velocity
0.3: excavation depth		
0.6: work efficiency	4: work hours (per day)	8: spreading cycles

From the above calculations, it works out that one Motor Grader is needed to carry out rehabilitation work on the two access roads.

2-3 Basic Design

2-3-1 Design Concept

1) Concept Regarding Natural Conditions

- During the rainy season, which lasts from November through March every year, because the access roads and roads within the disposal site fall into a poor state, the disposal of solid waste tends to concentrate in the part of the disposal site near the river, where the access is relatively easier.

The Project shall procure the equipment that is necessary in order to remedy this situation.

2) Concept Regarding Social Conditions

- The current system of solid waste collection in Chitungwiza involves door-to-door collection on set days in the Residential District and collection of general waste by container in the Market and Industrial Districts, and there are no plans to change this existing system.

- During the door-to-door collection in the Residential District, because it is a rule for six operators to ride on each Garbage Collection Truck, this factor shall be taken into consideration when deciding the specifications of Garbage Collection Trucks to be newly procured.

3) Concept Regarding Use of Local Equipment and Materials and Third Country Equipment and Materials

- Local dealers in some items of the Project equipment do exist in Zimbabwe, however, because there has been no experience of local procurement for Japan's Grant Aid projects in the past, doubts remain about the ability of these dealers to meet the necessary delivery deadlines. For this reason, local dealers shall not be utilized in the Project.

4) Concept Regarding the Operating and Maintenance Capacity of the Implementing Agency

- Although Chitungwiza Municipality does possess a workshop, because its capacity level is not very high, a compactor that is difficult to maintain shall not be procured. Moreover, tools shall be procured for the workshop in order to enhance its functions.

- Regarding the numbers of each item of equipment to be procured, these shall be limited to levels that make it possible for the local side to afford operation and maintenance costs within existing budgets.

5) Concept Regarding Equipment Ranges and Grades

- In addition to solid waste collection and haulage vehicles, the equipment to be procured shall include a Bulldozer, etc. to carry out earth covering every day and thus prevent deterioration of the environment in and around the disposal site.

6) Concept Regarding the Implementation Period

Because the Project is to be implemented under Japan's Grant Aid Scheme, implementation from the exchange of notes through to the final payments must be completed within one accounting year. Because none of the items of equipment to be procured have long manufacturing lead times, the Project shall be completed in a single year.

2-3-2 Basic Design

(1) Overall Plan

The equipment to be procured under the Project shall be put to use in the ways described below.

- 1) Eight new Detachable Containre Trucks plus the two existing Detachable Containre Trucks (one of which is tractor-pulled) shall collect general waste from the Market and Industrial Districts.
- 2) The tractors with trailers shall be replaced with Garbage Collection Trucks in order to raise work efficiency. The tractors and trailers shall be used for ancillary works such as the collection of solid waste that has been unlawfully disposed.
- 3) Regarding closed-type Detachable Containre Truck containres for preventing the spillage of solid waste during haulage, a total of 10 shall be installed: nine in the Market District and one in the Industrial District. Moreover, new containres shall also be procured together with the new Detachable Containre Trucks, making it possible for full containres to be immediately replaced with empty ones during collections.
- 4) Regarding workshop equipment, general tools shall be procured for the workshop in order to strengthen its service setup.
- 5) Regarding heavy machinery haulage equipment, a Trailer Truck shall be procured for transferring heavy machinery between sites.
- 6) Regarding work supervision vehicles, small trucks shall be procured to enable supervisors to monitor work deliver small items of equipment.
- 7) Regarding quarry equipment, Dump Trucks, a Bulldozer and a Wheel Loader shall be procured.
- 8) Regarding disposal site equipment: the Bulldozer for the quarry shall also be used at the disposal site.
- 9) Regarding access road rehabilitation equipment, a Motor Grader shall be procured.

(2) Equipment Plan

The main specifications and purposes of use of the Project equipment are given in Table 3.

