

Table J.3-1 Phased Improvement Plan

Items	Phase Year	Immediate Improvement	1992	Phase I	1995	1997	1998	Phase II	2000
1. Collection & Other Cleansing Works		<ul style="list-style-type: none"> <li>- Preparation of weekly and monthly working schedule</li> <li>- Collection of data regarding amount of waste collected.</li> <li>- Stimulation of the community cooperation for cleaning up its surroundings.</li> </ul>		<ul style="list-style-type: none"> <li>- Extension of collection service area.</li> <li>- Establishment of appropriate transfer system for the institutional waste.</li> <li>- Establishment of public cooperation for cleaning up road and drain.</li> <li>- Establishment of proper operation and maintenance system.</li> </ul>				<ul style="list-style-type: none"> <li>- Extension of collection service to whole Vientiane urban area</li> </ul>	
2. Final Disposal		<ul style="list-style-type: none"> <li>- Securing land for the KM 18-DS.</li> <li>- Provision of a record of incoming vehicles.</li> <li>- Improvement of tipping fee collection system</li> </ul>		<ul style="list-style-type: none"> <li>- Construction and execution of a sanitary landfill level 2 at the KM 18-DS; Area = 8 ha.</li> <li>- Establishment of an organization for final disposal.</li> </ul>				<ul style="list-style-type: none"> <li>- Construction and execution of the sanitary landfill level 3 at the KM 18-DS; Area = 13 ha</li> </ul>	
3. Organization & Manpower		<ul style="list-style-type: none"> <li>- 48 persons</li> <li>- 4 persons</li> <li>- 7 persons</li> <li>-(8 persons)</li> </ul>		<ul style="list-style-type: none"> <li>- Establishment of USD</li> <li>- 126 persons</li> <li>- 16 persons</li> <li>- 28 persons</li> <li>-(27 persons)</li> </ul>			<ul style="list-style-type: none"> <li>- 242 persons</li> <li>- 26 persons</li> <li>- 48 persons</li> <li>-(50 persons)</li> </ul>		
4. Financial Plan		<ul style="list-style-type: none"> <li>- 11.9 million kips in 1991</li> <li>- 10.5 million kips in 1991</li> <li>- 0.6 million kips in 1991</li> </ul>		<ul style="list-style-type: none"> <li>- 322 million kips in 1995</li> <li>- 129 million kips in 1995</li> <li>- 2,139 million kips</li> </ul>			<ul style="list-style-type: none"> <li>- 903 million kips in 2000</li> <li>- 132 million kips in 2000</li> <li>- 2,300 million kips</li> </ul>		

- e. It is also proposed that an independent organization for solid waste management called as Urban Service Department which will contribute to specialization will be established in Phase I.

## 2) Discharge and Collection

It is indispensable to get resident's cooperation to expand collection area and to achieve curb and bell collection which requires following discharge manners;

- a. Use of bamboo basket;
- b. To discharge waste once a week designated by the Municipality; and
- c. To bring out waste and discharge at collection point (waste station) designated by the Municipality.

It was recommended that the proposed collection system as well as expansion of collection area should be introduced as a pilot project in a model area and then expanded to other areas. Experience gained through the pilot project was useful in expanding the same system to other areas.

Considering the above conditions, stage plan for discharge and collection is summarized as follows:

### a. Expansion of collection area

- Expansion of collection area up to 50% of residential area and 60% of commercial area of the Vientiane urban area by 1995.
- Expansion of collection area up to the entire Vientiane urban area by 2000.

### b. Establishment of curb and bell collection system both in residential and commercial area.

### c. Introduction of detachable container trucks

- Introduction of communal containers for institutional wastes collection by 1995.
- Expansion of container collection system to the institution and other large generation sources by 2000.

### 3) Road Sweeping and Drain Cleansing

Citizen's cooperation is required to reduce littering of waste.

