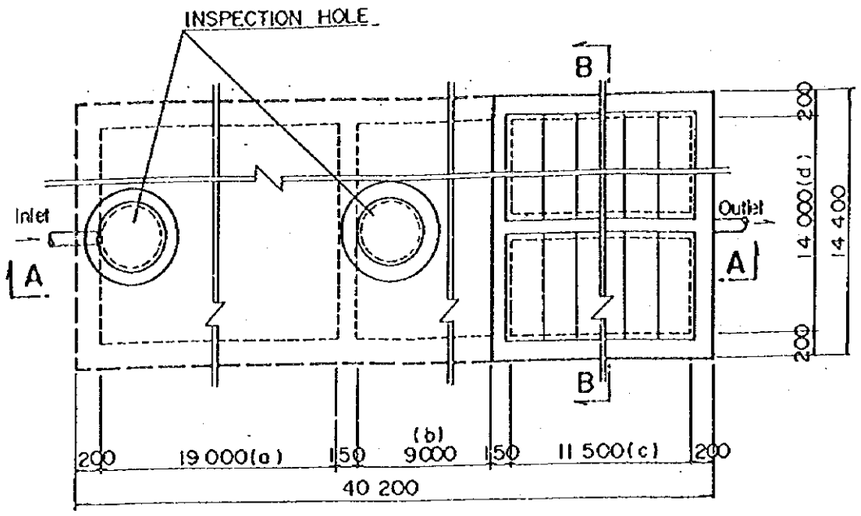

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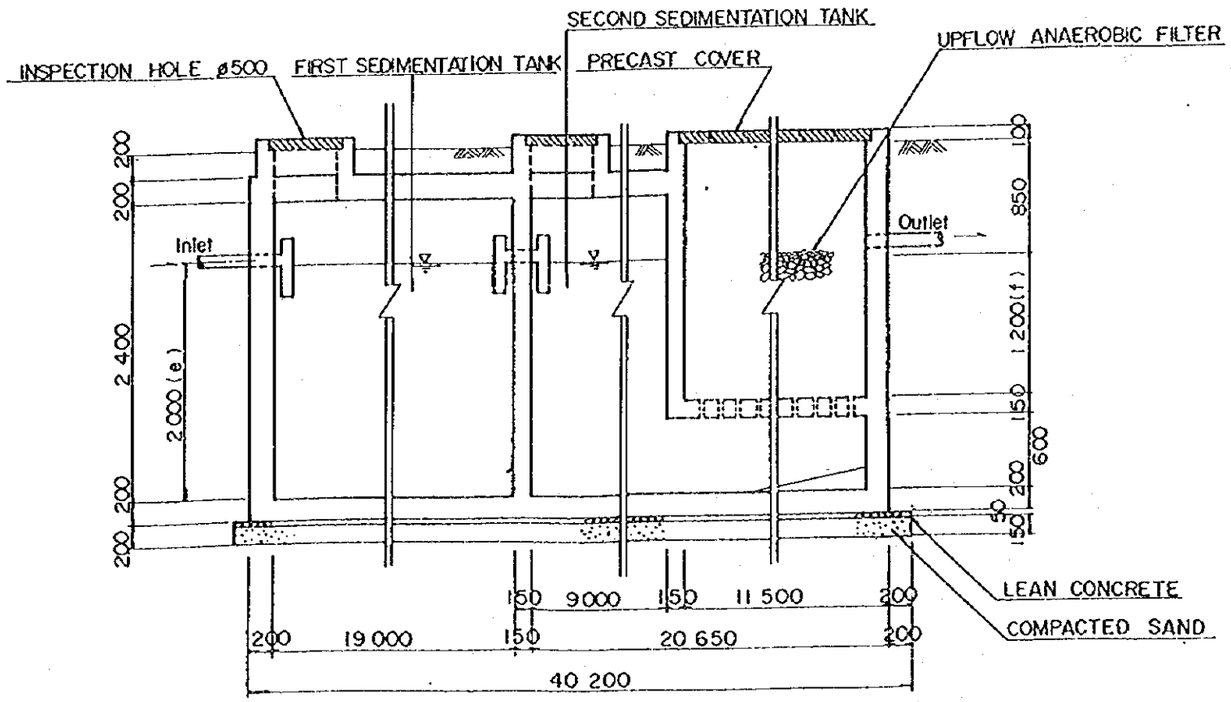

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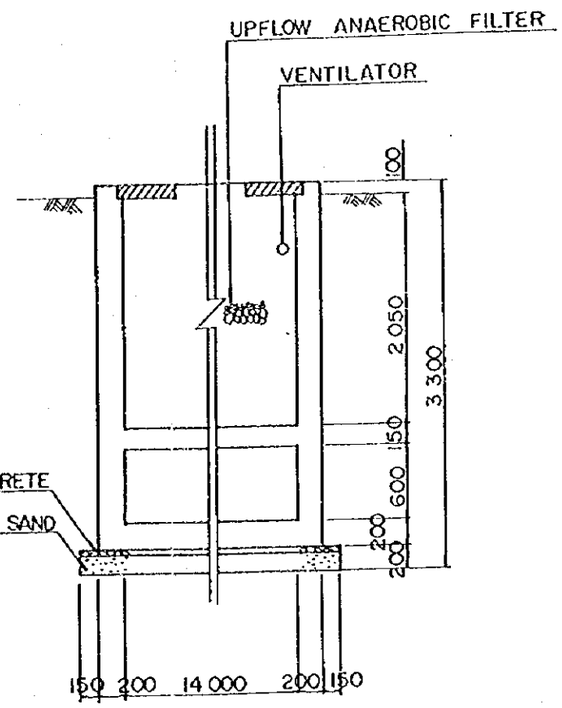

SECTION B — B

Note

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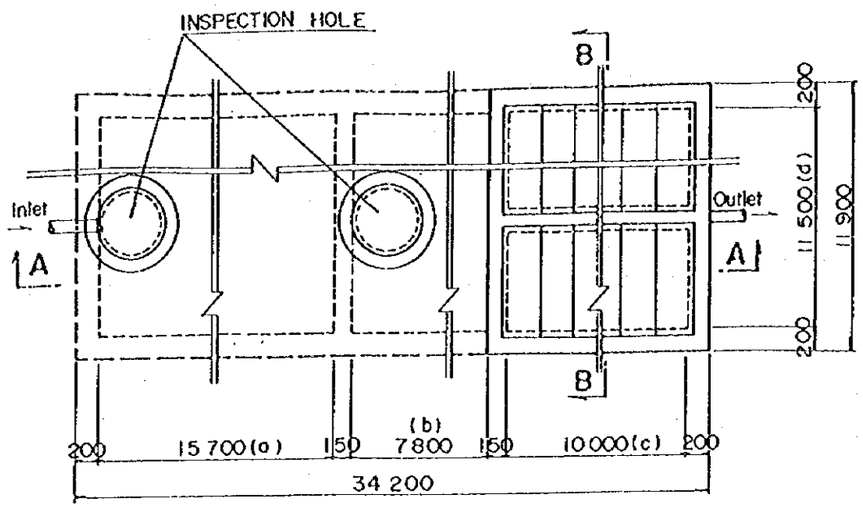
THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DESIGN DETAILS OF COMMUNITY TREATMENT PLANT FOR BETHANIA I



