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ASSESSMENT OF SOLID WASTE MANAGEMENT IN PORT - AU - PRINCE, HAITI

WASH FIELD REPORT NO. 292

JANUARY 1990

Prepared for
the USAID Mission to Haiti
WASH Task No. 126

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ASSESSMENT OF SOLID WASTE MANAGEMENT IN PORT-AU-PRINCE, HAITI

Prepared for the USAID Mission to Haiti
under WASH Task 126

by

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and
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Menajem Bessalel has more than 30 years experience in civil engineering. He has previously worked in solid waste management in Ivory Coast and Zaire. As an independent consultant, Mr. Bessalel has worked for a variety of engineering and development firms, as well as the World Bank, USAID, and other international development organizations. He is fluent in Spanish and French.

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ACRONYMS

CDS	Centre pour le Développement et la Santé
EDH	State-owned electric power company
GOH	Government of Haiti
IDB	Inter-American Development Bank
MTPTC	Ministères Travaux Publiques Transports et Communications
OFATMA	Medical insurance
ONA	Social security
SMCRS	Service Metropolitain de Collecte des Residues Solides
USAID	U.S. Agency for International Development
WASH	Water and Sanitation for Health Project

EXECUTIVE SUMMARY

General

At the request of USAID/Haiti, the Water and Sanitation for Health (WASH) Project sent a two-person team to Port-au-Prince on November 9, 1989 to review the solid waste collection proposal presented to USAID by Centre pour le Développement et la Santé (CDS).

The Problem

Collection and treatment of solid waste in the metropolitan area of Port-au-Prince has been a problem for many years. Garbage lies uncollected in the streets or open fields, particularly in the poorest sections of the city, jeopardizing the city's infrastructure and creating health hazards.

The collection system has progressively deteriorated because much of the equipment stands idle for lack of maintenance and repair. At present about 1,000 tons of waste are generated daily in Port au Prince, but government services have the capacity to handle only about one quarter of this amount. Following the closure of the only landfill outside the city in 1987, three temporary sites were opened within the city, only compounding the problem.

The Proposed Solution

The solution to the problem requires adequate equipment in operational condition and adequate treatment and disposal facilities at the most economical cost. In order to address the problem the WASH consultants developed four alternatives each with varying degrees of investments, plus a do-nothing alternative, to determine the most economical approach.

CDS Proposal

The CDS proposal for privatizing solid waste collection envisioned a new corporation in which the Government of Haiti (GOH) would be the minority shareholder. Its suggestion for transferring the assets and personnel of Service Metropolitain de Collecte des Residues Solides (SMCRS), the agency responsible for solid waste collection, to the proposed corporation was considered plausible in view of the poor management prevailing in SMCRS's operations. However, the proposal was found to rest on erroneous projections of revenue and an unrealistic increase in user fees. The consultants recommend rejection of the CDS proposal.

Findings

The consultants arrived at three major findings:

- The metropolitan area of Port-au-Prince is a highly segmented market of solid waste producers, defined by income level, locality, commerce, and industry.

- Some of the more affluent producers prefer to pay for the collection services of informal private sector entrepreneurs, while other producers depend on the free but unsatisfactory services provided by the government. The poorest dump their garbage in the streets.

- The informal sector's share of the market is impossible to determine since it operates outside the pale of the law. But there are indications that informal waste collection and disposal is a $6-million-a-year industry.

Recommendations

Based on these findings, the consultants offer the following recommendations:

The Government of Haiti should consider

1. Appropriate legislation and strictly enforceable regulations governing the production, collection, and disposal of solid waste.

2. Creation of an autonomous authority with power to assess and collect fees in the affluent market segments and to administer solid waste collection and disposal contracts.

3. Segmentation of the metropolitan area into contract zones and creation of a mechanism for selecting competitive bids for solid waste collection and disposal from local entrepreneurs.

USAID/Haiti should support the Government of Haiti in taking these steps by

1. Conducting a six-week survey to determine the number of garbage collection entrepreneurs and the segments they cover; the number of households and enterprises in each segment; and the actual and maximum fee-raising potential of each segment.

2. Conducting a parallel study to determine whether composting is practical and what the size of the market for compost might be; and whether a landfill operation can be managed through the private sector.

3. Conducting a follow-on study, based on the results of the above, to determine the most appropriate regulatory framework and enforceable regulations; a mechanism for rate assessments and for recovering fees from households/enterprises; the cost and best method of fee collection, including the possible use of a private contractor; how to set up a solid waste management authority; and how to build on de facto arrangements by involving local entrepreneurs in garbage collection.

Chapter 1

INTRODUCTION

1.1 General

At the request of USAID/Haiti the Water and Sanitation for Health (WASH) Project sent a two-person team to Port-au-Prince on November 9, 1989, to review the solid waste collection proposal presented to the Mission by Centre pour le Développement et la Santé (CDS).

The scope of work included:

- Evaluation of the feasibility of privatizing garbage collection in Port-au Prince
- Consideration of the environmental effects of solid waste disposal and recommendations for remedial action if needed
- Review of the financial viability of the CDS proposal
- Consideration of the merits of recycling garbage
- Review of the Government of Haiti's policies and regulations affecting privatization and environmental protection

1.2 Content of the Report

Chapter 2 - describes existing arrangements for the collection and disposal of solid waste in the metropolitan area of Port-au-Prince and their impact on the urban infrastructure and environment

Chapter 3 - presents the developments that led to the creation of the company responsible for the collection of solid waste, Service Metropolitain de Collecte des Residues Solides (SMCRS).

Chapter 4 - defines the operational capabilities of SMCRS.

Chapter 5 - defines and calculates the basic parameters for the analysis of the proposed alternatives

Chapter 6 - estimates solid waste production by the metropolitan area of Port-au-Prince from 1990-1994.

Chapter 7 - discusses four alternatives and the do-nothing solution for the collection of garbage. Describes the proposed equipment and compares the investment and operating costs for each alternative.

Chapter 8 - presents a financial analysis of the CDS proposal and explains why the transfer of SMCRS operations to a new corporation, as CDS suggests, would be unwise.

Chapter 9 - considers the possibilities of composting the organic component of solid waste and the initial investment and operation costs.

Chapter 10 - describes the environmental impacts and potential benefits from implementing the recommended alternative.

Chapter 11 - presents the conclusions and recommendations of the study.

1.3 Methodology

The analysis and assessment of present garbage collection arrangements in the metropolitan area of Port-au-Prince and a review of the solution proposed by CDS followed the approach described below.

1.3.1 Technical Analysis

Field Reconnaissance

Three field exercises were performed:

- a survey of the capabilities for collecting and treating solid waste
- an investigation of garbage collection methods
- an examination of the impact of inadequate collection on other sectors of the city's infrastructure and on the environment.

Review of Previous Studies

The collection and treatment of garbage in Port-au-Prince has been the subject of several studies which have proposed various solutions. The team reviewed the following reports:

- "Projet de Drainage des Eaux Pluviales de Port-au-Prince SCEF International-Beture"
- "Projet d'Etude Operationnelle de Collecte des Ordures Menagers et Dechetes des Marches, Sita-SOGED"
- Transfert du Service Metropolitain de Collecte des Resldues Solides, Ministère des Travaux Publics Transports et Communications

- Projet de Drainage des Eaux Pluviales de Port-au-Prince Rapport d'Evaluation, MTPTC, Service de Genie Urbain

- Schema Directeur de la Ville de Port-au-Prince Lavalin International

Consultations with Local Authorities and International Institutions

The team held consultations with staff at the Ministry of Public Works, SMCRS, the Inter-American Development Bank, the World Bank, and USAID.

1.3.2 Alternative Solutions

Four alternatives for improving the collection and treatment of solid waste were studied. The city was divided into four sections selected by physical characteristics, economic development, and income level. The main variables for each alternative were input in a spreadsheet model.

1.3.3 Recommended Alternative

The recommended alternative was based on the most economical technical solution using existing and proposed new equipment.

1.4 Limitations

The appropriate functioning of the components of the recommended alternative depends on a number of factors. It is impossible to confidently name the best collecting system, since this will depend not only on the selection of equipment and the collecting circuits but also on the efforts made by the population and the solid waste collecting entity.

Chapter 2

EXISTING CONDITIONS

2.1 Present Situation

The collection of solid waste in the metropolitan area of Port-au-Prince has been a problem for many years. Garbage remains uncollected, particularly in the poorest sections of the city. Huge piles of trash on the streets are not merely unsightly and malodorous but also a health hazard, (Photograph 1).

The garbage collection system has deteriorated progressively for lack of equipment maintenance, the poor condition of the streets, traffic congestion, several years of indiscriminate discharge, and the recent closure of the only landfill.

It is impossible to quantify the amount of garbage that litters the metropolitan area of Port-au-Prince. To compound the problem, three temporary sites were officially opened in the Bicentenaire, Fort Dimange, and Croix de Bossales areas after closure of the landfill. A preliminary estimate indicates that the trash accumulated in the temporary landfills exceeds 200,000 tons.