Littering can be reduced by providing reliable and regular waste collection services, while illegal dumping can be reduced by the strong enforcement of the law. Therefore, the improvement of cleansing services is planned as follows:

- a. Introduction of drain cleansing waste collection through the citizen's cooperation and clean-up services of illegal dumps by 1995.
- b. Expansion of drain cleansing waste collection services to the entire Vientiane urban area by 2000.
- c. Introduction of the following mechanization by 1995.
  - mechanization of grass cutting; and
  - mechanization for collection of road sweeping, drain cleansing and grass cutting wastes.

### 4) Final Disposal

It is financially impractical to construct in Phase I all facilities which would meet the whole disposal demand up to 2000, therefore, the Basic Plan for the KM 18-DS will be implemented as follows:

a. Phase I

The northern section of the disposal site (8 ha) will be used for landfill operation which will be completed at the end of 1994.

- Commencement of construction : beginning of 1994
- Period of landfill operation : 1995 - 1997
- Design disposal amount : 72.3 ton/day (1997)
- Design landfill volume : 123 thousand m<sup>3</sup> (total volume between 1995 and 1997 including covering soil)
- Landfill Site Area : 8 ha

b. Phase II

The southern section of the disposal site (13 ha) will be used for landfill operations which will be completed at the end of 2000.

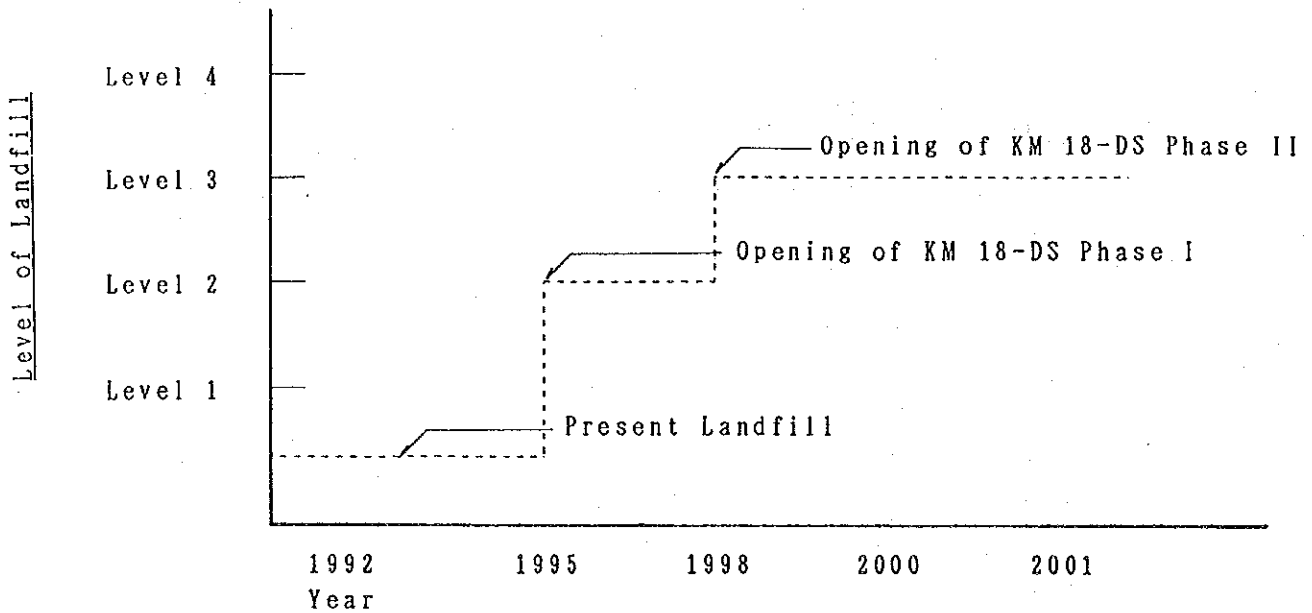
- Commencement of construction : beginning of 1997
- Period of landfill operation : 1998 - 2000
- Design disposal amount : 152.9 ton/day (2000)
- Design landfill volume : 286 thousand m<sup>3</sup> (total volume between 1998 and 2000 including covering soil)
- Landfill Site Area : 13 ha

In view of the facts that the promotion of the project which requires substantial investment against limited financial resources may destroy the financial basis of the Municipality and that the balanced development of the infrastructure (including drainage system) in addition to the solid waste management system is essential for the cost-effective preservation of a healthy environment for urban life, it has been decided that the KM 18-DS to be constructed in Phase I will be within Level 2 where the enclosing bund and daily soil covering will be introduced, and that this will be improved to Level 3 in Phase II onwards.