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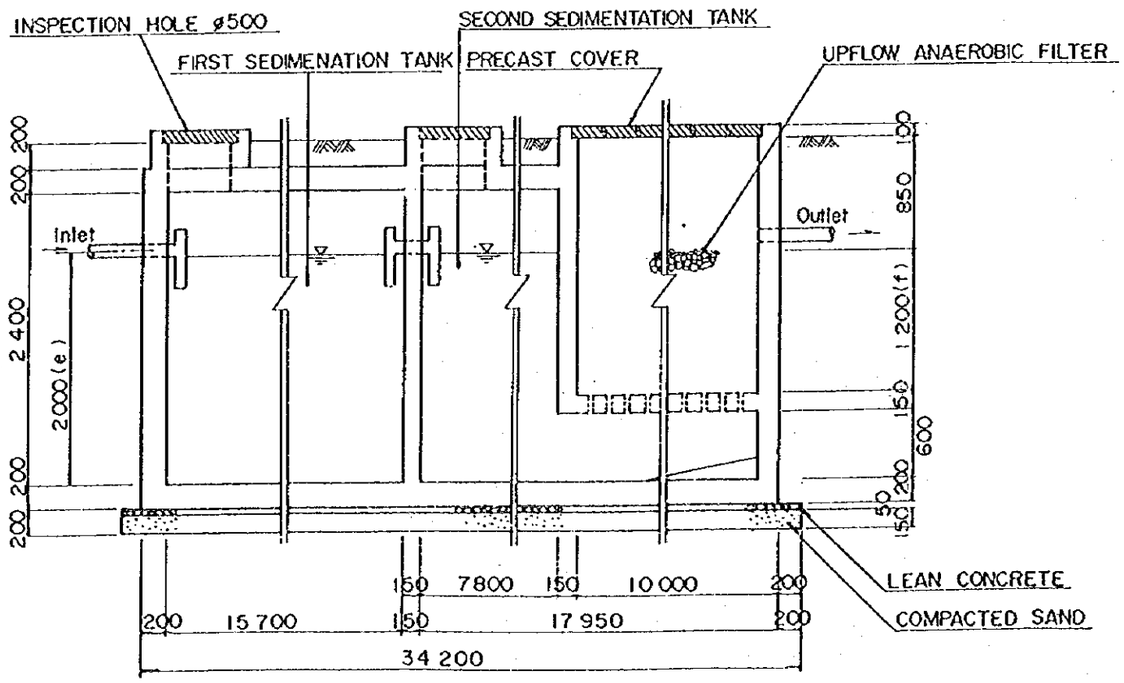

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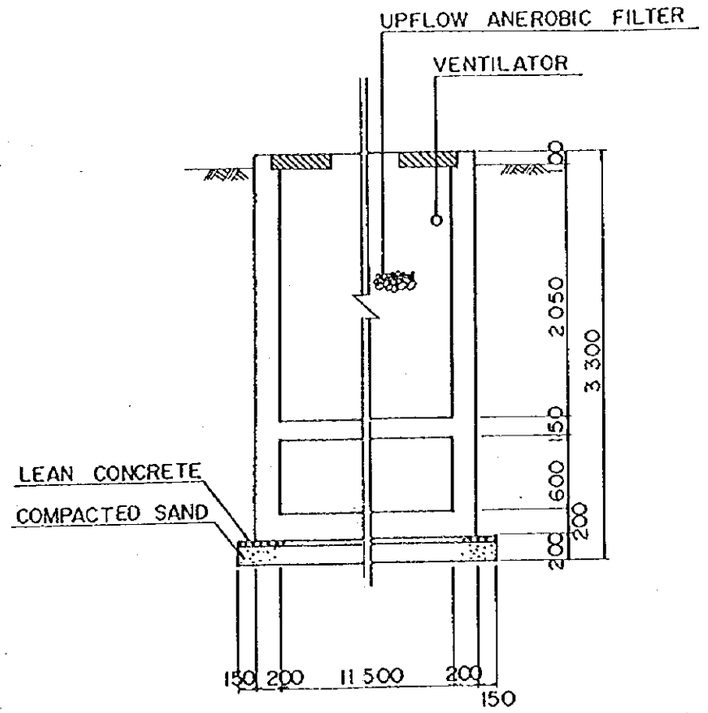

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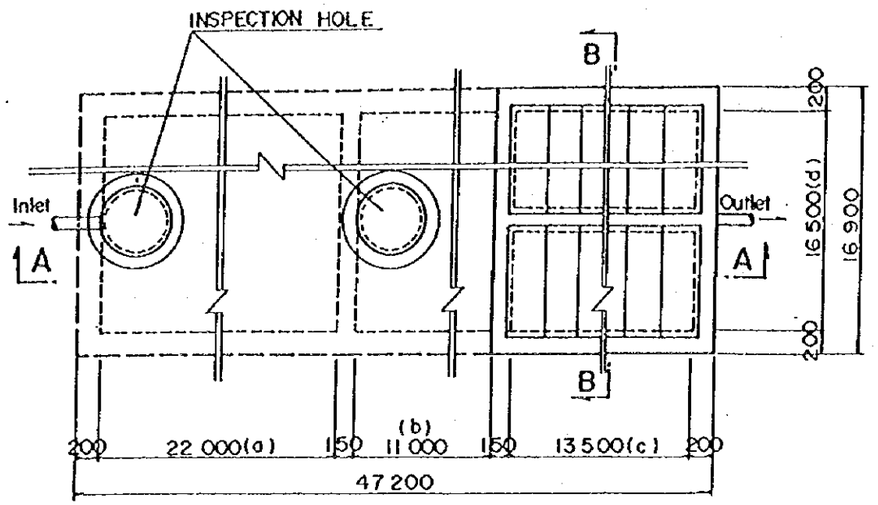

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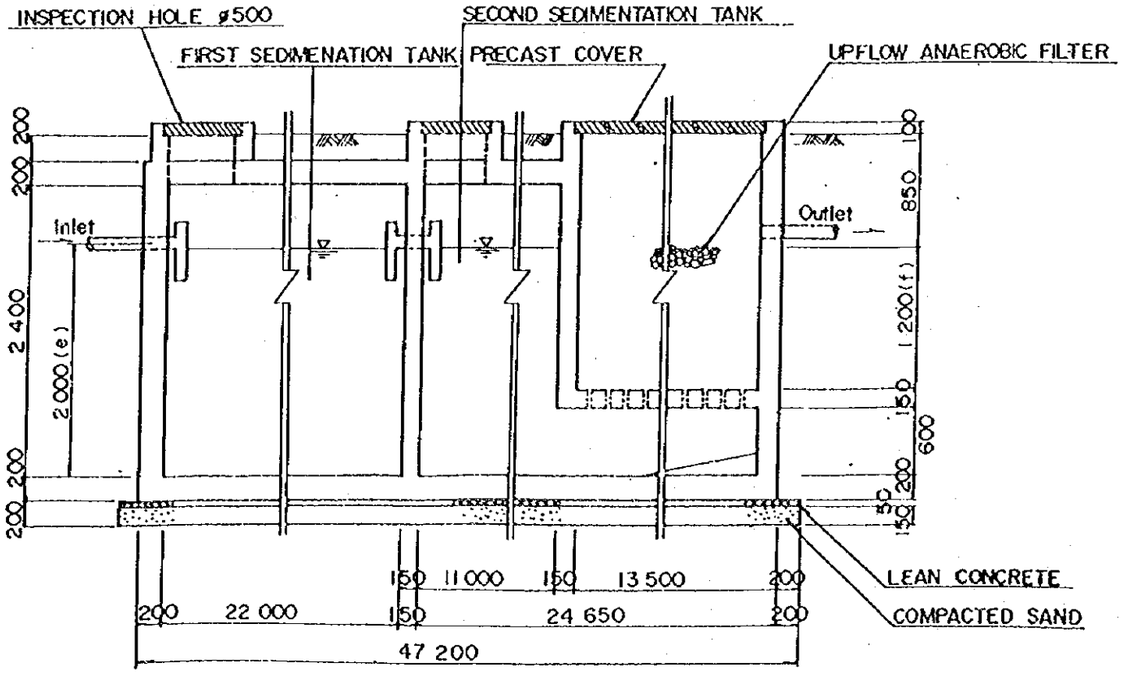

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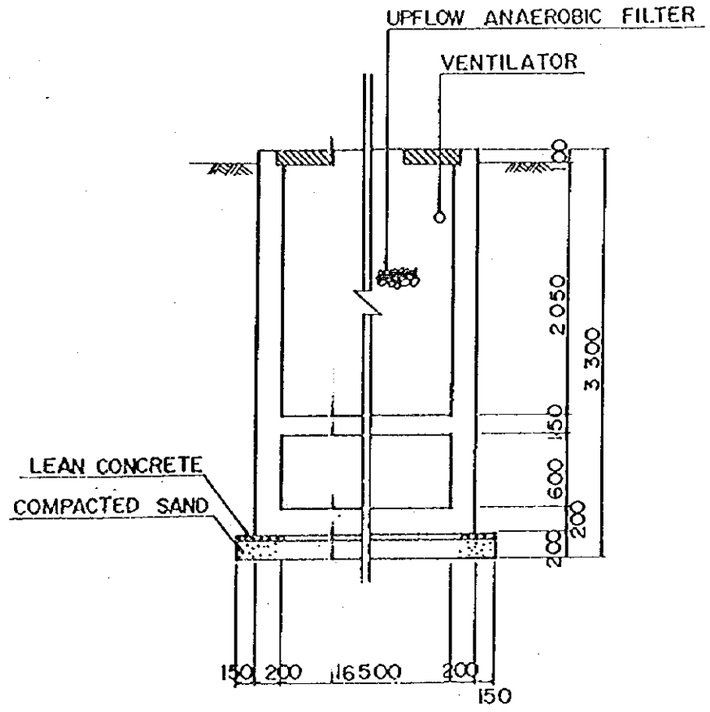