2.2 Critical Areas

In several areas of the city, especially Cité du Soleil, Croix de Bossales and Carrefour, the accumulation of solid waste has created serious problems for other sectors of the city's infrastructure (Photograph 2).

2.3 Existing Equipment

The existing equipment for the collection and treatment of solid waste is in very poor condition, most of it out of service for lack of spare parts or new tires, and in some cases as a result of vandalism.

2.4 Impact on the Infrastructure of the City

The progressive accumulation of garbage in the streets and the tendency of residents, especially in poor areas, to discharge their solid waste in open areas or in the drainage system have damaged all sectors of the infrastructure of the city.

Photo 1:

Health Hazard Conditions

Photo 2:

Cité Soleil—
Garbage Accumulation

The biggest impacts are on:

- Transportation

  The poor condition of the streets and the topographic characteristics of the city combine to slow down traffic, especially during the peak hours. The starting time for garbage collection, previously set at 4:00 a.m. to avoid rush hour traffic especially downtown, was changed to 8:00 a.m. at the request of collection crews for security reasons. This change has aggravated traffic congestion especially in the main arteries.

- Drainage

  One of the results of inadequate solid waste collection is that residents frequently dump their garbage in drainage ditches, thereby obstructing most of the secondary collectors. As a result, rain water finds its way down the streets, causing erosion, or stagnates in flat areas.

Chapter 3

SOLID WASTE MANAGEMENT BACKGROUND

3.1 Background

In 1976, a population of 640,000 in Port-au-Prince generated 110,500 tons of solid waste annually as shown in Table 1.

Table 1

Solid Waste Production in Port-au-Prince

Source	Annual Production in Tons	Percentage
Residential	90,500	82
Commercial and Industrial	10,000	9
Other	10,000	9
Total	110,500	100

Source: Lavalin International - Schema Directeur de la Ville de Port-au-Prince

The responsibility for collecting solid waste and cleaning the city was assigned to the following agencies:

- Service de la Voire - collection of waste and transport to disposal sites
- Service de Contrôle - street sweeping
- Service du Genie Municipal du DTTC - cleaning of ditches and drainage system

In December 1978, the Inter-American Development Bank approved a $35 million loan for the implementation of Phase I of a drainage project for the metropolitan area of Port-au-Prince (subproject A), under which credits were allocated for improving the collection and treatment of solid waste (subproject B). SMCRS was created as a state-owned enterprise to provide solid waste collection services.

3.2 Solid Waste Studies

The following are studies undertaken in solid waste collection and treatment.

3.2.1 SCET-INTERNATIONAL-BETURE

SCET-INTERNATIONAL-BETURE was the consultant selected to undertake the proposed study. The scope of work included:

- Creation of an institution responsible for the collection and disposal of the solid waste.
- Design of collection and treatment equipment

The design of subproject B included the following:

Truitier Landfill

The selected landfill was a 205 ha. site, in Truitier, about 10 km. from downtown Port-Au-Prince. Equipment (tractor, compactor, and front loader) was provided for the treatment of solid waste.

In addition, the Ministry of Public Works, Transport and Communications constructed a warehouse at a cost of $17,000.

In January 1987, the landfill was closed by order of the President of the Communauté Urbaine de Port-au-Prince. Since then the collected solid waste has been discharged in a temporary site downtown (Bicentenaire).

SMCRS Headquarters

The SMCRS headquarters, made up of the following units, was constructed at Mais Gate, about 6 km. from downtown Port-au-Prince:

- administrative building
- repair building
- maintenance building
- water tower
- warehouse
- service station
- parking lot of 800 m^2

Equipment and Training

The landfill equipment listed below was purchased under subcontract B1, and the solid waste collection equipment under subcontracts B2 and B4.

- Landfill equipment

  1 compactor
  1 tractor
  1 front loader and spare parts

- Solid waste collection equipment

  13 trucks with compressors (15 m^3)
  10 trucks with compactors (8 m^3)
  2 trucks (6 m^3)
  10 trucks to carry flat containers
  27 containers (10 m^3)
  115 containers (5 m^3).

  Under subcontract B5 the following were purchased:

  250 containers of 100 liters each
  1100 containers of 600 liters each.

  Under subcontract B3 the following equipment was purchased:

  12 inspection vehicles (Jeep)

  2 pick-ups (Landrover)

  Under subcontract 6 tool sets were purchased

- Training of Personnel

  Fifteen mechanics were trained at the Institut National de Formation Professionnelle, with follow-up field training at Haitian Tractors. Other operators have also had follow-up field training at Haitian Tractors.

3.2.2 National Composting Plant of Port-au-Prince

Under a different contract, a 2500-tons/day composting plant was constructed at a site north of Port-au-Prince. The plant never functioned at a capacity over 5 percent and was closed after two years.

3.2.3 Project d'Etude Operationnelle de Collecte des Ordurés Menagers et Dechetes des Marches

The operational study defined the present operational garbage collection. The collection schemes recommended by the firm SOGED consisted of:

Door-to-Door Collection

Collection is performed by compression trucks for 60 percent of the production in downtown Port-au-Prince and the residential areas of Port-au-Prince, Petion-ville, and Delmas. The recommended starting time was 4:00 a.m.

Collection by Container at Specific Locations

With the utilization of Sitalift (container pick-up truck) the garbage was collected in four sections (see Figure 1).

Section I - Center City
Section II - Center City
Section III - Cité Soleil
Section IV - Carrefour

This program is the same as the one followed today. However, the operation has been scaled down for lack of operational funds, change in the collection schedules, and the poor condition of the equipment.

Since April 1989, SMCRS has been under the jurisdiction of the MTPTC. Several solutions have been considered for improving the collection and discharge of solid waste, including privatization.

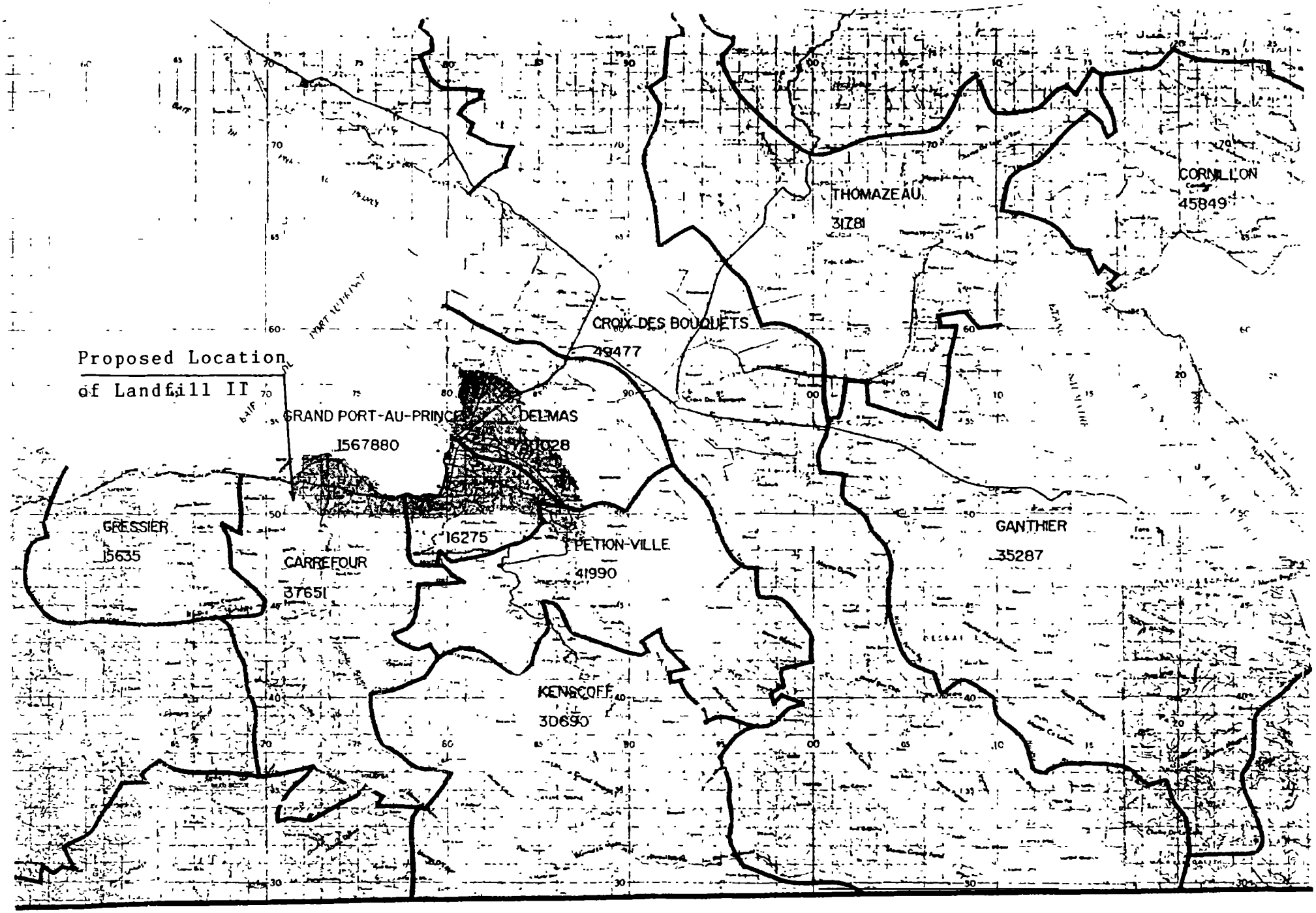

Figure 1. Map of The Metropolitan Area of Port-au-Prince

Chapter 4

EQUIPMENT INVENTORY AND REHABILITATION COST

4.1 General

The poor condition of the equipment because of a lack of funds for spare parts and maintenance is one of the main reasons for the inadequate collection of solid waste. Most of the equipment is idle in SMCRS's repair shop waiting for parts or new tires. Some of the trucks have been cannibalized.