Upon consideration of the above-mentioned aspects, a stage plan is proposed and illustrated as follows:

- From 1992 to December 1994;  
Improvement of the present landfill operation
- From January 1995 to December 1997;  
Landfill at the KM 18-DS Phase I site (Level 2)
- From January 1998 to 2000;  
Landfill at the KM 18-DS Phase II sites (Level 3)

Based on the above stage plan, the actual site preparation and construction of the KM 18-DS is proposed as shown in Fig. J.3-1 and J.3-2.



Landfill Level and Target Year

Fig. J.3-1 Stage Plan of Final Disposal

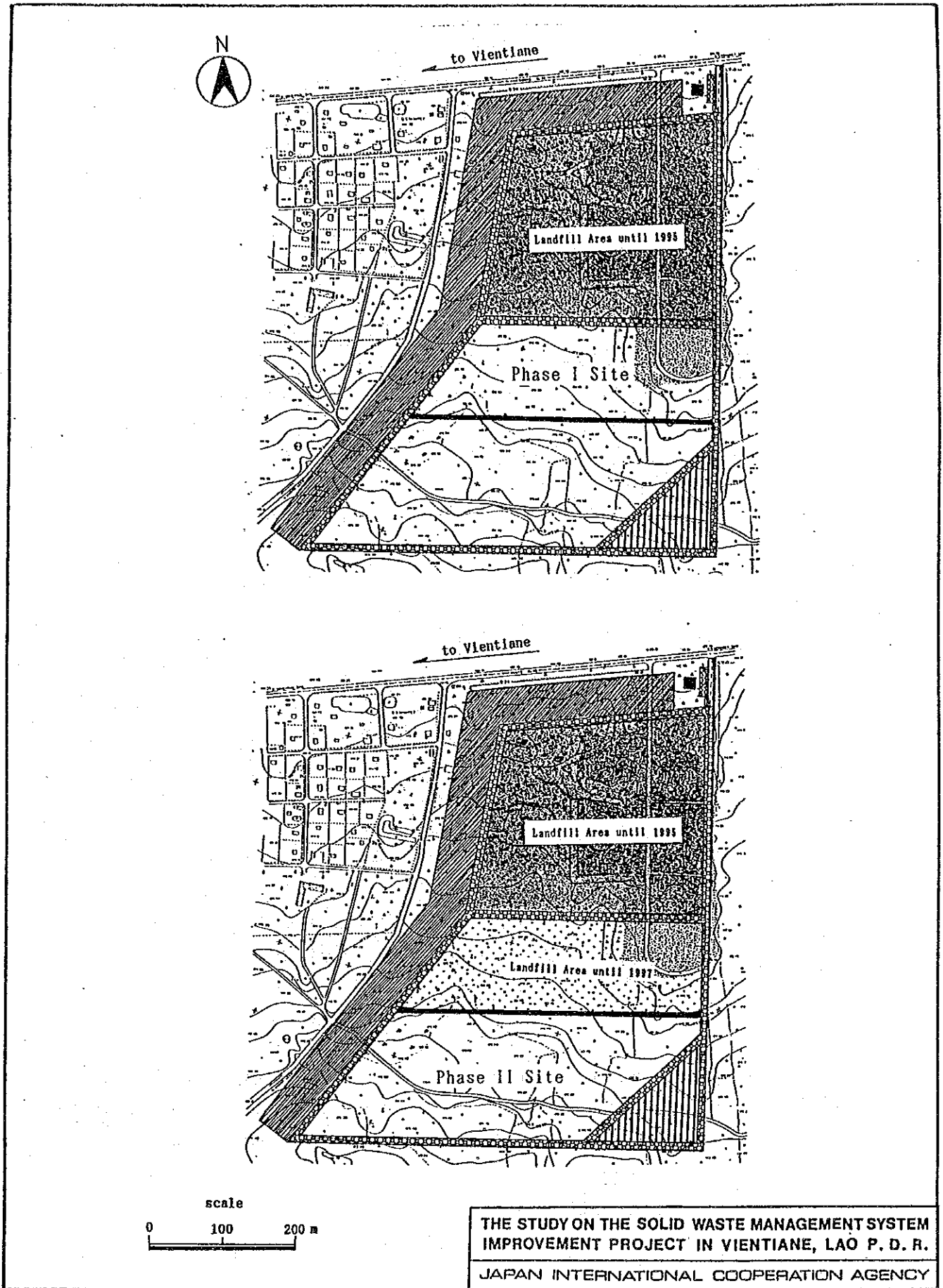


Fig. J.3-2 Staged Development Plan for KM 18-DS

### J.3.2 Financial Plan

#### 1) Major Assumptions

To investigate financial affordability of the Basic Plan, a cash flow is prepared the following assumptions;

##### a. Financial requirement

Total investment cost of the Basic Plan is shown in Section I.2.4, Table I.2-14. Investment plan as shown in Table J.3-2 is prepared with the same idea of economic evaluation as follows;

- i. With regard to vehicle procurement, the number of vehicles procured in 1994 is in accordance to what is required in 1995. The number of vehicles for other years is for additional requirement due to the increase of the waste collected.
- ii. With regard to disposal site, the facility to be constructed in 1994 is set at the level 2 and will be improved to level 3 in 1997. The available year of the disposal site proposed is set only for 6 years in this calculation.
- iii. The construction of maintenance shop is assumed for 1994.

The life of containers, grass cutter and equipment for maintenance is estimated at 5 years, therefore, the additional investment for their renewal is considered in 1999. With regard to disposal site, the same idea is as used shown in Table J.3-2.