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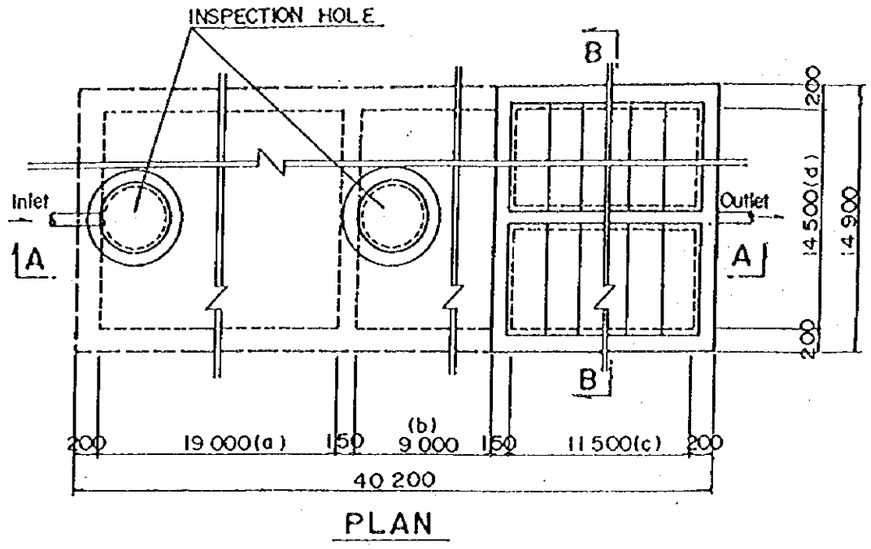
THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DESIGN DETAILS OF COMMUNITY TREATMENT PLANT FOR BETHANIA II



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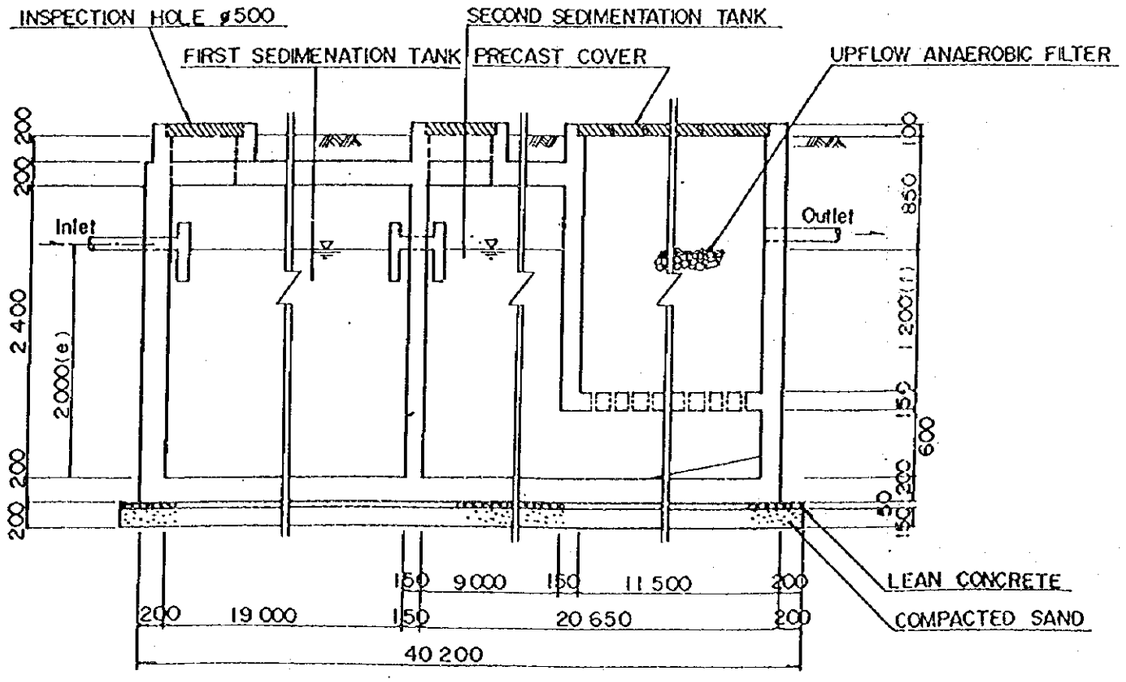

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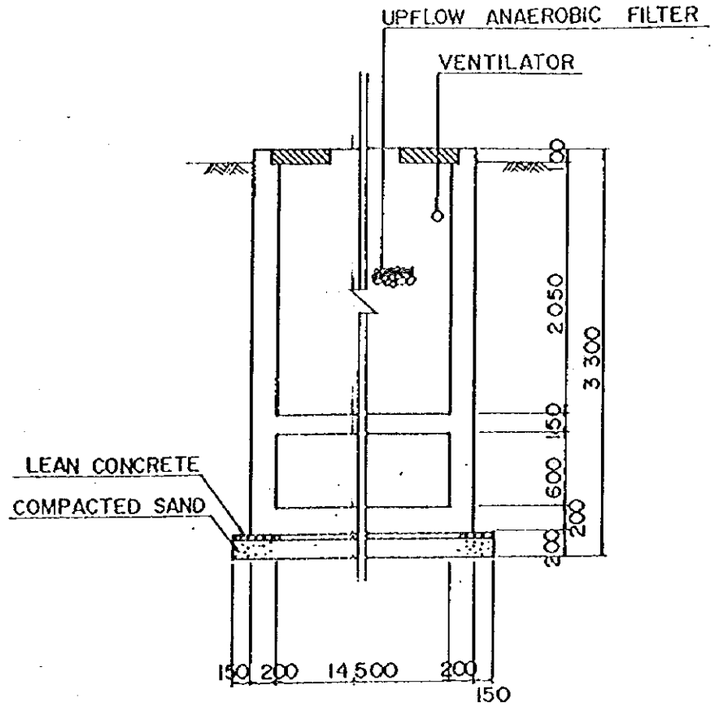

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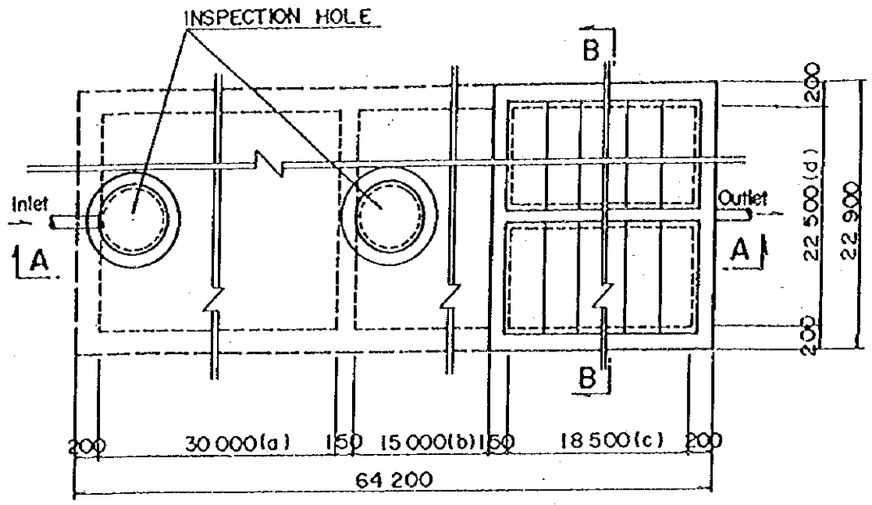