4.2 Present Collection Capacity of SMCRS

The SMCRS equipment inventory is shown in Appendix A. The nominal maximum transport capacity of the entire SMCRS fleet is 346 m^3, or 173 metric tons. However, the capacity of the vehicles in actual service is only 209 m^3, or 104 metric tons per trip. Based on 2.5 trips per day and 341 working days per year, the annual transport capacity is as shown in Table 2:

Table 2

Annual Transport Capacity of SMCRS Fleet

Item	in m^3	in metric tons
Entire SMCRS fleet	294,965	147,482
SMCRS fleet in service	178,172	89,086

A list of needed repairs has been prepared for each of the vehicles. The total cost was estimated at $240,000 by local dealers.

4.3 Repair Schedule

For the purpose of establishing an implementation program, the following repair schedule was estimated:

Minor repairs	30 days
Major repairs	180 days

4.4 Cash Disbursement Projections for Equipment Rehabilitation

Month 1	$ 90,000
Month 2	$ 30,000
Month 3	$ 30,000
Month 4	$ 30,000
Month 5	$ 30,000
Month 6	$ 30,000
Total	$ 240,000

Chapter 5

DEFINITION OF BASIC PARAMETERS

5.1 General

This study proposing a program of solid waste collection for the metropolitan area of Port-au-Prince includes an analysis of the topographic characteristics of the city, the location of the existing landfill, the proposed location of a new landfill, and the economic characteristics of each section of the city.

5.2 Definition of Collecting Sections

For waste collection purposes, the metropolitan area of Port-au-Prince should be segmented into four major sections. In addition, all future unplanned settlements should be considered as new areas to be included in the Carrefour section.

Table 3 indicates 5-year population projections based on 1989 population estimates.

Table 3

1990-1994 Population Projections for the Metropolitan Area of Port-au-Prince (in thousands)

Population in 1,000	1990	1991	1992	1993	1994
Port-au-Prince	828	869	913	958	1,006
Petion-ville Delmas	422	434	448	461	475
Cité Soleil	203	216	232	248	266
Carrefour - new areas	353	414	475	546	621
Total	1,806	1,933	2,068	2,213	2,368

Source: Based on 1988 data by Lavalin International—Schema Directeur de la Ville de Port-au-Prince with projections by WASH consultants.

5.3 Waste Generation Rates

The estimation of waste generation rates is very difficult where the methods of sampling are not reliable or often do not exist. It is difficult not only to collect accurate data, but also to quantify the amount to be collected.

There are several processes which reduce the weight of garbage that is accumulated in open collection points including:

- natural biodegradation
- picking out recyclable items by human scavengers
- eating out of the food wastes by animals and in some cases by humans
- accumulation in drainage structure or dragged to the sea.

However, there are compensating processes and activities which tend to increase the weight of garbage, including rainfall, animal manure, direct fecal discharges, night soil, and other sources such as construction material and industrial waste.

Table 4 indicates the best estimates of waste generation per capita for the defined city sections.

Table 4

Per Capita Waste Generation
(kilograms)

	Daily	Annual
Port-au-Prince	0.45	164.3
Petion-ville/Delmas	0.60	219.0
Cité Soleil	0.40	146.0
Carrefour and new areas	0.45	164.3

Source: WASH Consultant estimates

Density, composition, and moisture content are the main analytical parameters. Density is of special importance for the design of the required collection equipment, and waste composition for waste treatment methods. Waste densities vary from area to area in the city. In the affluent areas, densities tend to be low and garbage tends to have a high percentage of non-putrescible materials such as paper, plastics, glass, and metals. The garbage composition in lower-income areas is mostly organic, with natural compaction. This would suggest that collection by compactor would be appropriate only for areas with low-density waste.

Table 5 indicates the densities used to calculate the volume to be transported from each section of the city.

Table 5

Solid Waste Densities
(tons/m^3)

	Density
Port-au Prince	0.5
Petion-ville/Delmas	0.4
Cité Soleil	0.6
Carrefour	0.6
Other areas	0.5

Source: WASH consultant estimates

5.4 Accessibility

The collection of solid waste is made difficult by the lack of roads in the poor areas and by traffic congestion in affluent sections like Petion-ville and Delmas.

Chapter 6

SOLID WASTE PRODUCTION

Based on the parameters defined by the WASH team, the annual estimated solid waste production for 1990-1994 is indicated in Table 6:

Table 6

1990-1994 Solid Waste Production
(thousands of tons)

	1990	1991	1992	1993	1994
Port-au-Prince	136	143	150	157	165
Petion-ville/Delmas	92	95	98	101	104
Cité Soleil	30	32	34	36	38
Carrefour & new areas	58	68	78	90	102
Commercial, industrial & other	63	68	72	77	82
Total	379	406	432	461	491

Source: WASH consultant estimates

Chapter 7

SOLID WASTE COLLECTION ALTERNATIVES

7.1 General

The physical characteristics and requirements of each section of the metropolitan area of Port-au-Prince and the assets of SMCRS permit a wide range of combinations for the utilization of existing and new equipment. This chapter analyzes four alternatives for the collection and discharge of solid waste with reference to the following factors:

- Economic resources of different sections of the city
- Conditions of streets
- Composition of garbage
- Existing equipment
- Segmentation of the city into four collection sections

7.2 Description of Alternatives

- Alternative I

  This alternative considers the rehabilitation of the existing equipment for the Port-au-Prince, Petion-ville/Delmas, and Cité Soleil sections, acquisition of new equipment for the Carrefour section, and new containers on wheels for the Cité Soleil and Carrefour sections. In addition, it considers the rehabilitation of the existing landfill and access road and the purchase of new equipment for treatment and disposal of solid waste.

- Alternative II

  This alternative is similar to Alternative I, with the addition of a new landfill south of the Carrefour section (Landfill II). The addition of a second landfill will require less collection equipment.

- Alternative III

  This alternative proposes to rehabilitate Landfill I and replace all existing equipment.

- Alternative IV

  Except for the addition of Landfill II, this alternative is the same as alternative III.

In addition to the four alternatives, this study briefly discusses the do-nothing solution, the possibilities of composting the organic components of solid waste, and purchasing garbage from the producers at pick-up points especially in areas where access for the collecting equipment is very difficult.

7.3 Elements Common to the Four Alternatives

The cost of elements common to the four alternatives is set out below.

7.3.1 Rehabilitation of Existing Equipment and Landfill I

The cost of rehabilitating or repairing existing SMCRS equipment was estimated as follows:

Landfill I and access road - rehabilitation	$100,000
Collection equipment - rehabilitation	$240,000
Landfill II - site preparation	$200,000

7.3.2 New Equipment

The cost of new equipment would be:

Truck, 10 m^3 capacity	$ 70,000
Tractor	$ 25,000
Container on wheels	$ 10,000
Tractor for Landfill I	$285,000
Grader	$126,000
Loader	$ 79,000
Compactor	$ 56,000
Tractor for Landfill II	$125,000

Table 7

Annual Nominal Capacity of Collection Equipment

	Combined Existing Equipment	All Alternatives New Trucks (each)	Alternatives II & IV New Tractors (each)	Alternatives I & III New Tractors (each)
Nominal capacity in tons	173	5	6	6
Trips per day	2.5	2.5	4.0	2.0
Daily capacity in tons	432.5	12.5	24.0	12.0
Working days	341	341	289	289
Annual nominal capacity in tons	147,482	4,263	6,936	3,468

7.4 Capital Investment Requirements

Alternative I

Required Equipment	1990	1991	1992	1993	1994
Trucks					
Petion-ville/Delmas	0	0	0	0	0
Port-au-Prince	20	2	1	1	1
New areas	2	1	-	1	0
Total Trucks	22	3	1	2	1
Tractors					
Carrefour	31	2	2	2	2
Total Tractors	31	2	2	2	2
Containers					
Cité Soleil	16	1	1	2	2
Carrefour	31	2	2	2	2
Total Containers	47	3	3	4	4

Capital Investments (in $000)		1990	1991	1992	1993	1994
Landfill rehabilitation	100	--	--	--	--	
Landfill equipment	820	--	--	--	--	
Collection equipment rehab.	240	--	--	--	--	
New trucks	1,848	252	84	168	84	
New tractors	930	60	60	60	60	
New containers	470	30	30	40	40	
Total	4,408	342	174	268	184	

Note: The cost of new equipment includes 20 percent for spare parts.