Table 3 Specifications and Purposes of Use of Equipment

	Equipment	Specification	Quantitys	Purpose of Use
1	Garbage collection trucks	4 x 2, closed-type, capacity 6-10 m ³	6	Solid waste collection in the Residential District
2	Detachable Containre Trucks	4 x 2, containre capacity 5 m ³	8	Solid waste collection in the Market District, etc.
3	Containres	Closed-type	18	Solid waste discharge in the Market District, etc.
4	Dump Trucks	4 x 2, capacity 4.4-6 m ³	3	Carrying earth for covering solid waste
5	Bulldozer	168 kw min., ROPS cabin	1	Excavation work at the quarry and spreading at the disposal site
6	Wheel Loader	130-150 HP, general purpose bucket	1	Loading quarried earth
7	Motor Grader	3.7 m blade, with ripper, ROPS cabin	1	Rehabilitation of access roads
8	Workshop tools	—	1 set	For maintenance work in the workshop
9	Trailer Truck	Head: 4 x 2 or 6 x 4, three-axle trailer, head wheels used for trailer undercarriage	1	Transfer of heavy machinery
10	Work trucks	Diesel engine	2	Emergency repair work

Chapter 3 Implementation Schedule

3-1 Implementation Schedule

3-1-1 Implementation Schedule

The implementation schedule is shown in Table 4.

Table 4 Implementation Schedule

	1	2	3	4	5	6	7	8	9	10	11	12	
Detailed Design		(Site Survey).											
				(Tender Work)									
						(Evaluation and Contract)						Total 4 months	
Procurement						(Equipment Manufacture)							
								(Transportation)					
	Total 8 months							(Inspection and acceptance)					

3-1-2 Obligations of Recipient Country

The items to be borne by the Zimbabwean side in the course of Project implementation are as indicated below.

- 1) To take prompt measures relating to the landing and customs clearance of the procured equipment.
- 2) To exempt taxes that may otherwise be charged for customs clearance of the procured equipment upon its arrival in Zimbabwe.
- 3) To accord Japanese nationals, whose services may be required in connection with the supply of Project equipment, such facilities as may be necessary for their entry into Zimbabwe and stay therein.
- 4) To bear all expenses other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment.
- 5) To supervise the participation of the counterparts in the Project implementation.
- 6) To maintain and properly and effectively use the equipment purchased under the Grant.
- 7) To conclude the Banking Arrangement.
- 8) To assign the necessary staff and secure the necessary budget for operation and maintenance of the equipment purchased under the Grant.

3-2 Operation and Maintenance Plan

(1) Operation and Maintenance Setup

Maintenance work on the equipment used in the collection and management of solid waste in Chitungwiza is performed by the workshop. However, because the absolute number of collection vehicles is currently insufficient, the vehicles in use are made to work so hard that they are unable to spare the time to receive basic maintenance such as oil changes, washing and general checks, etc. The procurement of new solid waste collection vehicles under the Project will not only raise collection efficiency but, by enabling collection schedules that allow sufficient time to be secured for vehicle maintenance to be compiled, it will contribute to the extension of vehicle service lives.

The workshop basically maintains and repairs vehicles and equipment in accordance with maintenance manuals, however, it sometimes has to consign work to local dealers as a result of staff shortages and insufficient technical capacity. Moreover, there is no planned system of training for the workshop staff, and the only technical guidance is that provided when new staff members are recruited or when new items of equipment are installed.

The workshop currently claims to be in need of one additional car electrical mechanic, two diesel machine workers, one plating worker and one coating worker, and in June 1996 it issued a request to the head of engineering services (in charge of the workshop) for additional staff. The head of engineering services has told the study team that the said staff members will be newly assigned to the workshop in four months.

Examination is also being carried out on the necessity for additional workshop staff following implementation of the Project, however, detailed job descriptions and staff numbers are as yet undecided. It is scheduled to settle these matters by next March, when the budget for next year is compiled.

(2) Annual Operation and Maintenance Costs

Operation and maintenance costs that will arise as a result of the Project implementation are described item by item in the following paragraphs.

1) General Administration Expenses

General administration expenses refer to taxes, insurance premiums and storage and management costs and shall be assumed to be 1% of the standard equipment price (price based on standard specifications). General administration expenses will amount to 237,500 Z \$.

2) Maintenance Costs

Maintenance costs, excluding operating expenses, shall be assumed to comprise repair and inspection costs and shall be calculated by the following expression (first year only):

(Standard price x maintenance rate x number of vehicles x spare parts cost) ÷ 10 (service life)

The spare parts cost is based on the integrated price.

Maintenance costs calculated using this expression amount to approximately 380,100 Z \$.