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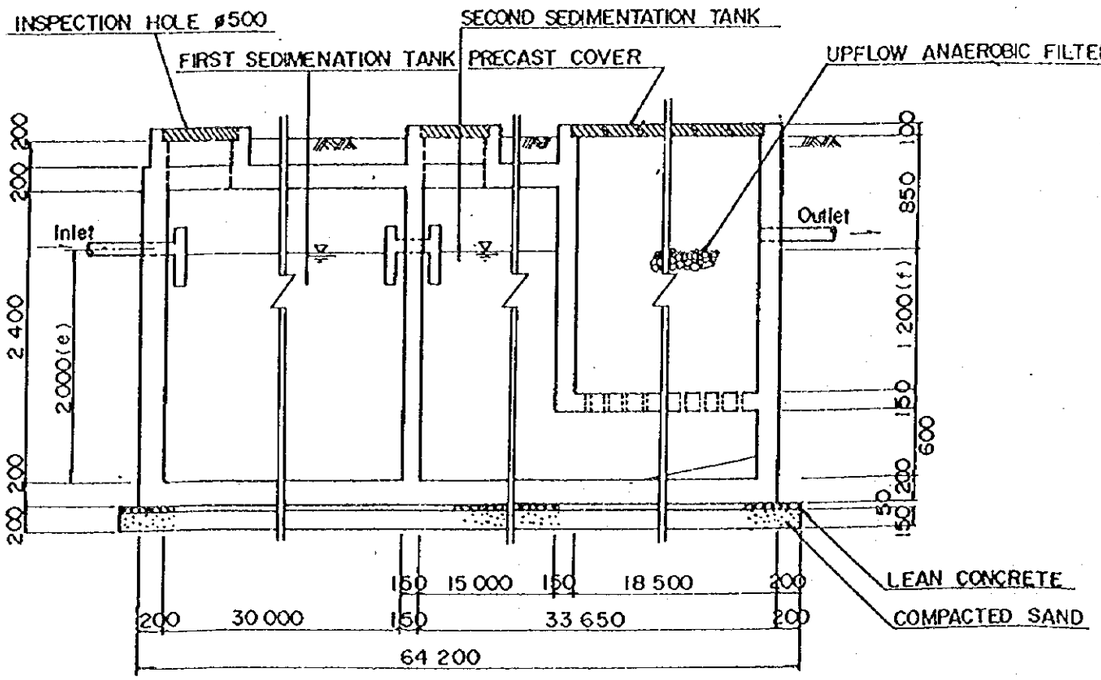

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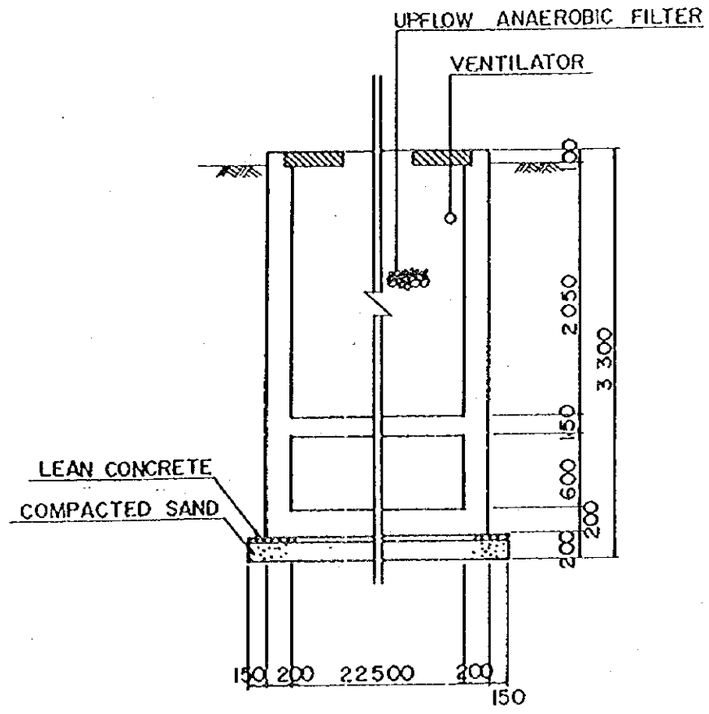

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THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DESIGN DETAILS OF COMMUNITY TREATMENT PLANT FOR QUINTANAL

SUPPORTING REPORT O

COST ESTIMATION

SUPPORTING REPORT O
COST ESTIMATION
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O COST ESTIMATION

The cost estimation of this project is carried out in two phases, first one is for the selection of priority region of the study area at the Master Plan Study level. Second one is in accordance with the results of above study, however more detailed cost estimation was conducted select an appropriate alternative plan for the Feasibility Study.
The above mentioned two phases of cost estimation and the related cost data are below described.

O1 SELECTION OF PRIORITY REGIONS

O1.1 Basic Conditions of Cost Estimation

The served population, wastewater flow rate and service area for this study of sewerage and sanitation system are shown in Table O1-1. It has been used as basic data for the cost estimation.

Table O1-1 Basic Conditions in Year 2015

No	Region	Sewerage System			Sanitation System			Total		
		Population (Person)	Wastewater Rate (m3/day)	Service Area (ha)	Population (Person)	Wastewater Rate (m3/day)	Service Area (ha)	Population (Person)	Wastewater Rate (m3/day)	Service Area (ha)
1	Central	751,800	238,000	6,460	109,600	18,084	767	861,400	256,084	7,227
2	North 1	379,100	89,000	2,190	12,900	2,129	42	392,000	91,129	2,232
3	North 2	0	0	0	150,000	24,750	480	150,000	24,750	480
4	South 1	277,510	64,000	1,640	2,500	413	8	280,010	64,413	1,648
5	South 2	183,000	51,000	2,220	8,000	1,320	73	191,000	52,320	2,293
6	South 3	276,100	66,000	2,360	2,900	479	41	278,300	66,479	2,401
7	East 1	500,800	121,000	3,705	20,200	3,333	230	521,000	124,333	3,935
8	East 2	0	0	0	40,000	6,600	1,408	40,000	6,600	1,408
	Total	2,367,610	629,000	18,575	346,100	57,107	3,049	2,713,710	686,107	21,624

Note : Wastewater Rate of above table is indicated as the daily average.
The daily maximum is estimated as 1.1 times of daily average of wastewater rate.
The hourly maximum is estimated as 1.65 times of the daily average of wastewater quantities.

O1.2 Investment Cost

a) Total Investment Cost

The total investment cost for sewerage and sanitation system is shown in Table O1-2. And investment cost for each system is shown separately in Table O1-3 and O1-4 attached at the end of this section.
The detailed land acquisition cost of both system is shown in Table O1-5.

Table O1-2 Summary of Total Investment Cost

(Unit : Million Quetzal)

No	Region	Direct Construction	Land Acquisition	Engineering Fee	Administration Fee	Physical Contingency	Total
1	Central	443.3	33.0	26.6	13.3	44.3	560.4
2	North 1	272.7	10.3	16.4	8.2	27.3	334.9
3	North 2	68.7	4.2	4.1	2.1	6.9	85.9
4	South 1	173.0	11.7	10.4	5.2	17.3	217.6
5	South 2	149.2	10.0	9.0	4.5	14.9	187.6
6	South 3	257.1	12.7	15.4	7.7	25.7	318.6
7	East 1	334.8	22.7	20.1	10.0	33.5	421.1
8	East 2	71.4	3.4	4.3	2.1	7.1	88.3
	Total	1,770.1	108.0	106.2	53.1	177.0	2,214.4

Note 1. Engineering Fee = (Direct Construction Cost) x 0.06
2. Administration Fee = (Direct Construction Cost) x 0.03
3. Physical Contingency = (Direct Construction Cost) x 0.10
4. Cost : as of September 1995.

b) Direct Construction Cost

The summary of direct construction cost of both system is shown in Table O1-6. The detailed construction cost of the wastewater treatment and community plant, detailed construction cost of primary and secondary treatment facilities for wastewater treatment plant, sewer pipeline, are described in Table O1-7, O1-8 and O1-9 respectively.

The direct construction cost of community plant for sanitation system is estimated in accordance with the formula mentioned below and are estimated as total cost including the materials, labors and some benefits without a consumption tax (IVA). They have been

obtained based on the results of the survey conducted in Guatemala from April to July 1995.

$C2 = U \times N \times W2 / (10)^6$

---Where---

C2 : Construction cost of community plant including the upflow filter / absorption well in Guatemala. (Unit : Million Quetzales)
The "C2" is estimated based on actual results of the similar constructed facilities obtained from EMPAGUA and based on the results of trial estimation.

U : Unit cost of above actual results. (Unit : Quetzal/m^3/day)
(Note)
The unit cost "U" is estimated as follows.
Septic Tank : Q 19,000. (Capacity : 42 m3)
[Data Source : EMPAGUA]
Upflow Filter / Absorption Well : Q 11,000.
Flow Rate is 14 m^3/day, assuming that the retention time of wastewater in the septic tank is three (3) days.