Alternative II

Required Equipment	1990	1991	1992	1993	1994
Trucks	22	3	1	2	1
Tractors	8	-	1	-	1
Containers	47	3	3	4	4

Capital Investments (in $000)	1990	1991	1992	1993	1994
Landfill I rehabilitation	100	-	-	-	-
Landfill I equipment	820	-	-	-	-
Landfill II site preparation	200	-	-	-	-
Landfill II equipment	430	-	-	-	-
Collection equipment rehab.	240	-	-	-	-
New trucks	1,848	252	84	168	84
New tractors	240	-	30	-	30
New containers	470	30	30	40	40
Total	4,348	282	144	208	154

Alternative III

Required Equipment	1990	1991	1992	1993	1994
Trucks					
Petion-ville/Delmas	25	-	1	-	1
Port au Prince	20	2	2	2	2
New Areas	2	1	-	1	1
Total Trucks	47	3	3	3	4
Tractors					
City Soleil	11	1	-	1	1
Carrefour	17	1	1	1	1
Total Tractors	28	2	1	2	2
Containers					
Cité Soleil	16	1	1	2	2
Carrefour	31	2	2	2	2
Total Containers	47	3	3	4	4

Capital Investments (in $000)	1990	1991	1992	1993	1994
Landfill I rehabilitation	100	-	-	-	-
Landfill I equipment	820	-	-	-	-
New trucks	3,948	252	252	252	336
New tractors	840	60	30	60	60
New trailers	470	30	30	40	40
Total	6,178	342	312	352	436

Alternative IV

Required Equipment	1990	1991	1992	1993	1994
Trucks	47	3	3	3	4
Tractors					
Cité Soleil	11	1	-	1	1
Carrefour	8	-	1	-	1
Total Tractors	19	1	1	1	2
Containers	47	3	3	4	4

Capital Investments (in $000)	1990	1991	1992	1993	1994
Landfill I rehabilitation	100	-	-	-	-
Landfill I equipment	820	-	-	-	-
Landfill II site preparation	200	-	-	-	-
Landfill II equipment	430	-	-	-	-
New trucks	3,948	252	252	252	336
New tractors	570	30	30	30	60
New containers	470	30	30	40	40
Total	6,538	312	312	322	436

Do-nothing Alternative

This alternative is discussed only to indicate the minimum cost of garbage collection. It will be impossible to continue collecting solid waste as is done at present, because the maximum capacity of the existing equipment is about 500 tons per day while the present production of solid waste is more than 1,000 tons per day. The do-nothing alternative would require:

- rehabilitating Landfill I
- rehabilitating existing equipment
- reestablishing the garbage collection schedule defined in "Projet d'Etudes Operationnelle de Collecte des Ordures Menagers et Dechets Solides" (Sita-SOGED 1985 report).

It would require the following minimum investment:

Rehabilitation of Landfill I	$ 100,000
Rehabilitation of collection equipment	$ 240,000
Purchase of treatment equipment	$ 816,000
Total	$1,156,000

Table 8

Summary of Capital Investment Requirements
(in $000)

	1990	1991	1992	1993	1994	Total
Alternative I	4,408	342	174	268	184	5,376
Alternative II	4,348	282	144	208	154	5,136
Alternative III	6,178	342	312	352	436	7,620
Alternative IV	6,538	312	312	322	436	7,920
Do Nothing Alternative	1,156	-	-	-	-	1,156

7.5 Retained Alternative for Further Studies

After presenting the different alternatives and their cost to USAID and representatives of CDS, the consultants were instructed to study different scenarios for Alternative II (see Chapter 8, "Financial Analysis"), including the production of compost from the garbage collected in the Carrefour section, (see Chapter 9, "Projecting Alternatives").

Chapter 8

FINANCIAL ANALYSIS

8.1 Analysis of CDS Proposal

The Centre pour le Développement et la Santé (CDS) (referred to as the "promoter") is a Haitian-owned private enterprise providing USAID-funded humanitarian services to the local community. Its proposal submitted to the Mission is for the privatization of solid waste collection services in Port-au-Prince, the capital.

8.1.1 Concept

As proposed by CDS, a new corporation would be created with the promoter as majority shareholder and the GOH as minority shareholder in the business.

The Service Metropolitain de Collecte des Residues Solides (SMCRS), a state-owned enterprise created under a loan agreement between the Inter-American Development Bank (IDB) and the GOH, is currently responsible for providing the metropolitan area of Port-au-Prince with solid waste collection services.

CDS has proposed to create a holding company with a combined fixed and net working capital of $2.1 million funded entirely by USAID. The holding company in turn would create jointly with SMCRS a new solid waste management corporation by absorbing the existing assets, operations, and work force of SMCRS.

Of the new corporation's equity base of $3.7 million, CDS would own $2.1 million (57 percent) and the GOH $1.6 million (43 percent).

The GOH share of the business is based on CDS's valuation of SMCRS fixed assets at $2.41 million and accumulated depreciation at $0.84 million.

The actual IDB disbursements for SMCRS fixed assets amounted to $4.63 million. The net book value cannot be determined since the company carries no depreciation schedule.

From enquiries made, it appeared that the GOH has second thoughts about allowing one company to hold majority shares in the new venture, and that a transfer of SMCRS assets to a new corporate entity will have to be cleared with the IDB.

8.1.2 Revenues

The promoter has proposed to raise revenues for the new corporation through the mechanism of fees assessment based on electrical power consumption by residential users, employing the state-owned electric power company, EDH, as a collection agency. According to this full-cost recovery combined billing scheme, the new corporation would add a projected profit margin of 79 percent to its total operating costs and another 15 percent to cover EDH administrative costs, and EDH would turn over the collected fees to the new corporation. An implicit assumption is that the revenue will be collected and turned over to the new corporation regardless of the quality and level of service.

The CDS-projected revenue of $3.6 million is based on a figure of 132,857 households with electricity in the metropolitan area of Port-au-Prince. In reality, an audit of EDH customer accounts revealed that as of October 1989 there were only 71,162 registered residential users, with a combined projected 1989 payment recovery of $19.1 million.

The CDS-projected user fees plus EDH administrative costs for a total of $3.68 million would increase the average utility bill by 19.2 percent.

Even at that, the projected revenues would not be sufficient to cover the new corporation's operating costs: at full production capacity these would amount to $3.51 million. Assuming a nominal profit margin of at least 10 percent and maintaining the 15 percent for EDH administrative costs, EDH would have to bill residential users an additional $4.44 million, a 23 percent increase.

Such an increase would raise serious objections from residential users, the electric power company and, last but not least, the donors and creditors of EDH whose total contribution amounts to $133.9 million.

There is also a deep concern that a massive increase in utility rates, whatever its justification may be, would induce the targeted class of users to fraud. According to conservative EDH 1989 estimates, consumer fraud amounts to about $24 million in the metropolitan area of Port-au-Prince alone against a total billing of $45.4 million.

8.1.3 Project Opportunity Study

The promoter prepared a project opportunity study with a brief investment profile. The information in the profile could not be used as a base for a subsequent feasibility study because erroneous data and unrealistic assumptions placed the accuracy of estimates concerning investment requirements and production costs outside the usually acceptable range of $\pm$30 percent.

Specifically, projected initial capital investments, landfill operations included, were $1.3 million. However, the most likely capital investment requirement without landfills is $2.5 million.

Projected working capital requirements under the same conditions were $0.8 million. The most likely working capital requirement, however, is $0.5 million.

The projected operating costs, landfill operations included, were $1.8 million. However, the most likely operating costs without landfills are $3.5 million.

8.1.4 SMCRS Operations

Likewise, SMCRS operations provided no usable information for the feasibility study. A three-day survey revealed the following:

1. The actual decision-making concerning the SMCRS budget, accounts, and operations rests with the municipal government agencies, which were inaccessible to WASH consultants.

2. The specific authority and responsibility of SMCRS could not be determined with certitude.

3. The annual financial statements and the depreciation schedule could not be located.

4. The payroll data are unreliable. As an example, an audit of the 1988-1989 time sheets of 30-odd mechanics revealed that about a dozen of them report to work. The whereabouts of the others could not be ascertained.

5. The performance of vehicles could not be monitored as the odometers and trip recorders were damaged.

6. The gas pumps at the main service facility are inoperative and operators receive a daily cash allowance for purchases at commercial gas stations.