Operation and maintenance cost in 2000 is shown in Table I.2-15. The cost of other years is calculated from the waste volume treated in 1995 and 2000 as shown in Table J.3-3 and Table J.3-4.

Table J. 3-2 Investment Plan

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000	Total
Collection								
Vehicle	495	127	127	127	127	127		1,131
Container	159							159
(Renual)						159		159
Final Disposi								
Construction	757			431				1,188
(Renual)							1,188	1,188
Heavy Equipment	258							258
Cleansing Work								
Vehicle etc	171							171
Grass Cutter	6							6
(Renual)						6		6
Maintenance								
Shop	158							158
Equipment etc	8							8
(Renual)						8		8
Total	2,012	127	127	558	127	300	1,188	4,440

Table J. 3-3 Annual Cost for Operation and Maintenance

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000
Personnel Cost		28	32	36	40	45	49
Maintenance Cost		37	42	47	53	58	64
Fuels & Others		124	138	153	167	182	197
Depreciation		271	292	312	405	426	447

Table J. 3-4 Solid Waste to be Treated by USD

(ton/day)

Year	1994	1995	1996	1997	1998	1999	2000
Collection		58.3	72.4	87.4	103.4	120.3	138.2
Disposal		72.3	86.5	101.7	117.8	134.9	152.9



b. Financial source

Financial source proposed for the investment is shown in Table J.3-5. The first investment in 1994 is assumed to be financed from long term loan entailing a 10 years repayment with 3 years grace period and 4 percent interest rate to set up the SWM in Vientiane Municipality. The additional investment for vehicles and equipment is assumed to be financed by the budget of Vientiane Municipality. The investment for the improvement of disposal site is assumed by long term loan an above mentioned.

Financial source for annual expenses is covered with fee and budget from Vientiane Municipality as shown in Table J.3-6. The budget from Vientiane Municipality is considered as public burden. Solid waste covered by the each category of burdens and type of services is shown in Table J.3-7.