Therefore, the total construction cost is Q 30,000 and the unit cost "U" was calculated Q 2,100.

W2 : Capacity of a community plant.
The served population of a community plant is estimated as 1,000 persons.
W2 = [Daily Maximum] x 1,000
= 0.18 m^3/c/day x 1,000 = 180 m^3/day

N : Number of community plants
N = (served population) / 1,000

O1.3 Operation and Maintenance (O/M) Cost

a) Sewerage System

The operation and maintenance (O/M) costs required, consists of the annual O/M costs for wastewater treatment plant and sewer pipeline. The O/M costs of wastewater treatment plant are composed of personnel expenses, disposal/transportation cost of sludge generated and repair costs. And that of sewer pipeline is composed of personnel expenses and repair costs.

The conditions assumed for O/M costs estimation are described below.

(i) Required Staff

Wastewater Treatment Plant : The required number of staff for routine operation work is estimated as two (2) persons for each train. The staff required for laboratory analysis works have not been included.

Sewer Pipeline : Major works include the cleaning and surveying in the sewer pipeline. The required staff for cleaning are estimated as 15 man days per kilometer of sewer per year (m-d/km/y) and for survey works 3 (m-d/km/y).

(ii) Disposal/Transportation Cost of Sludge Generated in Wastewater Treatment Plant

The water contents of sludge is estimated to be 60 % after withdrawing from sludge drying beds. Dried sludge is transferred to the disposal land for final disposal.

(iii) Repair Work

The required annual repairing cost is assumed to be 0.5 % of direct construction cost. This should be sufficient since the system will be comprise of concrete structures including sedimentation tanks, trickling filters and sludge drying beds, etc.

The summary of required annual O/M costs at 1995 prices for the full operational capacity is shown in the Table O1-10 and further breakdown are described in Table O1-11 and O1-12, attached at the end of this section.

Table O1-10 Summary of Required Annual O/M Cost for Sewerage System

(Unit : Quetzal/Year)

	Item	Central	North 1	South 1	South 2	South 3	East 1
1	Wastewater Treatment Plant						
-1	Personnel Cost	1,200,000	480,000	300,000	240,000	360,000	600,000
-2	Transportation Cost of sludge	1,228,360	401,144	290,936	230,912	301,432	548,416
-3	Repair Costs (0.5% of C/C)	1,161,000	468,500	295,500	237,500	353,000	584,000
	Sub-Total	3,589,360	1,349,644	886,436	708,412	1,014,432	1,732,416
2	Sewer Pipeline						
-1	Personnel Cost	2,404,258	845,359	647,704	879,978	927,468	1,417,241
-2	Repair Costs (0.5% of C/C)	682,000	861,500	562,500	477,000	917,000	1,001,000
	Sub-Total	3,086,258	1,706,859	1,210,204	1,356,978	1,844,468	2,418,241
	Total O/M Cost	6,524,738	3,056,503	2,096,640	2,065,390	2,856,932	4,150,657

Note (1) The data source of "Unit Average Personnel Cost" is accepted by EMPAGUA in June 1995.

(2) The data source of "Unit Transportation Cost" is accepted by Municipality of Mixco in June 1995, it was approved by EMPAGUA promptly.

(3) Repair Costs is estimated as 0.5% of construction cost .

(4) The Personnel required for maintenance of pipeline is estimated as follows.

Cleaning Workers = (Pipe Length km) x 15 persons*day/km x (1/365 day)

Survey Workers = (Pipe Length km) x 3 persons*day/km x (1/365 day)

b) Sanitation System

The O/M costs of sanitation system consists of annual costs required for community plant and sewer pipeline. The O/M costs of community plant are composed of personnel expenses, disposal/transportation cost of sludge generated and repairing costs. Cost for sewer pipeline are composed of personnel expenses and repair cost. The condition of O/M costs estimation are described below.

(i) Required Staff

Community Plant : The frequency of O/M of the community plants is considered to be once (1) a month and two (2) persons are assigned for this job. The staff required for laboratory analysis works have not been included.

Sewer Pipeline : Major works include the cleaning and surveying in the sewer pipelines. The staff required for cleaning is estimated as 10 man days per kilometer of sewer per year (m-d/km/y) and for survey works 2 (m-d/km/y).

(ii) Disposal/Transportation Cost of Sludge Generated in Community Plants

The water contents of sludge (septage) is estimated to be 93 % after digestion in the septic tank. Septage will be transferred to the wastewater treatment plant for further treatment.

(iii) Repair Work

The required annual repairing cost is assumed to be 0.5 % of direct construction cost. This should be adequate since the facilities such as septic tanks, upflow anaerobic filters and soil absorption wells will be built of concrete.

The summary of required annual O/M costs are shown in the Table O1-13 and further breakdown are described in O1-14 and O1-15, attached at the end of this section.

Table O1-3 Summary of the Investment Cost of Sewerage System

(Unit : Million Quetzal)

No	Region	Direct Construction	Land Acquisition	Engineering Fee	Administration Fee	Physical Contingency	Total
1	Central	368.7	26.8	22.1	11.1	36.9	465.5
2	North 1	265.9	9.7	16.0	8.0	26.6	326.2
3	North 2	0.0	0.0	0.0	0.0	0.0	0.0
4	South 1	171.5	11.5	10.3	5.1	17.2	215.6
5	South 2	143.0	9.4	8.6	4.3	14.3	179.5
6	South 3	254.1	12.4	15.2	7.6	25.4	314.8
7	East 1	317.0	20.9	19.0	9.5	31.7	398.2
8	East 2	0.0	0.0	0.0	0.0	0.0	0.0
	Total	1,520.2	90.7	91.2	45.6	152.0	1,899.7

Table O1-4 Summary of the Investment Cost of Sanitation System

(Unit : Million Quetzal)

No	Region	Direct Construction	Land Acquisition	Engineering Fee	Administration Fee	Physical Contingency	Total
1	Central	74.6	6.2	4.5	2.2	7.5	94.9
2	North 1	6.8	0.6	0.4	0.2	0.7	8.7
3	North 2	68.7	4.2	4.1	2.1	6.9	85.9
4	South 1	1.5	0.3	0.1	0.0	0.2	2.0
5	South 2	6.2	0.7	0.4	0.2	0.6	8.0
6	South 3	3.0	0.3	0.2	0.1	0.3	3.8
7	East 1	17.8	1.8	1.1	0.5	1.8	23.0
8	East 2	71.4	3.4	4.3	2.1	7.1	88.3
	Total	249.9	17.3	15.0	7.5	25.0	314.7

Table O1-5 Land Acquisition Cost of Wastewater Treatment Plant

(Unit : Million Quetzal)

No	Region	Sewerage System			Sanitation System				Total
		WWTP (ha)	Unit Cost (M-Q/ha)	Sub-Total (M-Q)	Unit Land Area (ha/Plant)	No's of Plant (Q'ty)	Unit Cost (M-Q/ha)	Sub-Total (M-Q)	(M-Q)
1	Central	67.0	0.4	26.8	0.14	110	0.4	6.2	33.0
2	North 1	27.7	0.4	9.7	0.14	13	0.4	0.6	10.3
3	North 2	0.0	0.2	0.0	0.14	150	0.2	4.2	4.2
4	South 1	19.1	0.6	11.5	0.14	3	0.6	0.3	11.7
5	South 2	15.6	0.6	9.4	0.14	8	0.6	0.7	10.0
6	South 3	20.7	0.6	12.4	0.14	3	0.6	0.3	12.7
7	East 1	34.9	0.6	20.9	0.14	21	0.6	1.8	22.7
8	East 2	0.0	0.6	0.0	0.14	40	0.6	3.4	3.4
	Total	185.0		90.7		348		17.3	108.0

Note 1. The unit costs of land acquisition applied it, that were provided by EMPAGUA in June 1995.