7. There are no maintenance records other than requests for reimbursement from operators for out-of-pocket expenses for alleged repairs to their vehicles.

8. The monthly operation statistics are inflated and bear no relation to actual performance. The basic input data received from municipal dispatchers cannot be verified.

8.1.5 Conclusion re CDS Proposal

After analyzing the proposal submitted by CDS and the subsequent financial analysis performed by WASH consultants it was concluded that the proposal was not feasible and consequently the proposal would not be recommended.

8.2 Analysis of Proposed Alternative II

8.2.1 General

The feasibility study is based on Alternative II accepted jointly by the Mission and the promoter. Only one option has been retained out of five under consideration.

Among the other options, Alternative I was eliminated because of high transportation costs associated with the distance to the landfill. Alternatives III and IV were discarded because of excessive initial capital investment. The Do-nothing Alternative would maintain the present conditions but not solve the waste problems, clearly an unacceptable option.

The selected option can be considered as the "least cost". However, it does not resolve the all-important problem of landfills and the rational processing and disposal of the collected solid waste.

8.2.2 Financial Details of the Feasibility Study

The financial details of the proposed venture are presented in Schedules 1 through 17.

The promoter would have to mobilize $2.98 million to meet fixed assets and working capital requirements: $2.21 million in foreign currency and the equivalent of $771,000 in local currency. The projected figures reflect optimal operating conditions at nominal maximum capacity without taking into consideration productivity factors and provisions for possible debt servicing.

Even under these conditions, the project has a marginal profit-making potential. During the first two years of operation, it can be expected to lose $540,000, and during its entire five-year life-span it should generate a total profit of only $528,000.

Translated into a simple rate of return on investment, the project will return only 17.7 percent through profits and 34.8 percent through profit and depreciation accounts.

Even though the project has a potential for generating a cumulative cash flow of $1.82 million by the end of the fifth year, the replacement schedule of fixed assets will require at least $3.9 million the following year.

The project has a very high break-even point and it is extremely sensitive to any cost and price changes. Its safety margin, expressed as a percentage of the "selling price" at which it would break even, is only 9.1 percent. A 10 percent increase in costs would shift the break-even point to capacity utilization of 100 percent.

Schedule 1
Initial capital investment costs
(in $000)

Item	Investment category	Foreign currency	Local currency	Total
1	Rehabilitation of existing equipment		240	240
2	22 new trucks	1,540		1,540
3	8 new tractors	200		200
4	47 new containers on wheels	470		470
5	Initial capital investment costs	2,210	240	2,450

Schedule 2
5-year capital investment schedule
(in $000)

Category	Year 1	Year 2	Year 3	Year 4	Year 5	.....	Total
trucks	1,780	140	70	140	70		2,200
tractors	200		25		25		250
containers	470	30	30	40	40		610
Total	2,450	170	125	180	135		3,060

Schedule 3
Depreciation schedule
(in $000)

Item	Category	Depreciation term	Residual value
1	Buildings	unknown	unknown
2	Existing equipment	6-year straight line	10 percent
3	New trucks	6-year straight line	10 percent
4	New tractors	6-year straight line	10 percent
5	New containers	6-year straight line	10 percent

Annual depreciation

Item	Category	Year 1	Year 2	Year 3	Year 4	Year 5
1	Buildings (estimate)	45	45	45	45	45
2	Existing equipment	40	40	40	40	40
3	New trucks	231	252	263	284	294
4	New tractors	30	30	34	34	38
5	New containers	71	75	80	86	92
6	Annual totals	417	442	462	489	509

Schedule 4
Surcharge computation on indirect wages and salaries

1. Effective working days per year

Number of days per year	365
less Sundays	52
less Saturdays	52
Number of paid days	261

Deductions for paid unproductive days:

Official holidays	12
Leave according to law	15
Sickness according to law	15
Total paid unproductive days	-42
Effective working days	219

2. Computation of surcharge due:

	Percentage
Social security (ONA)	3.0
ONA on unproductive days: (42 : 219) = 19.2% 3% on 19.2%	0.6
Employment tax	2.0
Allowances:	
leave equivalent to 15 days	
sickness equivalent to 15 days	
annual bonus equivalent to 30 days	
corresponds to (60 : 219) x 100	27.4
Total surcharge	33.0%

Schedule 5

Indirect manning and payroll table
(in $000)

Function	Number	Base salary	Surcharge	Total per Function
General Manager	1	72.0	23.8	95.8
Deputy Manager	1	36.0	11.9	47.9
Chief Accountant	1	24.0	7.9	31.9
Personnel Manager	1	24.0	7.9	31.9
Operations Manager	1	24.0	7.9	31.9
Fleet Service Mgr	1	24.0	7.9	31.9
Office staff	6	26.4	8.7	35.1
Service staff	13	40.6	13.4	54.0
Totals	25	271.0	89.4	360.4
Employer's contribution to health insurance				7.5
	Total			367.9

Schedule 6
Annual administrative overheads (in US $1,000)

Item	Cost component	Amount
1	Payroll	368
2	Insurance	36
3	Utilities	24
4	Contingencies	43
5	Total	471

Schedule 7
Annual maintenance costs
(in $000)

1. Provisions for spare parts

1.1 Rehabilitated equipment

20 percent of average new equipment value spread over the 6-year estimated life span, or 38.5 thousand dollars per annum.

1.2 New equipment

20 percent of new equipment value spread over the 6-year estimated life span of equipment. Per annum values: trucks, 2.3; tractors, 0.8; containers, 0.3.

2. Provisions for contract maintenance

10 percent of new equipment value spread over the 6-year estimated life span of equipment. Per annum values: trucks, 1.2; tractors, 0.4; containers, 0.1.

Item	Category	Year 1	Year 2	Year 3	Year 4	Year 5
1	Spare parts, trucks	127	131	133	138	140
2	Spare parts, tractors	6	6	7	7	8
3	Spare parts containers	14	15	16	17	18
4	Maintenance, trucks	66	68	70	72	73
5	Maintenance, tractors	2	2	3	3	3
6	Maintenance, containers	5	5	5	6	6
7	Totals	220	227	234	243	248

(the figures are rounded up to the nearest thousand)

Schedule 8
Surcharge computation on direct labor wages

1. Effective working days per year

Number of days per year	365
less Sundays	52
less Saturdays	52
Number of paid days	261

Deductions for paid unproductive days:

legal holidays	12
leave according to law	15
sickness according to law	15
tolerated absenteeism	15
Total paid unproductive days	-57
Effective working days	204

corresponds to (57 : 204) x 100 = 27.9%

2. Computation of surcharges due to:

	Percentage
Paid unproductive days	27.9
Social security (ONA)	3.0
Medical insurance (OFATMA)	2.0
Social insurance on unproductive days: 5% of 27.9%	1.4
Employment tax	2.0
Allowances:	
leave equivalent to 15 days	
sickness equivalent to 15 days	
annual bonus equivalent to 30 days	
corresponds to (60 : 204) x 100	29.4
total surcharge	65.7

Schedule 9
Computation of direct costs per truck
(in $000)

1. Effective working days per vehicle

Number of days per year	365
less legal holidays	-12
less maintenance days	-12
Effective working days per vehicle	341
less effective working days per crew	-204
Additional crew days required	137

corresponds to: (137 : 204) x 100 = 67.2%

2. Annual base wage per crew

1 driver	$3,600
3 loaders	5,400
Total	9,000

3. Annual direct cost per truck

3.1 Wages

base wage for crew	$9,000
65.7% surcharge on wages	5,913
67.2% surcharge for additional crew	10,021
Direct labor cost per truck	24,934

3.2 Fuel

Effective working days	341
gallons per day	18
cost per gallon	$1.70
Cost of fuel per truck	10,435
Total direct cost per truck	35,369

Schedule 10
Computation of direct costs per tractor
(in $000)

1. Effective working days per tractor

Number of days per year	365
less Sundays	-52
less legal holidays	-12
less maintenance days	-12
Effective working days per tractor	289
less effective working days per crew	204
Additional crew days required	85

corresponds to (85 : 204) x 100 = 41.7%

2. Annual base wage per crew

1 driver	$3,600
1 helper	1,800
Total	5,400

3. Annual direct cost per tractor

3.1 Wages

base wage for crew	$5,400
65.7% surcharge on wages	3,548
41.7% surcharge for additional crew	3,731
Direct labor cost per tractor	12,679

3.2 Fuel

effective working days	289
gallons per day	18
cost per gallon	$ 1.70
Cost of fuel per tractor	8,843
Total direct cost per tractor	21,522

Schedule 11
Operating cost estimate
(in $000)

Cost Component	Year 1	Year 2	Year 3	Year 4	Year 5
Production program	55%	80%	100%	100%	100%
Administrative overheads	471	471	471	471	471
Maintenance	110	182	234	243	248
Direct cost	1,165	1,759	2,245	2,316	2,373
Net operating costs	1,746	2,412	2,950	3,030	3,092
Depreciation	417	442	462	489	509
Debt Servicing	-	-	-	-	-
Total operating costs	2,163	2,854	3,412	3,519	3,601