3) Personnel Expenses

There are 23 items of vehicular equipment to be procured under the Project. Assuming that 20 vehicles, excluding the work supervision trucks and Trailer Truck, will require new drivers/operators, the additional personnel expenses have been calculated as follows:

1,000 Z \$ (month) x 20 (staff) x 12 (months) = 240,000 Z \$

4) Expendable Items

Tire changes do not require any special technology and are connected with normal operation. The target equipment here shall be assumed to consist of Dump Trucks, Detachable Containre Trucks, Garbage Collection Trucks, a Trailer Truck and work supervision trucks. Regarding the Wheel Loader and Motor Grader, because spare parts are scheduled to be procured under the Project, they are not included.

It is estimated that the cost of expendable items for the above-mentioned vehicles will amount to 41,750 Z \$.

5) Fuel Cost

The fuel cost is calculated using the following expression:

Fuel consumption rate (varies according to vehicle) x estimated HP x annual operating time (varies according to vehicle between 200-1,000 hours) x number of vehicles x local fuel cost

From this expression, it is estimated that the annual fuel cost will amount to approximately 679,701 Z \$.

As a result of the above calculations, it works out that the total operation and maintenance cost in the first year of the Project will amount to approximately 1,579,051 Z \$, which is considered to be within the budget range of the local side if the planned rate of increase in next year's budget is taken into account.

Chapter 4 Project Evaluation and Recommendation

4-1 Project Effect

The effect of the Project in terms of improving the solid waste collection efficiency in Chitungwiza Municipality was measured by comparing the current solid waste collection amount and generation amount (estimated based on the collection amount) with the forecast solid waste collection amount in the case where the Project equipment is introduced. The estimated amount of solid waste generated was calculated based on data recorded by CMC relating to the numbers of target households and drum bins and containres, the capacities of drum bins and containres and the frequency of collections. The estimated amount of waste collected was calculated based on assumptions from current operating records relating to the number of collection trips made by each vehicle type every day and the amount of solid waste collected in each trip.

The estimated amount of waste collected every day in Chitungwiza, based on operating records for between October 17 and November 19, 1997 is shown in Table 5.

Table 5 Estimated Solid Waste Collection Amount

	Operating Vehicles	Load Capacity per Vehicle (m ³)	Average Amount Collected Daily (m ³)
Detachable Containre Truck	1	7	28.7
Tractor with Trailer	6	7	134.4
Garbage Collection Truck	1	8	24.75
Total	8	—	Approximately 187.9 m ³

* Sunday collections are not included because records are not kept. From this it works out that the current solid waste collection rate is 50.3%. In the event of Project implementation, it is planned to use the existing equipment of CMC for ancillary work such as the collection of unlawfully discharged solid waste and the cleaning of roads, etc. Consequently, as is indicated in Table 6, implementation of the Project will raise the solid waste collection rate from the current 50.3% to approximately 80%.

Table 6 Collection Capacity of Project Equipment

Vehicle Type	Number of Vehicles	Load Capacity (m ³)	Number of transportation per day	Assessed Load Ratio	Loaded Amount Per Vehicle Per Day (m ³)	Collection Capacity (m ³ /day)
Garbage Collection Truck	6	7	4	0.8	22.4	142.3
Detachable Containre Truck	8	5	4	0.8	16	153.5
Total	14	—	—	—	—	295.8

(2) Sanitary Landfilling at the Final Disposal Site

Because the solid waste management department possesses no Dump Trucks, solid waste that is carried to the final disposal site is open dumped and has to wait until the following weekend before being covered with earth. As a result, compared with parts of the disposal site where landfilling was carried out in the past, problems are arising in terms of the scattering of waste and the generation of odor, etc.

Because the Project will procure Dump Trucks to bring earth for covering into the final disposal site, it will become possible to carry out landfilling, which is currently only possible on Saturdays and Sundays, every day. This will make it possible to prevent the scattering of waste and the generation of odor and diseases.

Furthermore, the procurement of equipment for final disposal site management will make it possible to utilize disposal zones in an effective and planned manner. At the moment, the poor state of the access roads in the rainy season means that only the part of the final disposal site near the river can be used and there are concerns that waste may be carried away by the river, however, if the access roads and in-site roads can be rehabilitated with the Project equipment, the proper zoning of disposal site use will become possible, and this will eliminate the risk of any adverse impact being had on the downstream population.

In consideration of the above points, it is concluded that implementation of the Project under Japan's Grant Aid is appropriate in that it will achieve the proper collection and disposal of Chitungwiza Municipal solid waste, the generated amount of which is increasing in line with the rapidly growing population, and thus contribute to improving the living and sanitary environment of the said city.