2. The required area of WWTP is applied from results of the preliminary design for Master Plan.

Table O1-6 Summary of the Direct Construction Cost

(Unit : Million Quetzal)

No	Region	Sewerage System			Sanitation System			Total
		Sewer Pipeline	WWTP	Sub-Total	Sewer Pipeline	WWTP	Sub-Total	
1	Central	136.4	232.3	368.7	33.0	41.6	74.6	443.3
2	North 1	172.3	93.7	265.9	1.9	4.9	6.8	272.7
3	North 2	0.0	0.0	0.0	12.0	56.7	68.7	68.7
4	South 1	112.5	59.1	171.5	0.4	1.1	1.5	173.0
5	South 2	95.4	47.6	143.0	3.2	3.0	6.2	149.2
6	South 3	183.4	70.7	254.1	1.9	1.1	3.0	257.1
7	East 1	200.2	116.8	317.0	9.9	7.9	17.8	334.8
8	East 2	0.0	0.0	0.0	56.3	15.1	71.4	71.4
	Total	900.2	620.0	1,520.2	118.4	131.5	249.9	1,770.1

Table O1-7 Direct Construction Cost of Wastewater Treatment Plant and Community Plant

(Unit : Million Quetzal)

No	Region	Sewerage System				Sanitation System				Total
		Primary Treatment	Secondary Treatment	Common Facilities	Sub-Total (C1)	Unit Cost (Q/m3/day)	Community Plant (m3/day)	Number of Community Plant	Sub-Total (C2)	(C1+C2)
1	Central	81.6	149.3	1.4	232.3	2,100	180	110	41.6	273.8
2	North 1	32.6	59.7	1.4	93.7	2,100	180	13	4.9	98.6
3	North 2	0.0	0.0	0.0	0.0	2,100	180	150	56.7	56.7
4	South 1	20.4	37.3	1.4	59.1	2,100	180	3	1.1	60.2
5	South 2	15.3	29.9	1.4	47.6	2,100	180	8	3.0	50.6
6	South 3	24.5	44.8	1.4	70.7	2,100	180	3	1.1	71.8
7	East 1	40.8	74.6	1.4	116.8	2,100	180	21	7.9	124.7
8	East 2	0.0	0.0	0.0	0.0	2,100	180	40	15.1	15.1
	Total	216.2	395.6	8.2	620.0			348	131.5	751.6

Note : Cost : as of September 1995.

Table O1-8 Detailed Construction Cost of Wastewater Treatment Plant for Sewerage System

(Unit : Quetzal)

No	Regions	Wastewater Rate (m3/day)			Primary Treatment		Secondary Treatment		Common	Total
		Daily Max	Daily Max per Train	No's of Train	Unit Train Cost	Sub-Total (1)	Unit Train Cost	Sub-Total (2)	Sub-Total (3)	
1	Central	261,000	13,050	20	4,077,860	81,557,200	7,463,710	149,274,200	1,368,000	232,199,400
2	North 1	97,000	12,125	8	4,077,860	32,622,880	7,463,710	59,709,680	1,368,000	93,700,560
3	North 2	0	0	0	0	0	0	0	0	0
4	South 1	70,000	14,000	5	4,077,860	20,389,300	7,463,710	37,318,550	1,368,000	59,075,850
5	South 2	55,000	13,750	4	4,077,860	16,311,440	7,463,710	29,854,840	1,368,000	47,534,280
6	South 3	72,000	12,000	6	4,077,860	24,467,160	7,463,710	44,782,260	1,368,000	70,617,420
7	East 1	131,000	13,100	10	4,077,860	40,778,600	7,463,710	74,637,100	1,368,000	116,783,700
8	East 2	0	0	0	0	0	0	0	0	0
	Total	686,000	---	---		216,126,580		395,576,630	8,208,000	619,911,210

[Note]

1. The unit price in above table applied the value which were estimated by EMPAGUA and survey results of JICA Study Team in June 1995 in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of September 1995.

Table O1-9 Direct Construction Cost of Sewer Pipeline

(Unit : Million Quetzal)

No	Region	Sewerage System				Sanitation System					Total
		Trunk Sewer	Branch Sewer	Existing Sewered Area (%)	Sub-Total	Average Dia (m)	Unit Cost (Q/m)	Pipe Length (m)	Existing Sewered Area (%)	Sub-Total	
1	Central	51.3	85.1	76.3	136.4	0.20	186.42	177,000	0.0	33.0	169.4
2	North 1	31.0	141.3	34.8	172.3	0.20	186.42	10,000	0.0	1.9	174.1
3	North 2	0.0	0.0	0.0	0.0	0.20	186.42	111,000	42.2	12.0	12.0
4	South 1	27.1	85.4	55.0	112.5	0.20	186.42	2,000	0.0	0.4	112.8
5	South 2	39.2	56.2	79.5	95.4	0.20	186.42	17,000	0.0	3.2	98.6
6	South 3	34.3	149.1	37.9	183.4	0.20	186.42	10,000	0.0	1.9	185.3
7	East 1	39.6	160.7	42.0	200.2	0.20	186.42	53,000	0.0	9.9	210.1
8	East 2	0.0	0.0	0.0	0.0	0.20	186.42	324,000	6.8	56.3	56.3
	Total	222.4	677.8		900.2			704,000	---	118.4	1,018.6

Note 1. Unit Cost in above table applied the value which were estimated by EMPAGUA in June 1995.
2. The data source of above "Existing Sewered Area" are accepted from EMPAGUA in June 1995.
3. Cost : as of September 1995.

Table O1-11 Annual O/M Cost of Wastewater Treatment Plant for Sewerage System]

	Item	Unit	Central	North 1	North 2	South 1	South 2	South 3	East 1	East 2
1	Population	person	751,800	379,100	0	277,510	183,000	275,400	500,800	0
2	Wastewater Q'ty : Daily Average	m3/d	238,000	89,000	0	64,000	51,000	66,000	121,000	0
3	Sludge Q'ty (as Wc:60%)	ton/Y	37,450	12,230	0	8,870	7,040	9,190	16,720	0
4	No's of Trains	No's	20	8	0	5	4	6	10	0
5	Personnel Cost	Quetzal/Year	1,200,000	480,000	0	300,000	240,000	360,000	600,000	0
6	Personnel for O/M	person	40.00	16.00	0	10.00	8.00	12.00	20.00	0
7	Unit Average Personnel Cost	Quetzal/Year	30,000	30,000	0	30,000	30,000	30,000	30,000	0
8	Transportation Cost of sludge	Quetzal/Year	1,228,360	401,144	0	290,936	230,912	301,432	548,416	0
9	Unit Sludge Transportation Cost	Quetzal/ton	32.8	32.8	0	32.8	32.8	32.8	32.8	0
10	Repair Costs (0.5% of C/C)	Quetzal/Year	1,161,000	468,500	0	295,500	237,500	353,000	584,000	0
11	Unit Cost of O/M	Quetzal/m3	0.04	0.04	0	0.04	0.04	0.04	0.04	0

Note (1) "Unit Cost of O/M" = (Personnel Cost) + (Transportation Cost of sludge) + (Repair Costs)

(2) The water contents of sludge is estimated as 60% after to dried up in sludge drying beds.

Table O1-12 Annual O/M Cost of Sewer Pipeline for Sewerage System

	Item	Unit	Central	North 1	North 2	South 1	South 2	South 3	East 1	East 2
1	Lengh of Sewer Pipeline	km	1,625.1	571.4	0.0	437.8	594.8	626.9	958.0	0.0
-1	Trunk Sewer	km	10.1	23.9	0.0	27.8	39.8	36.9	31.7	0.0
-2	Branch Sewer	km	1,615.0	547.5	0.0	410.0	555.0	590.0	926.3	0.0
2	Pipe Diameter (Min of Trunk)	mm	--	250	--	250	250	200	250	--
	ditto (Max of Trunk)	mm	3,000	1,500	--	1,500	1,500	1,500	1,500	--
3	Personnel for O/M	person	80.14	28.18	0.00	21.59	29.33	30.92	47.24	0.00
-1	Cleaning	person	66.78	23.48	0.00	17.99	24.44	25.76	39.37	0.00
-2	Survey	person	13.36	4.70	0.00	3.60	4.89	5.15	7.87	0.00
4	Unit Average Personnel Cost	Quetzal/Year	30,000	30,000	0	30,000	30,000	30,000	30,000	0
5	Personnel Cost	Quetzal/Year	2,404,258	845,359	0	647,704	879,978	927,468	1,417,241	0
6	Repair Costs (0.5% of C/C)	Quetzal/Year	682,000	861,500	0	562,500	477,000	917,000	1,001,000	0
	Total O/M Cost	Quetzal/Year	3,086,258	1,706,859	0	1,210,204	1,356,978	1,844,468	2,418,241	0

Table O1-13 The Summary of Required Annual O/M Cost for Sanitation System

	Item	Unit	Central	North 1	North 2	South 1	South 2	South 3	East 1	East 2
1	Community Plant									
-1	Personnel Cost	Quetzal/Year	220,000	30,000	300,000	30,000	30,000	30,000	42,000	80,000
-2	Transportation Cost of sludge	Quetzal/Year	140,288	16,512	192,000	3,200	10,240	3,712	25,856	51,200
-3	Repair Costs (0.5% of C/C)	Quetzal/Year	208,000	24,500	283,500	5,500	15,000	5,500	39,500	75,500
	Sub-Total		568,288	71,012	775,500	38,700	55,240	39,212	107,356	206,700
2	Sewer Pipeline									
-1	Personnel Cost	Quetzal/Year	174,575	30,000	109,479	30,000	30,000	30,000	52,274	319,562
-2	Repair Costs (0.5% of C/C)	Quetzal/Year	165,000	9,500	60,000	2,000	16,000	9,500	49,500	281,500
	Sub-Total		339,575	39,500	169,479	32,000	46,000	39,500	101,774	601,062
	Total O/M Cost	Quetzal/Year	907,863	110,512	944,979	70,700	101,240	78,712	209,130	807,762

Note (1) The data source of "Unit Average Personnel Cost" is accepted by EMPAGUA in June 1995.