(The production program is expressed as percentage of Nominal Maximum Capacity)

Schedule 12
Calculation of working capital

1. Minimum requirements of current assets and liabilities

1.1 Accounts receivable: 105 days at net operating costs.
Coefficient of turnover: 3.5

1.2 Accounts payable: 30 days for fuel, maintenance and utilities
Coefficient of turnover: 12

1.3 Inventory: 30 days for fuel at purchase cost.
Coefficient of turn-over: 12

1.4 Cash in hand: 15 days for net operating costs less accounts payable. Coefficient of turnover: 24.

Computation of accounts
(in $000)

Item		Year 1	Year 2	Year 3	Year 4	Year 5
1.	Accounts receivable	1,746	2,412	2,950	3,030	3,092
2.	Accounts payable					
	Fuel	354	532	685	706	725
	Maintenance	110	182	234	243	248
	Utilities	60	60	60	60	60
	subtotal	524	774	979	1,009	1,033
3.	Cash in hand	1,222	1,638	1,971	2,021	2,059
4.	Fuel inventory	30	44	58	59	60

Schedule 13
Working capital requirements
(in $000)

Item	Category	Year 1	Year 2	Year 3	Year 4	Year 5
A.	CURRENT ASSETS					
	Cash in hand	51	68	82	84	86
	Accounts receivable	499	689	843	866	883
	Inventory	30	44	58	59	60
	Total	580	801	983	1,009	1,029
B.	CURRENT LIABILITIES					
	Accounts payable	49	65	82	84	86
C.	WORKING CAPITAL					
	Net working capital	531	736	901	925	943
	Increase	-	205	165	24	18

Schedule 14
Net income statement
(in $000)

Computation of "Selling Price" per ton

The standard cost per ton is based on 3-year production averages at Nominal Maximum Capacity:

Total operating costs ($000)	3,511
Tonnage collected (1,000 tons)	320
Standard cost per ton	$10.97
Assumed gross profit of 10 percent	1.10
"Selling Price" per ton	$12.07

Net income statement

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Tonnage collected (1,000)	145	226	300	319	342
Revenues	1,750	2,728	3,621	3,850	4,128
Total operating costs	2,163	2,854	3,412	3,519	3,601
"Accounting profit"	- 413	- 126	209	331	527
Cumulative profit	- 413	- 539	- 330	+ 1	+ 528

Schedule 15
Cash-flow table for financial analysis
(in $000)

Total investment schedule
(in US $1,000)

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Capital investments	2,450	170	125	180	135
Working capital	531	205	165	24	18
Total	2,981	375	290	204	153

Cash-flow statement
(in $000)

Item	Year 1	Year 2	Year 3	Year 4	Year 5
A. CASH INFLOW					
Financial resources	2,981	-	-	-	-
Revenues	1,750	2,728	3,621	3,850	4,128
Total inflow	4,731	2,728	3,621	3,850	4,128
B. CASH OUTFLOW					
Total for assets	2,981	375	290	204	153
Net production cost	1,746	2,412	2,950	3,030	3,092
Total outflow	4,727	2,787	3,240	3,234	3,245
C. SURPLUS/DEFICIT	- 4	-59	+381	+616	+883
D. CUMULATIVE BALANCE	-4	-63	318	934	1,817

Schedule 16
Investment profitability analysis
(Pay-back period method)

A. Initial investment (in $000)

Capital investment	2,450
Working capital	531
Total	2,981

B. Amount "paid-back" each year (in $000)

Year	Net Profit	Depreciation	Paid-back
1	-413	417	4
2	-126	442	316
3	+209	462	671
4	+331	489	820
5	+527	509	1,036

C. Computation of pay-back period (in $000)

	Amount paid-back	End of year balance
Initial Investment		2,981
Year 1	4	2,977
Year 2	316	2,661
Year 3	671	1,990
Year 4	820	1,170
Year 5	1,036	134

Schedule 16 (continued)
Investment profitability analysis
(Simple rate of return method)

A. Parameters

Rn: ratio of the profit for a given year to the original investment outlay (fixed assets, pre-production expenses, net working capital)

P: "accounting profit" for the year

D: annual depreciation for the year

K: total initial investment costs

Rate of return on profit only: (P : K) x 100

Rate of return on profit and depreciation: [(P + D) : K] x 100

B. Computation

Year	Rate of return on profit only	Rate of return on profit and depreciation
1	loss	0.1%
2	loss	10.6%
3	7.0%	22.5%
4	11.1%	27.5%
5	17.7%	34.8%

Schedule 17
Project sensitivity analysis

A. Parameters

The parameters are based on 3-year averages of production factors at Nominal Maximum Capacity:

Revenue in US $1,000 (r)	3,866
Production in 1,000 tons (x)	320
"Selling price" per ton in US$ (p)	12.07
Fixed costs in US $1,000 (f)	1,200
Variable costs in US $1,000 (c)	2,311
Variable cost per ton in US$ (v)	7.22

B. Analysis

1.	The break-even point would be reached at production level of	247,422 tons
2.	The break-even point would be reached at capacity utilization of	77.2 percent
3.	The "selling price" at which the project would break even is	10.97 US dollars
4.	The project safety margin expressed as percentage of "selling price" is	9.1 percent
5.	A 10 percent increase in production costs would shift the break-even point to	319,613 tons
6.	The increased break-even point would shift the capacity utilization to	99.7 percent

Chapter 9

RECYCLING ALTERNATIVES

9.1 General

The increasing quantity of solid waste is a serious environmental problem in Port-au-Prince. Presently, wastes are burned, buried, or simply dumped in any open space. In certain sections of the metropolitan area where population densities are high and the throw-away life style is increasingly adopted, the tremendous quantity of waste poses serious disposal problems. Composting the organic component of garbage is one solution.

9.2 Composting

9.2.1 Existing Composting Plant

Composting was considered as an alternative to disposal, and a 2,500 tons/day plant purchased in 1980 was assembled at a site north of Port-au-Prince, near the SMCRS headquarters. The plant never functioned at a capacity of more than 5 percent and was closed after two years because of the high operation and maintenance cost and the deficient quality of the compost.

A preliminary assessment of the plant indicated that an extensive overhaul of the process equipment and replacement of conveyors will be required for it to function again. A more precise estimate of the initial investment would require a detailed mechanical appraisal. But the cost of rehabilitation and operation and maintenance would be high, and the organic material available from garbage is not sufficient to maintain the plant at full capacity. In addition, the plant requires highly skilled operators.

Based on the above considerations, a detailed technical and economic feasibility study must precede any attempt at rehabilitation.

9.2.2 Other Composting Methods (Nonmechanical)

Solid waste collected in areas like Cité Soleil and Carrefour contains a high level of organic material. For the purpose of this analysis, however, only the garbage collected from the Carrefour section was considered for compost production.

The following assumptions were used to develop a composting program:

Composting method: with forced aeration
Windrow capacity: 500 m^3
Windrow dimensions: 10m X 50m X 2m (triangular in cross section)
Process location: site near proposed south landfill
Content of organic material: 80 percent
Separation of organic/nonorganic material at collection point
Composting period: 120 days
Treatment capacity: 200 tons/day

Initial investment

Site Preparation	
Excavation and drainage	$ 20,000
Surface preparation	$ 780,000
Pipes	$ 30,000
Total	$ 830,000
Equipment	
Front loader	$ 85,000
Exhaust fan	$ 30,000
Miscellaneous	$ 5,000
Total	$120,000
Total initial investment	$ 950,000

Maintenance, repair, and operation costs

12% Total cost	$ 114,000
Operation Costs	
Salaries/year	
1 Site manager	$ 24,000
1 Operator	$ 3,000
5 Labors	$ 9,000
Subtotal	$ 36,000
Surcharge 30%	$ 10,800
Contingency 10%	$ 4,680
Total Salaries	$ 51,480
Depreciation	
Front loader	$ 12,200/year
Misc. equip.	$ 5,000/year
Total	$ 17,200/year

9.3 Need for Additional Studies

The cost analysis should be validated by a feasibility study, where the assumptions made to determine the cash flow are calculated on actual values obtained from a field survey. The economic analysis should include a cost comparison (utilization of the existing compost plant versus the nonmechanical method) and an assessment of socioeconomic benefits.

Chapter 10

IMPACT OF INADEQUATE WASTE COLLECTION AND PROPOSED IMPROVEMENT

10.1 General

The conditions observed during the field reconnaissance were deplorable. Piles of solid waste have accumulated in almost every empty space, on the streets, and at intersections, affecting other sectors of the city's infrastructure and the health of the population, and breeding widespread apathy (see Photograph 3).