4-2 Recommendation

(1) Fuller Enforcement of the Charge Collection System

Chitungwiza Municipality has a charge system for solid waste collection which provides an important source of funds for the utility. The collection rate for this charge, which is collected together with the water supply charge and rents, is said to be 100%. However, the population of Chitungwiza is rapidly increasing, and it is doubtful that the city authorities have an accurate understanding of both the population and number of households (it is said that five or six "sub" households tend to live off one "main" household) in the urban area. Therefore, it is necessary for the municipal authorities to immediately survey all households that should be paying charges and examine ways to establish a system that makes it possible for charge collection to be conducted more fully.

(2) Staffing and Budget Appropriation

Implementation of the Project will involve recruitment of 17 new staff (excluding operators) and a 25% increase in budget. Therefore, it is necessary for the implementing agency to take immediate steps in readiness for this.

(3) Improving Maintenance Technology Levels of the Workshop and Staff

Although the municipality possesses a workshop with the express aim of carrying out equipment maintenance, the technical levels of its staff are not high. The workshop equipment to be procured under the Project will not require the introduction of new technology, but staff increases will be necessary.

(4) Clearer Management of the Final Disposal Site

Because management of the final disposal site currently consists of simply checking incoming solid waste collection vehicles, site running cannot be described as sufficient. In the future, upon surveying actual conditions within the disposal site (overall site surveying, verification of areas of completed landfill, reconfirmation of surrounding conditions, etc.), it is necessary to clarify the management direction of the final disposal site by compiling treatment zone plans and if necessary establishing a sanitary landfill manual.

In addition, it seems that the authorities have little concern about scavengers at the final disposal site, however, they need to become more aware about the extent of this problem.

(5) Increased Awareness of Sanitary Issues among the Target Population

Although the city provides extremely basic education to children on the sanitary environment ("do not unlawfully throw rubbish away," etc.), there is no education program that targets the municipality in general. This, combined with insufficient collection services, is

thought to contribute to the current high instance of unlawful discharge of solid waste in open spaces and drainage channels, etc. In order to preserve the sanitary environment within Chitungwiza Municipality, in addition to expanding collection equipment capacity levels, it is necessary to raise public awareness and encourage citizen participation. One way of encouraging citizen participation would be signal collections by ringing a bell, and so on.

(6) Compilation of Plans for Sustained Improvement of the Sanitary Environment

Chitungwiza Municipality has in the past treated development of the sewage treatment system as a priority issue, however, it has yet to earnestly carry out surveys and planning in the area of solid waste management. The population in the growing municipality of Chitungwiza is increasing at a rate of 5.5% per year, and it is forecast that the generated amount of solid waste will increase in unison with this. In these conditions, if the existing solid waste collection system is left unchanged, it is clear that deterioration of the sanitary environment will once again become a major problem. Following implementation of the Project, it is desirable for the municipality authorities to compile and execute an action plan for the solid waste management utility based on the premise of self-help. As an example of such self-help, collected charges could be pooled in order to pay for future equipment repairs and renewal.

Appendices 1.

Member List of the Survey Team

1. Leader Dr.Kunitoshi SAKURAI
Tokyo International Environmental Planning Institute

2. Equipment Planner Mr.Takefumi MAYUMI
Japan International Cooperation System

3. Scio-Economist Mr.Tomohiro ISHIMORI
Japan International Cooperation System

Survey Schedule

Appendices 2.

No.	Date		Dr.SAKURAI	Mr.MAYUMI Mr.ISHIMORI	Stay
1	Nov.6	Wed.		NARITA→(NH201)→LONDON LONDON→	
2	Nov.7	Thu.		→(BA053)→HARARE Courtesy call to Embassy, JICA office and the Ministry of Local Government, Rural, and Urban Development	Harare
3	Nov.8	Fri.		Courtesy call and discussion with the Chitungwiza Municipal Council	Harare
4	Nov.9	Sat.		Site Survey	Harare
5	Nov.10	Sun.		Site Survey	Harare
6	Nov.11	Mon.		Discussion with CMC	Harare
7	Nov.12	Tue.		Discussion with CMC	Harare
8	Nov.13	Wed.		Discussion with CMC	Harare
9	Nov.14	Thu.		Discussion with CMC	Harare
10	Nov.15	Fri.		Discussion with CMC	Harare
11	Nov.16	Sat.		Site Survey	Harare
12	Nov.17	Sun.		Site Survey	Harare
13	Nov.18	Mon.		Discussion with CMC	Harare
14	Nov.19	Tue.	NARITA→(JL411)→AMSTERDAM AMSTERDAM	Discussion with CMC	Harare
15	Nov.20	Wed.	→(KL597)→HARARE (10:45) (PM)Site Survey	Discussion with CMC, Site survey	Harare
16	Nov.21	Thu.	Discussion with CMC		Harare
17	Nov.22	Fri.	Discussion about the Draft Minutes of Discussion		Harare
18	Nov.23	Sat.	Site Survey		Harare
19	Nov.24	Sun.	Internal Meeting		Harare
20	Nov.25	Mon.	Discussion about the Draft Minutes of Discussion		Harare
21	Nov.26	Tue.	Discussion with CMC		Harare
22	Nov.27	Wed.	Signing of Minutes of Discussion and report to Embassy and JICA office HARARE→		Harare
23	Nov.28	Thu.	→(KL598)→AMSTERDAM		Amsterdam
24	Nov.29	Fri.	AMSTERDAM→		
25	Nov.30	Sat.	→(JL412)→NARITA		