(2) The data source of "Unit Transportation Cost" is accepted by Municipality of Mixco in June 1995, it was approved by EMPAGUA promptly.

(3) The interval of maintenance works at the community plant assumed as carried out one time by two workers in every month.

(4) Repair Costs is estimated as 0.5% of construction cost .

(5) The Personnel number of maintenance of pipeline is estimated as follows.

Cleaning Workers = (Pipe Length km) x 10 persons*day/km x (1/365 day)

Survey Workers = (Pipe Length km) x 2 persons*day/km x (1/365 day)

Table O1-14 Annual O/M Cost of Community Plant for Sanitation System

	Item	Unit	Central	North 1	North 2	South 1	South 2	South 3	East 1	East 2
1	Population	person	109,600	12,900	150,000	2,500	8,000	2,900	20,200	40,000
2	Wastewater Q'ty : Daily Average	m3/d	18,084	2,129	24,750	413	1,320	479	3,333	6,600
3	Sludge Q'ty (as Wc:97%)	ton/Year	4,384	516	6,000	100	320	116	808	1,600
4	No's of WWTP	No's	110	13	150	3	8	3	21	40
5	Personnel Cost	Quetzal/Year	220,000	30,000	300,000	30,000	30,000	30,000	42,000	80,000
6	Personnel for O/M	person	7.33	1.00	10.00	1.00	1.00	1.00	1.40	2.67
7	Unit Average Personnel Cost	Quetzal/Year	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
8	Transportation Cost of sludge	Quetzal/Year	140,288	16,512	192,000	3,200	10,240	3,712	25,856	51,200
9	Unit Sludge Transportation Cost	Quetzal/ton	32	32	32	32	32	32	32	32
10	Repair Costs (0.5% of C/C)	Quetzal/Year	208,000	24,500	283,500	5,500	15,000	5,500	39,500	75,500
11	Unit Cost of O/M	Quetzal/m3	0.09	0.09	0.09	0.26	0.11	0.22	0.09	0.09

Note (1) "Unit Cost of O/M" = (Personnel Cost) + (Transportation Cost of sludge) + (Repair Costs)

(2) Unit Q'ty a capita of sludge generation is estimated as 40 liter (as water contents is 93 %) per capita per year.

Table O1-15 Annual O/M Cost of Sewer Pipeline for Sanitation System

	Item	Unit	Central	North 1	North 2	South 1	South 2	South 3	East 1	East 2
1	Pipe Length	km	177	10	111	2	17	10	53	324
2	Pipe Diameter	mm	200	200	200	200	200	200	200	200
3	Personnel for O/M	person	5.82	1.00	3.65	1.00	1.00	1.00	1.74	10.65
-1	Cleaning	person	4.85	0.27	3.04	0.05	0.47	0.27	1.45	8.88
-2	Survey	person	0.97	0.05	0.61	0.01	0.09	0.05	0.29	1.78
4	Unit Average Personnel Cost	Quetzal/Year	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
5	Personnel Cost	Quetzal/Year	174,575	30,000	109,479	30,000	30,000	30,000	52,274	319,562
6	Repair Costs (0.5% of C/C)	Quetzal/Year	165,000	9,500	60,000	2,000	16,000	9,500	49,500	281,500
	Total O/M Cost	Quetzal/Year	339,575	39,500	169,479	32,000	46,000	39,500	101,774	601,062

O2 ALTERNATIVE STUDY ON THE FIRST STAGE PROJECT

O2.1 Fundamentals Conditions of Cost Estimation

a) Design Area

At the Master Plan Study, Central and South 3 Regions were selected as priority regions. Although the two regions are proposed to be implemented in three (3) stages, first stag of each region is considered for the feasibility study.

b) Design Condition

The basic conditions such as served population, served area and wastewater rate are described in Table O2-1.

Table O2-1 Summary of Design Conditions

Region / Basic Item	Unit	Central			South 3		
		Sewerage	Sanitation	Sub-Total	Sewerage	Sanitation	Sub-Total
Served Population	Person	520,400	33,900	554,300	44,700	2,900	47,600
Served Settlement	No's	---	20	---	---	3	---
Served Area	ha	4,605	283	4,888	896	42	938
Wastewater Rate (Daily Maximum)	m3/day	196,000	6,140	202,140	36,000	530	36,530
Wastewater Rate (Daily Average)	m3/day	179,000	5,600	184,600	33,000	480	33,480
Flow Rate of Unit Train in WWTP (Daily Maximum)	m3/day	13,070	---	---	9,600	---	---
Train Number of WWTP	No's	15	---	---	4	---	---

[Note] WWTP : Wastewater Treatment Plant for Sewerage System.

c) Outline of Facilities to be Constructed

An outline of the facilities to be constructed in first stage for Central and South regions are as follows.

Sewerage System : In Central Region, the facilities to be constructed are main sewer pipeline as the collector which is constructed by tunneling methods (diameter : 3.0 m, length : about 11 km) and primary treatment facilities of wastewater treatment plant. On the

other hand, in South 3 Region, main sewer pipeline as the collector and branch sewer which is constructed by open cut and tunneling methods (diameter : 1.5 m, length : about 10 km), primary and secondary treatment facilities of wastewater treatment plant are the main facilities.

Sanitation System : The area which can not be collected by proposed sewerage system is considered for sanitation system, which include construction of sewer pipeline and community treatment plant in the colonies. In the first stage of Central region, twenty (20) settlements are proposed to be implemented with Sanitation System and for South region, three (3) settlements are proposed to have Sanitation System. The Sanitation System has to serve mainly low income homesteads or slums who are living near and/or in the valley. Therefore, access roads for construction and maintenance of the community treatment plant is necessary to include in this project because most of them do not have existing roads to proposed plant.

O2.2 Investment Cost

The major components involved in cost estimation and method used are same as described in the previous section. However, the total investment cost of sewerage and sanitation system are updated as of February 1996.
Among the above, only a part of engineering fee is considered as foreign currency portion and other are considered in local currency portion in principle.

The total investment cost is summarized below and shown in Table O2-2. Further details of total investment cost for sewerage and sanitation system are shown in Table O2-4.

Table O2-2 Summary of Total Investment Cost

(Unit : Million Quetzal)

No	Region / Cost Items	Central	South 3	Total
1	Direct Construction	379.5	173.8	553.3
2	Land Acquisition	29.2	18.1	47.3
3	Engineering Fee	22.8	13.9	36.7
4	Administration Fee	11.4	5.2	16.6
5	Physical Contingency	38.0	17.4	55.4
	Total	480.9	228.4	709.3

a) Direct Construction Cost

The direct construction cost of sewerage and sanitation system are estimated based on the preliminary design mentioned above and unit construction costs that has been obtained based on the results of the survey conducted in Guatemala from April 1995 to February 1996. The direct construction cost is summarized below.