10.2 Impact of Present Conditions

10.2.1 Impact on the City Infrastructure

The trash discharged in the streets is carried into the drainage system, clogging pipes and ditches and forcing water to find its way down the streets until it reaches flat areas where it stagnates. In some locations, after a heavy rain, an accumulation of 20 to 30 cm. of mud, sludge, and garbage is not unusual (see Photograph 4). The damage is enormous and is reflected in the poor condition of the streets, especially on high ground where streets are subject to erosion.

The IDB has financed Phase II of an improved drainage system. Construction is scheduled to start early in 1990. The project includes the rehabilitation of drainage sections built during Phase I, some of which have been permanently damaged by the accumulation of waste.

10.2.2 Impact on the Health of the Population

In addition to the solid waste indiscriminately discharged, small amounts of trash collected in some parts of the city are dumped in temporary landfills located downtown or in open spaces. During the rainy season, these accumulations become an ideal breeding places for disease-producing organisms. During the dry season they generate contaminated dust that blows over the city (see Photographs 5 and 6).

Photo 3:

Garbage Accumulation in Streets

Photo 4:

Garbage and Mud Accumulation

Photo 5:

Water Contamination

Photo 6:

Temporary Landfill—
Bicentenaire

10.2.3 Impact on Economic Development

The economic development of the city has suffered in the general climate of apathy towards the mounting accumulation of filth (photograph 7). This situation has not only impeded commercial growth but has deterred the development of tourism.

10.2.4 Impact on Air Quality

The industrial activities in Port-au-Prince have no impact on air quality. However, the heavy traffic and unpaved streets are responsible for concentrations of dust and other pollutants. This situation is aggravated by the presence of huge piles of trash (see Photograph 8). The air is constantly laden with contaminated dust and unpleasant odors, especially near the temporary landfills.

10.2.5 Impact on Quality of Life

The combination of all these conditions has drastically diminished the quality of life. Improving the collection and treatment of solid waste should upgrade the infrastructure of the city and the environment, bringing a transformation that will be reflected not only in the general health of the population, but also in the quality of life and in a greater awareness of civic responsibility (see Photograph 9).

10.3 Impact of Improved Collection and Treatment of Solid Waste

10.3.1 General Considerations

Any of the alternatives described in Chapter VII would improve existing conditions. However, for purposes of this study the benefits of the do-nothing alternative and of Alternative II were compared with the present situation. Two scenarios were considered for Alternative II: landfill versus landfill composting. The environmental impacts are summarized in Table 9.

10.3.2 Improvement from Do-nothing Alternative

If present conditions are allowed to continue there would be even graver consequences for public health. The recommendations listed below are the minimum requirements under the do-nothing alternative.

- Close all temporary landfills
- Rehabilitate Landfill I
- Purchase new treatment equipment
- Rehabilitate all collecting equipment
- Reinstate early collection hours

Photo 7:

Indiscriminate
Garbage Disposal

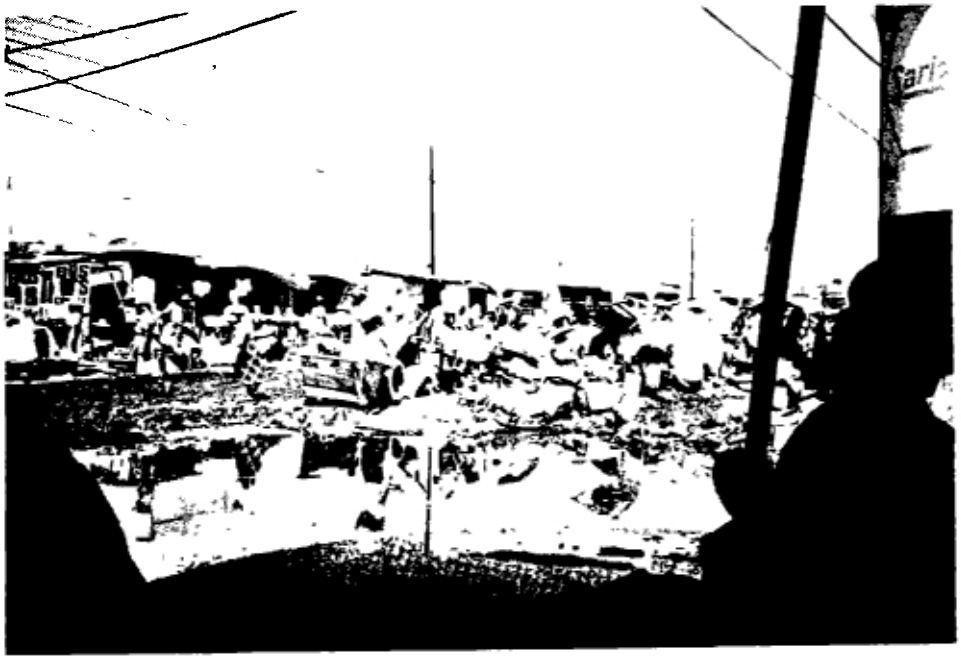

Photo 8:

Unhealthy
Environment

TABLE 9

SUMMARY OF ENVIRONMENTAL IMPACTS

Impact on	Existing conditions			Solutions: "Do nothing"			Alternative II			Alternative II/recycl.		
	+	+/-	-	+	+/-	-	+	+/-	-	+	+/-	-
Infrastructure												
- Transportation	-	-	o	o (p)	-	-	o	-	-	o	-	-
- Traffic flow	-	-	o	o (p)	-	-	o	-	-	o	-	-
- Drainage system	-	-	o	o (p)	-	-	o	-	-	o	-	-
- Erosion	-	-	o	o (p)	-	-	o	-	-	o	-	-
- Stagnation	-	-	o	o (p)	-	-	o	-	-	o	-	-
Water Pollution	-	-	o	o (p)	-	-	o	-	-	o	-	-
Air Quality												
- Gases	-	-	o	o (p)	-	-	o	-	-	o	-	-
- Dust	-	-	o	o (p)	-	-	o	-	-	o	-	-
- Odors	-	-	o	o (p)	-	-	o	-	-	o	-	-
Ecology	-	-	o	o (p)	-	-	o	-	-	o	-	-
Economic Development												
- Land Use												
. Urban	-	-	o	o (p)	-	-	o	-	-	o	-	-
. Agriculture	-	o	-	-	o	-	-	o	-	o	-	-
- Commerce	-		o	o (p)	-	-	o	-	-	o	-	-
- Tourism	-	-	o	-	o	-	o	-	-	o	-	-
Health	-	-	o	o(p)	-	-	o	-	-	-	-	-
Quality of Life	-	-	-	-	o	-	o	-	-	o	-	-

-Legends: + positive impact, +/- not significant impact, - negative impact
(p) partial

The maximum collection capacity at present is estimated to be 500 tons/day, which represents only 50 percent of the total waste production. However, implementation of this alternative, which should be considered no more than a temporary expedient, should least effect the following improvements:

- Drainage

  In areas where collection is regular, the drainage system will function more efficiently, erosion may be reduced, and water will flow where it is supposed to.

- Health

  The reduction of garbage on the streets and the closure of the downtown landfills should have an effect on the health of the population (see Photograph 9).

- Economic Development

  A cleaner city should show some improvement in economic growth, especially in the development of tourism.

- Air Quality

  Air quality will improve since the temporary landfills, the main source of air contamination, will be closed.

- Quality of life

  The do-nothing alternative is only a temporary solution. But to the extent that more garbage will be dumped outside the city limits, the transportation system, traffic regulations, and the overall appearance of the city will improve markedly, bringing about a corresponding improvement in the quality of life.

10.3.3 Alternative II

Alternative II considers the collection and disposal of all solid waste in the metropolitan area of Port-au-Prince and proposes to:

- rehabilitate Landfill I and open a new Landfill II
- rehabilitate all existing equipment
- purchase new treatment equipment for both landfills
- purchase new collecting equipment
- reinstate early collection hours

Alternative II should be considered a short-term response to a crisis. A long-term solution should include a recycling program. But any action to achieve a reversal of present conditions will require the full cooperation of the population, without which even an efficient program of waste management will not succeed.

Alternative II should realize the following improvements:

- Infrastructure

  The elimination of trash on the streets and in the drainage system will have a positive impact on transportation and the disposal of waste water.

Photo 9:

Hazardous Conditions—Cité Soleil

Photo 10:

Sources of Contamination

The traffic flow will improve with the better condition of the streets and the reestablishment of early hours for trash collections (see Photograph 10). The most significant effects of improved traffic flow will be a decrease in travel time, reduction of air pollution, and driving safety. Shortened travel times will result in a reduction in the cost of travel, a corresponding reduction in cars on the road, and lower vehicular operating costs.

Improved drainage will halt the erosion of streets and the accumulation of stagnant water caused by the accumulation of waste in ditches and pipes.

- Health

  Closure of the temporary landfills and adequate collection of waste will help to eliminate most of the problems of water and air contamination.

  In addition, improved traffic flow will reduce air pollution and accidents, and permit the delivery of better medical emergency services (see Photograph 11).