Appendices 3.

List of Party Concerned in the Recipient Country

Japanese Embassy

Counciler	Mr. Hironobu YASUMURA
First Secretary	Mr. Yasuo SHOJI

JICA Zimbabwe Office

Resident Representative	Mr. Mitsuo NAKAMURA
Staff	Mr. Tomohiro SEKI

Ministry of Local Government, Rural and Urban Development (MLGRUD)

Senior Secretary	Mr. Chiwewe	
Director	Mr. Mpamhanga	Development Planning and Coordination
Under Secretary	Mr. Mutamini	Development Planning and Coordination
Assistant Secretary	Ms. Musungwa	Development Planning and Coordination
Financial Analyst	Mr. Dingani	World Bank Urban II Project

Ministry of Finance

Officer	Mr. Fidelis	Publication Service
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Chitungwiza Municipal Corporation (CMC)

Town Clerk	Mr. Chiroodza	
Director	Mr. Khosla	Engineering Services Department
Engineer	Mr. Mbira	Engineering Services Department
Foreman	Mr. Makova	Engineering Services Department
Assistant Foreman	Mr. Dube	Engineering Services Department
Town Planner	Mr. Mutubuki	Engineering Services Department
Surveying Technician	Mr. Gwanzura	Engineering Services Department

Workshop

Foreman	Mr. Tobaiwa
Transport Controller	Mr. Gavaza
Stores Controller	Mr. Mapengo

MINUTES OF DISCUSSIONS
THE STUDY
ON
THE PROJECT
FOR
THE IMPROVEMENT OF SANITARY CONDITION
IN
THE MUNICIPALITY OF CHITUNGWIZA
IN
THE REPUBLIC OF ZIMBABWE

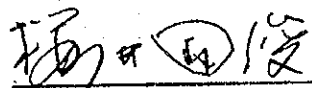
In response to a request from the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a Study on the Project for the Improvement of Sanitary Condition in the Municipality of Chitungwiza in the Republic of Zimbabwe (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

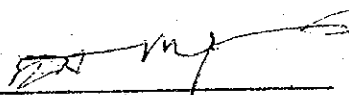
JICA sent to Zimbabwe a study team which is headed by Dr. Kunitoshi SAKURAI, President, Tokyo International Environmental Planning Institute, and is scheduled to stay in the country from November 7 to November 27, 1996.

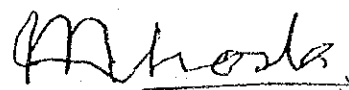
The team held discussions with the officials concerned of the Government of the Republic of Zimbabwe and conducted a field survey at the study area.

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

November 27, 1996


Dr. Kunitoshi SAKURAI
Leader, The Study Team,
JICA


Mr. Abbey Cleopas MPAMHANGA
Director, Development Planning and Coordination
Ministry of Local Government, Rural and
Urban Development,
Government of the Republic of Zimbabwe


Eng. Mohindar KHOSLA
Director, Engineering Service Department,
Chitungwiza Municipal Council

ATTACHMENT

1. Objective

The objectives of the Project are to procure the equipment necessary for the efficient collection and disposal of solid waste and to improve the method and facilities designed to maintain environmental and sanitary conditions.

2. Project site

The Municipality of Chitungwiza (see ANNEX-I)

3. Responsible Ministry and Executing Agency

Responsible Ministry

-Ministry of Local Government, Rural and Urban Development

Executing Agency

-Chitungwiza Municipal Council (see ANNEX-II)

4. Items Requested by the Government of the Republic of Zimbabwe

After discussions with the Study Team, the items shown in Annex-III were finally requested by the Zimbabwean side.