The budget from Vientiane Municipality is summarized in Table J.3-9. The burden of Vientiane Municipality is about 25 times of that of 1991.

Table J. 3-5 Financial Source for Investment

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000	Total
Budget								
VM		127	127	127	127	300	0	809
Long Term								
Loan	2,012			431			1,188	3,631
Total	2,012	127	127	558	127	300	1,188	4,440

Table J. 3-6 Financial Source for Annual Expenses

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000
Fee Collection							
Basic Fee		90	133	176	219	262	305
Special Fee		143	160	177	194	211	228
Tipping Fee		25	25	25	26	26	26
Bdget From							
VM		119	119	119	119	119	119
Total		377	437	497	558	619	679

Table J. 3-7 Amount of Waste According the Burdens and Fee

(ton/day)

Year	1994	1995	1996	1997	1998	1999	2000
Burden of							
Houschulus							
Basic Service		25.2	37.3	49.4	61.7	73.8	85.9
Special Service		25.1	28.7	32.3	35.8	39.4	43.0
Burden of							
Establishments							
Special Service		7.1	7.4	7.6	7.9	8.1	8.4
Disposal Service		14.0	14.1	14.3	14.4	14.6	14.7
Public Burden		0.9	0.9	0.9	0.9	0.9	0.9
Total		72.3	88.4	104.5	120.7	136.8	152.9

Table J. 3-8 Tariff Table

(Kips/ton)

Year	1995 ~ 2000
Basic Fee	11,360(=1,270 Kips/month/household)
Special fee	14,200(=1,580 Kips/month/household)
Tipping Fee	5,700

Table J. 3-9 Budget of Vientiane Municipality for Solid Waste

(Unit: million Kips)

Year	1994	1995	1996	1997	1998	1999	2000
For Investment		127	127	127	127	300	0
For Public Burden		119	119	119	119	119	119
Total		246	246	246	246	419	119