- Economic Development

  The potential economic benefits of adequate garbage collection are:

  - improvement in the health of the population and a consequent improvement in the efficiency of the work force
  - improvement in the overall appearance of the city
  - a more efficient transportation system
  - improved traffic flow, especially during rush hours
  - potential elimination of water-related illnesses
  - more efficient use of infrastructure maintenance and repair funds

- Air Quality

  The improved traffic flow and the elimination of piles of trash will reduce air pollution.

- Quality of Life

  All the benefits listed above will combine to upgrade the quality of life.

Photo 11:

Traffic Congestion

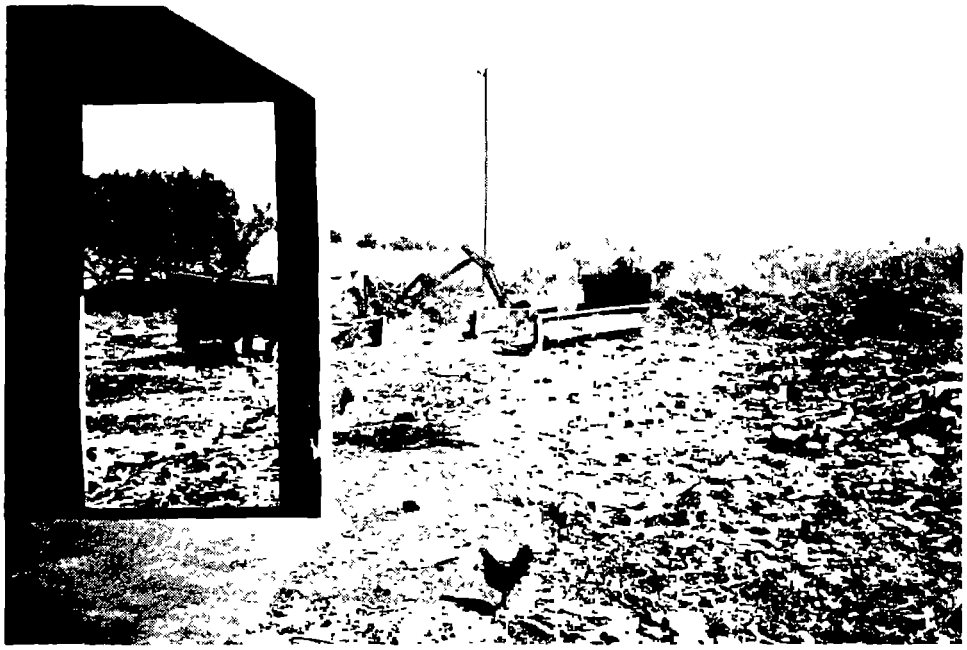

Photo 12:

Landfill at Truitier

10.3.4 Recycling of Solid Waste

Alternative II is a vehicle for immediate action. A long-term solution should include a recycling program. Composting and biogas are the most logical considerations in view of the high organic content in the garbage, especially in the poorer sections of the city.

A recycling program that supplemented Alternative II would add these benefits:

- Extend the life of the landfills
- Improve the land use in areas close to Port-au-Prince
- Develop new sources of income
- Help programs for in-home separation of organic and inorganic materials
- Develop new sources of energy
- Provide compost for use in agriculture

Chapter 11

CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The privatization of solid waste collection and disposal services in Port-au-Prince, as proposed by the promoter, is not feasible. However, an alternative based on the following factors should be explored further:

- The municipal and central governments have failed to provide the community with the necessary services, even though outside funds were made available.
- This government failure has contributed to the emergence of an informal private sector which provides the services to segments of the population willing to pay for them.
- The production, disposal, and management of waste remain unregulated.
- The absence of regulations has encouraged indiscriminate dumping by both the informal private sector and the government agencies responsible for "official" collection and disposal of waste free of charge.

The recommendations that follow are based on three findings:

1. The metropolitan area of Port-au-Prince is highly segmented. The WASH team has identified the following market segments of solid waste producers.
   - The residential segment of Petion-ville and Delmas, with at least 60,000 households ranging from lower-middle class to highly affluent
   - The commercial segment, with more than 3,000 enterprises in the services and distribution sectors
   - The industrial segment, with more than 1,000 enterprises in the small- and medium-scale manufacturing sector
   - The unregulated popular open markets, with an unknown number of vendors plying their trades
   - The residential segment concentrated around downtown Port-au-Prince, with a population of about one million, ranging from poor to below poverty level

2. Some in the first three segments are already paying the informal sector for waste collection, while others prefer to depend on free but unsatisfactory government services. The penetration of market segments by the informal sector is very uneven and without any discernible pattern. The following conditions have been identified:

   - Waste collection in Petion-ville and Delmas is almost exclusively in the hands of the informal sector. The annual fees appear to range from $120 to $180 per year per household.

   - Waste collection in the more affluent commercial segment also depends almost exclusively on the services of the informal sector. In the less affluent areas and in downtown Port-au-Prince on the other hand, it depends exclusively on free government services, with garbage dumped on the sidewalks for pick-up.

   - No information is available on solid waste disposal in the industrial segment. It would appear, however, that only a handful of the bigger and more image-conscious enterprises use the services of the informal sector, while the majority tend to depend on free government services.

   - Finally, the vendors in the open markets and leave their garbage wherever they ply their business, while people in the poor residential segment are resigned to dumping their waste on the streets and sidewalks.

3. The informal sector's share of the total market and the size of its revenues are almost impossible to determine since it operates with total impunity outside the legal and institutional framework. Nevertheless, there are indications that informal waste collection and disposal is at least a $6 million-a-year industry.

11.2 Recommendations

The GOH should consider the following actions:

1. Appropriate legislation and strictly enforceable regulations governing the production, collection, and disposal of residential, commercial, and industrial solid waste.

2. Creation of a fully autonomous solid waste management authority governed by a board of directors consisting of civic, business, and religious leaders, and empowered to assess and collect fees in the affluent market segments and to administer solid waste collection and disposal contracts.

3. Segmentation of the metropolitan area of Port-au-Prince into contract zones, and creation of a mechanism for selecting competitive bids for solid waste collection and disposal from local entrepreneurs.

To assist the GOH in taking these steps, USAID should consider providing the following support:

1. Conduct a market survey of at least six weeks' duration to determine:

   - the number of garbage collection entrepreneurs and the market segments they cover
   - the number of households and enterprises in each segment
   - the actual and maximum fee-raising potential of each segment

2. Conduct a parallel study to determine whether:

   - composting is practical and, if so, what the size of the private, donor, and foreign markets for compost is
   - a landfill operation can be managed through the private sector

3. Conduct a follow-on study, based on the results above, to determine:

   - the most appropriate regulatory framework and enforceable regulations
   - a mechanism for rate assessments and for recovering fees from households/enterprises
   - the cost and best method of fee collection (including possible use of a private contractor)
   - how to set up a solid waste management authority
   - how to zone the total market by building upon de facto arrangements and involving small- and medium-sized entrepreneurs in garbage collection

APPENDIX A

Equipment Inventory

APPENDIX A

Equipment Inventory

The list indicated below includes the entire fleet of SMCRS, the conditions and the estimated present value.

License	Description	Conditions	Res. Value	Capacity
21807	Mack Red	Out of Service	5000	15
21811	Ford Coat	Out of Service	3000	5
21832	Mack Red	Out of Service	5000	15
21836	Nissan BTP	Service/Poor	3000	5
23108	Mack Blank	Out of Service	3000	-
23115	Toyota	Service/Poor	2000	4
23118	Toyota	Out of Service	2000	4
23122	Toyota	Service/Poor	2000	4
23124	Renault	Service	20000	8
23440	Sitalift	Out of Service	5000	-
23441	Sitalift	Out of Service	5000	-
23442	Renault	Out of Service	5000	15
23443	Sitalift	Service	10000	-
23444	Sitalift	Service	10000	-
23445	Sitalift	Service	10000	-
23446	Renault	Out of Service	5000	8
23448	Renault	Out of Service	5000	15
23449	Sitalift	Service	10000	-
23451	Renault	Out of Service	5000	15
23452	Sitalift	Out of Service	5000	-
23540	Renault	Service	20000	15
23542	Renault	Out of Service	2000	5
23543	Renault	Out of Service	5000	15
23551	Renault	Out of Service	2000	5
23557	Toyota	Service	9000	8
23559	Renault	Service	20000	15
23561	Toyota	Service	9000	8
23562	Toyota	Service	9000	8
23563	Renault	Service	20000	15
23564	Toyota	Service	9000	8
23565	Toyota	Service	9000	8
23566	Toyota	Service	9000	8
23567	Renault	Service	20000	15
23568	Renault	Service	20000	15
23569	Toyota	Service	9000	8
23570	Renault	Service	20000	15
23571	Toyota	Service	9000	8
23572	Toyota	Service	9000	8
23573	Renault	Service	20000	15
20439	Toyota	Service	9000	8
23546	Toyota	Service	9000	8
Total			368000	331


WASH