However, the final components of the Project, both quantity and specifications, will be described after further studies.

5. Japan's Grant Aid System

(1) The Government of the Republic of Zimbabwe has understood the system of Japan's Grant Aid explained by the team, as described in Annex-IV.

(2) The Government of the Republic of Zimbabwe will take necessary measures, described in Annex-V for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

JICA will complete the final report and send it to the Government of Zimbabwe by the end of February, 1997.

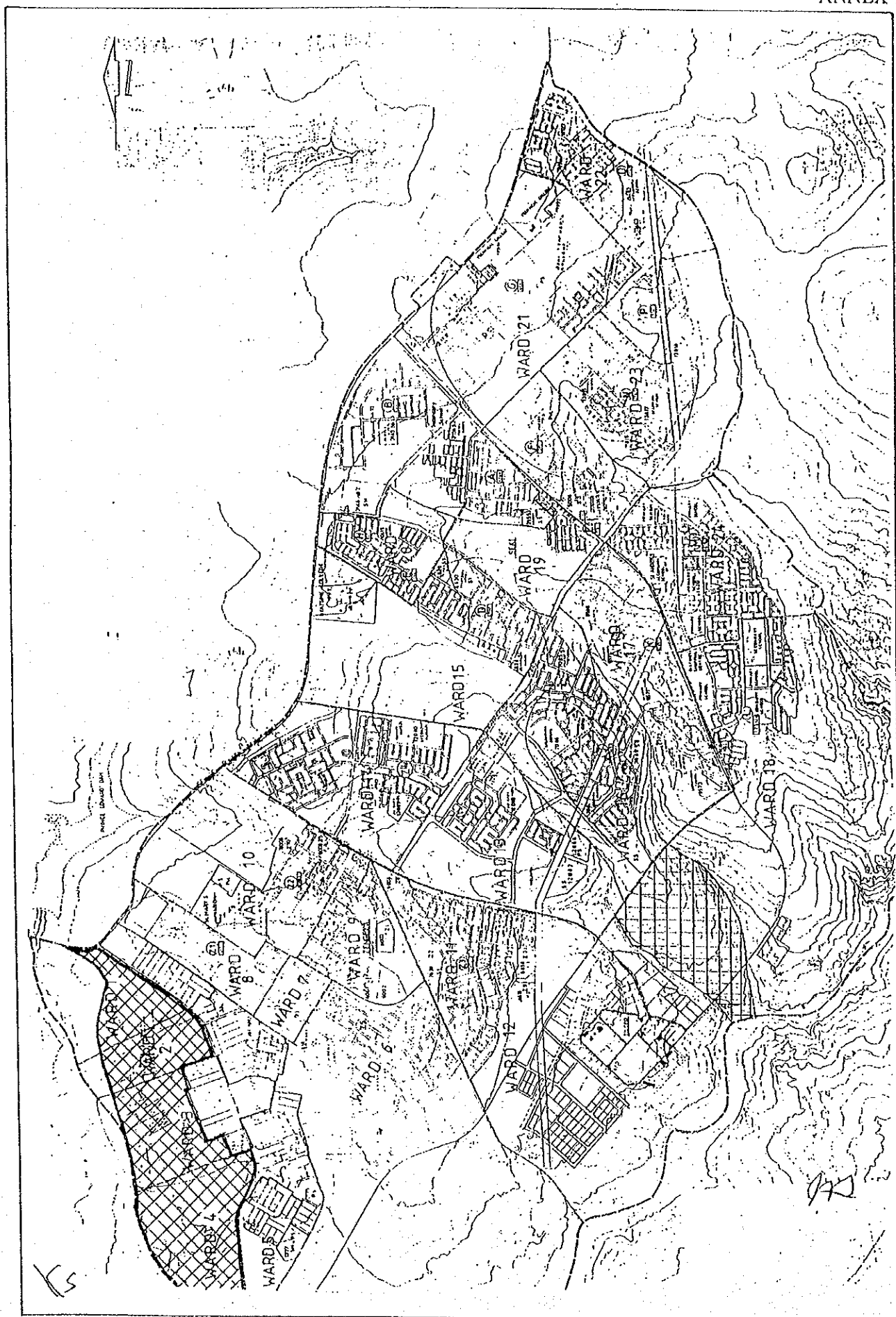
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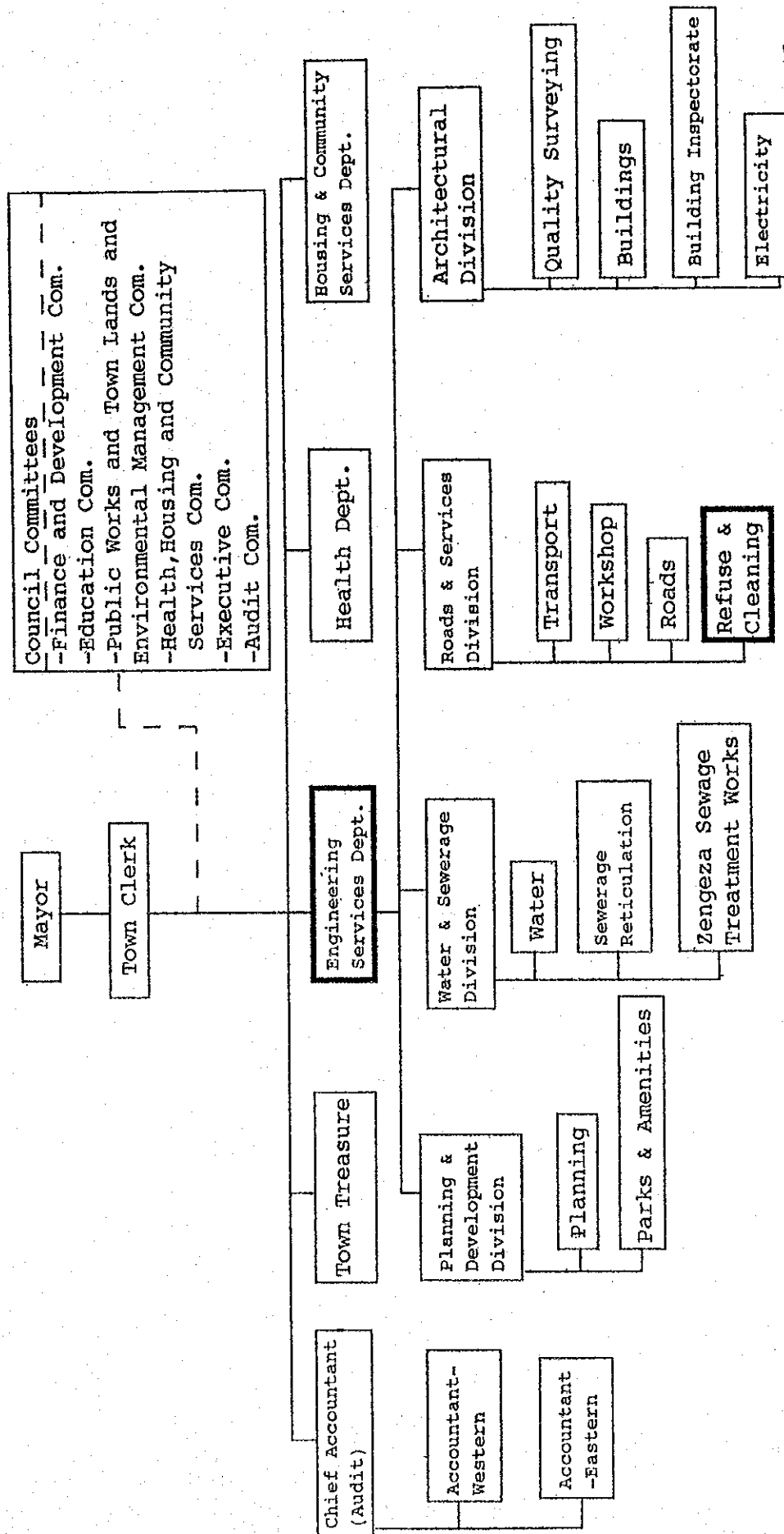
7. Other Relevant Issues