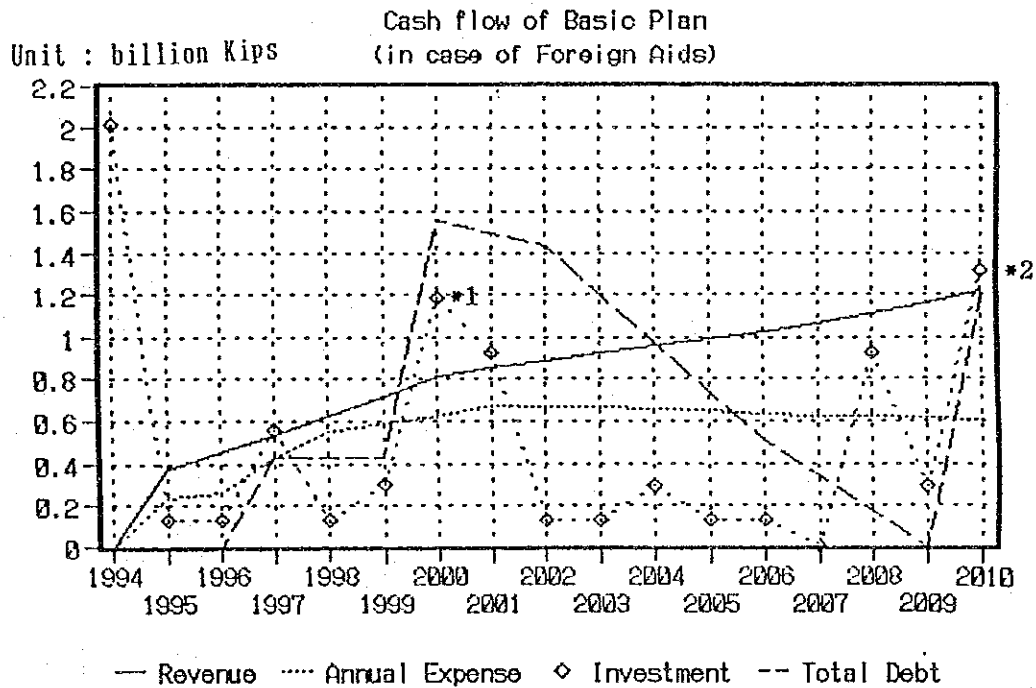
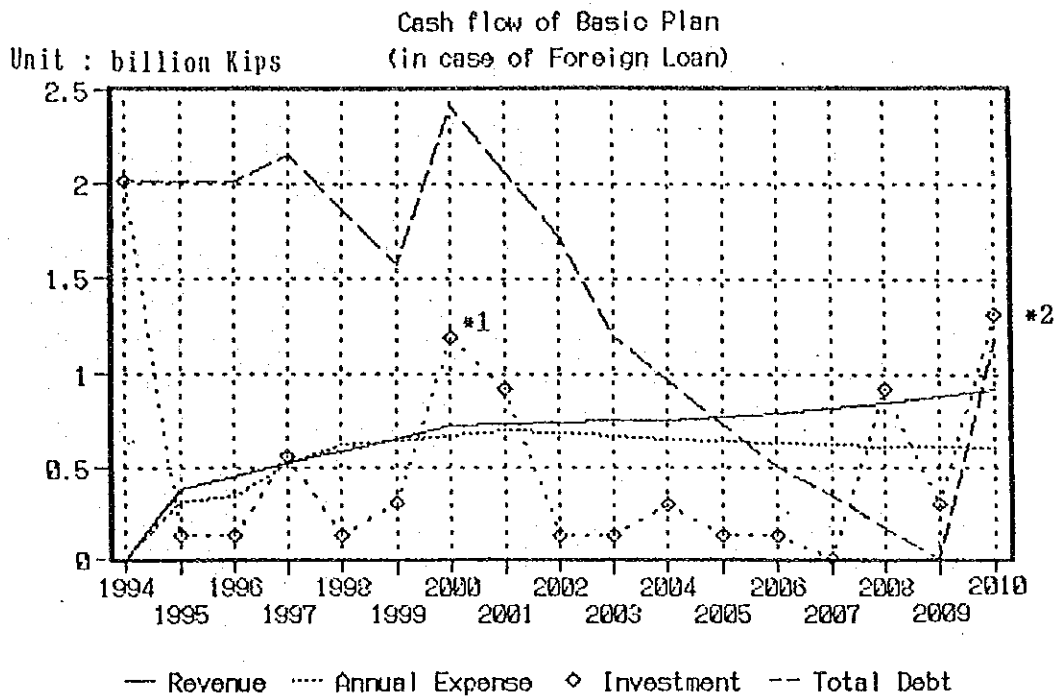
## 2) Result of calculation

The balance sheet shows good indications if the fee is collected successfully. But the total of debt, which includes long term and short term loans, will reach over 2 billion kips in 2000. It is thought to be too much for the financial capability of Vientiane Municipality. If the first investment in 1994 is to be subsidized by foreign aids, the balance will be improved as shown in Fig. J.3-3. The sensibility analysis on important points is done and feasible plan is prepared to establish a suitable financial system in the Feasibility Study. The calculation of longer term, as figured in Fig. J.3-3, also shows the possibility to repay the load if the revenue and annual expenses are maintained at the same level and if the financial source will be acquired similarly.

Table J.3-10 Balance Sheet and Cash Flow of SWM in Vientiane

Balance Sheet							
Unit: million Kips							
Year	1994	1995	1996	1997	1998	1999	2000
Revenue							
Fee Collection							
Basic Fee		90	133	176	219	262	305
Special Fee		143	160	177	194	211	228
Tipping Fee		25	25	25	26	26	26
Budget from VM		119	119	119	119	119	119
Others		0	13	29	32	37	47
Sub-total (A)	0	377	450	527	590	656	725
Expense							
Personnel							
Expenditure	0	28	32	36	40	45	49
Maintenance		37	42	36	40	45	49
Fuel & Others		37	42	47	53	58	64
Fee Collect							
Depreciation		136	146	312	405	426	447
Interest]		80	80	80	86	75	63
Sub-total (B)	0	317	342	513	625	648	671
Balance	0	59	107	14	-35	8	55