- (1) In the existing landfill of CMC the northern area is used in dry season, and it is not used in very wet weather because of bad road condition. A special area is reserved for very wet weather in the southern end of the site because of the better road condition. However, the wet weather operation in the southern end is not desirable because it is located very close to the Nyatsime River which is the source of drinking water for the people of Harare and its environs. Therefore the team advised CMC to improve the access condition to northern part using the equipment to be procured through the Project and carry out wet weather operation there in order to avoid the pollution of Nyatsime River by Leachate.
- (2) The Project will have required impact on the improvement of sanitary condition in Chitungwiza only when it is fully supported by its residents and workers. Therefore the Team advised CMC to carry out a campaign for clean Chitungwiza (CCC) at the time of equipment arrival so that the residents would have better understanding about the importance of improved solid waste management (SWM) as well as their responsibilities. Along with the strengthening of collection service delivery capacity, littering and illegal dumping of wastes should be strictly prohibited. Use of bells to inform the residents of the arrival of collection vehicles may be practical to get better cooperation of residents. Painting of the phone number of CMC's claim desk on the sides of procured equipment may facilitate the complaining by residents increasing the accountability of the CMC's SWM services. Operators and workers of CMC involved in SWM should be given a proper training about the collect and use of new equipment.
- (3) Although the privatization of public services is promoted in many parts of the world to increase their cost-effectiveness, the team explained that the equipment has to continue to be the property of CMC in the case of equipment to be procured under Japan's Grant Aid Program.

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ANNEX-II



Items requested by the Government of the Republic of Zimbabwe

Priority and Name of Equipment	Priority		
	A	B	C
Refuse Collection Dump(4×2, Closed Type Vessel whose Volume 6~10m ³)	6	2	2
Skip Hoist Truck(4×2)	8	2	0
Closed Type Container	1 8	2	0
Tipper (4×2, Vessel Volume 4.4~6m ³)	3	1	0
Bulldozer (168kw or more)	1	0	0
Wheel Loader (General Purpose Bucket)	1	0	0
Motor Grader (3.7m Mold Board with Ripper)	1	0	0
Workshop Tools	1 Set	0	0
Horse and Low Bed (Low Bed with 3axles)	1	0	0
Wrecker (4×2)	1	0	0
Pick Up (Diesel, 4×4)	2	1	0
Water Tank Truck (4×2)	0	1	0
Spare Parts	1 Set	0	0

ON JAPAN'S GRANT AID PROGRAM

1. Japan's Grant Aid Procedures

- (1) The Japan's Grant Aid Program is executed by the following procedures.
- **Application** (request made by a recipient country)
 - **Study** (Study conducted by JICA)
 - **Appraisal & Approval** (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
 - **Determination of Implementation** (Exchange of Notes between both Governments)
 - **Implementation** (Implementation of the Project)
- (2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's Grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study, using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preliminary Study is conducted prior to a Study.

Thirdly, the Government of Japan appraises to see whether or not the Project is suitable for Japan's Grant Aid Program, based on the Study report prepared by JICA and the results are then submitted for approval by the Cabinet of Japan.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

2. Contents of the Study

(1) Contents of the Study

The purpose of the Study conducted on a project requested by JICA is to provide a basic document necessary for appraisal of the project by the Japanese Government. The contents of the Study are as follows:

- a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for project implementation,
- b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a technical, social and economical point of view,
- c) to confirm items agreed on by both parties concerning a basic concept of the project,
- d) to prepare a basic design of the project,
- e) to estimate cost involved in the project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.

Implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized on Exchange of Notes.

(2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested.

The consulting firm(s) used for the study is(are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency and also to avoid possible undue delay in implementation caused if a new selection process is repeated.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)

The Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the Project, period of execution, conditions and amount of the Grant, etc. are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year (commencing from 1st April ending on 31st of March) which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

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

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of the "Verification"

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

(6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid, the recipient country is required to undertake necessary measures such as the following:

- a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) to secure buildings prior to the installation work in case the Project is providing equipment,
- d) 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,

- e) 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,
- f) 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 their work.

(7) Proper Use

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

(8) Re-export

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

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority shall 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 "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the contracts verified.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to pay issued by the Government of the recipient country or its designated authority.

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Necessary measures to be taken by the Government of the Republic of Zimbabwe in case Japan's Grant Aid is executed.

1. To provide necessary facilities for the Project such as electricity and other incidental facilities.
2. To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
 - (a) Advising Commission of Authorization to Pay
 - (b) Payment Commission
3. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the Project at the port of disembarkation.
4. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the Verified Contracts such facilities as may be necessary for their entry into Zimbabwe and stay therein for the performance of their work.
5. To maintain and use the equipment procured under the Grant properly and effectively.
6. To bear all expenses other than those to be borne by the Grant, necessary for the execution of the Project.
7. To ensure the necessary budget and personnel for the proper and effective implementation of the Project, including operation and maintenance of the equipment procured under the Grant.