Cash Flow							
Unit: million Kips							
Year	1994	1995	1996	1997	1998	1999	2000
Balance	0	59	107	14	-35	8	55
Depreciation	0	136	146	312	405	426	447
Sub-total	0	195	253	326	370	434	501
Money Demand							
Investment	2012	127	127	558	127	300	1188
Loan							
Long Term	0	0	0	287	287	287	349
Short Term	0	0	0	0	0	0	0
Sub-total	2012	127	127	846	415	587	1537
Money Supply							
Budget from VM	0	127	127	127	127	300	0
Foreign Aids	0	0	0	0	0	0	0
Long Term	2012	0	0	431	0	0	1188
Short Loan	0	0	0	0	0	0	0
Sub-total	2012	127	127	558	127	300	1188
Shortage of Money	0	195	253	39	83	146	152
Reserved Fund	0	195	448	487	570	716	868
Total of Debt	2012	2012	2012	2155	1868	1580	2420



Note : Investment (\*1) in 2000 is for the development and construction cost of the disposal site for 10 years from 2001 to 2010 and investment (\*2) in 2010 is for 10 years after 2011.

Fig. J. 3-3 Cash Flow of Basic Plan

### J.3.3 Selection of the First Priority Project

The Basic Plan consists of various projects as described in this chapter. Among the various projects in the Basic Plan, the first priority project regarding the technical system in 1995 is proposed and the outline of that is tabulated in Table J.3-11. The feasibility of the proposed technical system as well as institutional system was studied in Phase 2 of the Study from February 1992 to June 1992, and the result of the study is described in Appendix N of Supporting Report (3).

Table J.3-11 Outline of Proposed Technical System in 1995

Technical Sub-Systems	Contents and Proposed Systems
1. Discharge and Storage	
a. Amount of Generation	160.8 ton/day
b. Amount of Discharge	133.9 ton/day*
c. Type of Refuse Bins	Bamboo baskets for the residential and commercial area, and communal containers for the institutions.
2. Collection and Haulage	
a. Amount of Collection	68.3 ton/day* **
b. Collection Service Ratio	50% for residential area, 60% for commercial area and 100% for the institutions
c. Collection Frequency	Once a week for residential and commercial area, and everyday for the institutional waste in principle.
d. Collection System	Curb collection and bell collection for the residential and commercial area, and station collection for the institutions.
e. Equipment	Dump trucks for the residential and commercial area, and detachable container trucks for the institutional waste.
3. Road Sweeping, Drain Cleansing and Grass Cutting	
a. Service Area	Road Sweeping; 15 km of road same as the present road length for sweeping
	Drain Cleansing; The drains of the 15 km and any drains requested by the residents
	Grass Cutting; 15 km of road same as the present
b. Main Equipment	Road Sweeping; Detachable container trucks and containers, and water trucks
	Drain Cleansing; Small dump trucks and a wheel loader
	Grass Cutting; Grass cutters
4. Processing and Recycling	
a. Processing	No specific facility
b. Recycling Amount	26.9 ton/day
c. Recycling Facility	No specific facility
5. Final Disposal	
a. Disposal Amount	72.3 ton/day**
b. Final Disposal Site	KM 18-DS
c. Area	Available land area; more than 60 ha
	Landfill area; 8.0 ha
d. Final Disposal Method	Sanitary landfill level 2
e. Equipment	A bulldozer, a hydraulic excavator and a dump truck
6. Operation & Maintenance of Equipment	
a. Vehicle Depot	KM 7 Vehicle Depot
b. Maintenance	Preventive maintenance & light repair; KM 7 maintenance shop
	Heavy repair; outside order

Notes; \* The difference of waste amount (65.6 ton/day) between discharge amount and collection amount is derived from self-disposal amount (61.7 ton/day) and direct hauled amount (4.0 ton/day).

\*\* The difference of waste amount (4.0 ton/day) between collection amount and disposal amount is derived from direct hauled amount.



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