Table O2-3 Summary of Direct Construction Cost

(Unit : Million Quetzal)

Region		Central			South 3		
No	Item	L/C	F/C	Total	L/C	F/C	Total
1	Sewerage System	331.5	0	331.5	168.0	0	168.0
	(1) Sewer Pipeline	221.1	0	221.1	78.2	0	78.2
	(2) WWTP	110.4	0	110.4	89.8	0	89.8
2	Sanitation System	48.0	0	48.0	5.8	0	5.8
	(1) Sewer Pipeline	33.3	0	33.3	4.6	0	4.6
	(2) Community Plant	14.7	0	14.7	1.2	0	1.2
	Total of Direct C/C	379.5	0	379.5	173.8	0	173.8

Note 1. WWTP : Wastewater Treatment Plant
2. L/C : Local Currency, F/C : Foreign Currency

The detailed direct construction cost of sewerage system and unit train cost of wastewater treatment plant are shown in Table O2-5 and Table O2-6, attached at the end of this section. The detailed direct construction cost of sanitation system and further detailed break down of construction cost for each settlements are shown in Table O2-7 and Table O2-8 respectively.

The direct construction cost are estimated as total cost including the materials, labors and some benefits, without a consumption tax (IVA).

The unit relevant construction cost of sewer pipeline has been estimated based on the actual results obtained from EMPAGUA, which are shown in Table O3-1.

The other unit costs of construction works except the tunneling works of sewer route in the hard rock area for Central Region and materials have been investigated by JICA Study Team in Guatemala and are described in Table O3-2.

b) Land Acquisition Cost

The required land area for the wastewater treatment plants (WWTP) and community treatment plant for each region, is considered in the preliminary design and unit cost is applied from survey results obtained from EMPAGUA in February 1996.
The land acquisition cost of sewerage and sanitation system are described in Table O2-9,10 respectively.
The land acquisition cost of sewer pipeline installation is not considered since it will be installed underground the existing roads and under the hills / mountains of government reserved land in principle.

c) Engineering Fee

An engineering fee is the fee of designing and supervision of construction works which are conducted by the consultants after obtaining approval from Guatemala side. It has been assumed to be six (6) percent in Central Region and eight (8) percent in South 3 Region of the direct construction cost to account for the scale of the project.

d) Administration Fee

An administration fee, is the cost required to carry out this project. It has been assumed to be three (3) percent of the direct construction cost.

e) Physical Contingency

The contingency has been estimated as ten (10) percent of the direct construction cost.

O2.3 Operation and Maintenance (O/M) Cost

The operation and maintenance (O/M) costs of sewerage and sanitation system consists of annual O/M costs required for wastewater treatment plant (WWTP), community treatment plant and sewer pipeline.
The O/M costs of the former are composed of personnel expenses, disposal/transportation cost of sludge generated and repairing costs. And that of sewer pipeline is composed of personnel expenses and repairing costs. These O/M cost are estimated as of February 1996.

The conditions of O/M cost estimation, such as number of required staff, disposal/transportation cost of sludge generated and repair works of sewerage system and sanitation system, are same as described in Section O1.3 of this report.

The summary of required annual O/M costs for sewerage system at the first stage is shown in Table O2-11. Further details are shown in Table O2-12,13 attached at the end of this section. In the sanitation system, the summary is shown in Table O2-14, and details are mentioned below in Table O2-15,16 .

Table O2-4 Total Investment Cost

(Unit :Quetzal)

No	Costs Item \ Region	Central			South 3			Grand
		L/C	F/C	Total	L/C	F/C	Total	Total
1	Direct Construction	379,522,461	0	379,522,461	173,835,976	0	173,835,976	553,358,437
-1	Sewerage System	331,524,089	0	331,524,089	168,009,211	0	168,009,211	499,533,300
	(1) Sewer Pipeline	221,135,589	0	221,135,589	78,184,441	0	78,184,441	299,320,030
	(2) WWTP	110,388,500	0	110,388,500	89,824,770	0	89,824,770	200,213,270
-2	Sanitation System	47,998,372	0	47,998,372	5,826,765	0	5,826,765	53,825,138
	(1) Sewer Pipeline	33,326,159	0	33,326,159	4,553,822	0	4,553,822	37,879,981
	(2) Community Plant	14,672,213	0	14,672,213	1,272,943	0	1,272,943	15,945,156
2	Land Acquisition	29,236,300	0	29,236,300	18,113,000	0	18,113,000	47,349,300
-1	Sewerage System	28,000,000	0	28,000,000	18,000,000	0	18,000,000	46,000,000
-2	Sanitation System	1,236,300	0	1,236,300	113,000	0	113,000	1,349,300
3	Engineering Fee	5,692,837	17,078,511	22,771,348	3,476,720	10,430,159	13,906,878	36,678,226
4	Administration Fee	11,385,674	0	11,385,674	5,215,079	0	5,215,079	16,600,753
5	Physical Contingency	37,952,246	0	37,952,246	17,383,598	0	17,383,598	55,335,844
	Total	463,789,518	17,078,511	480,868,029	218,024,372	10,430,159	228,454,531	709,322,560

[Note]

1. Cost : as of February1996, excluding a Consumption Tax (IVA)
2. Exchange Rate (recent six month) : US$ 1.00 = Quetzales 5.88 = Japanese Yen 99.12
3. Engineering fee is assumed as six (6) percent in Central and eight (8) percent in South 3 Region of the direct construction cc
4. Administration fee is assumed as three (3) percent of the direct construction cost.
5. Physical contingency is assumed as ten (10) percent of the direct construction cost.
6. WWTP : Wastewater Treatment Plant
7. L/C : Local Currency, F/C : Foreign Currency

Table O2-5 Detailed Direct Construction Cost of Sewerage System (1/2)

[1] Region : Central (Unit : Quetzal)

No	Item	Description	Unit	L/C		
				No's	Unit Price	Sub-Total
1	Sewer Pipeline					
1.1	Trunk Sewer	Total Length	m	11,040		
1)	Concrete Pipe (Tunneling)					
	Soft Rock Area (by Man Power)	Dia 3,000	m	6,880	7,692	52,920,960
	Hard Rock Area (by Machine)	Dia 3,000	m	4,080	38,500	157,080,000
2)	Disposal of Excavated Materials	less than L=10 km	m3	123,000	65	7,995,000
3)	Pipe Bridge (L=20 m)	Dia 3,000	No	4	253,000	1,012,000
4)	Vertical Shafts	Dia 3,500 x 50mh	No	14	151,974	2,127,629
5)	Roads (including restoration)					
	New Road (unpaved)	width=3m	m		400	0
	New Road (paved)	width=5m	m		900	0
	Restoration (paved)	width=5m	m		260	0
	Sub-Total (1)					221,135,589
2	Wastewater Treatment Plant					
2.1	Primary Treatment Facilities	Primary Sedimentation	Train	15	2,905,100	43,576,500
2.2	Secondary Treatment Facilities	Trickling Filter etc.,	Train	0	11,667,300	0
2.3	Common Facilities (1/2)	3/4 of Sludge Beds, Ponds	Set	0.75	64,960,000	48,720,000
		1/2 of Ponds	Set	0.5	4,460,000	2,230,000
2.4	Common Facilities (2/2)	Buldings, Roads, etc.,	Set	1	15,862,000	15,862,000
	Sub-Total (2)					110,388,500
	Grand Total					331,524,089

Note 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.

2. The above construction cost is fully treated by local currency (L/C).

3. Cost : as of February 1996.

Table O2-5 Detailed Direct Construction Cost of Sewerage System (2/2)

[2] Region : South 3 (Unit : Quetzal)

No	Item	Description	Unit	L/C		
				No's	Unit Price	Sub-Total
1	Sewer Pipeline					
1.1	Trunk Sewer	Total Length	m	17,320		
1)	Concrete Pipe (Open cut)	Dia 300 x 2mh	m	1,730	403	697,363
	"	Dia 400 x 3mh	m	2,010	602	1,209,095
	"	Dia 500 x 3mh	m	1,040	723	752,388
	"	Dia 600 x 3mh	m	1,050	902	946,659
	"	Dia 750 x 3mh	m	200	1,279	255,800
	"	Dia 1,200 x 3.2mh	m	1,150	2,626	3,020,130
2)	Concrete Pipe (Tunneling)	Dia 1,500	m	10,020	1,553	15,561,060
3)	Disposal of Excavated Materials	less than L=10 km	m3	37,000	65	2,405,000
4)	Pipe Bridge (L=50 m)	Dia 400	No	1	330,488	330,488
	" Existing (L=70 m)	Dia 750	No	1	74,064	74,064
5)	Vertical Shafts	Dia 2,500 x 50mh	m	13	118,924	1,546,012
6)	Roads (including restoration)					
	New Road (unpaved)	width=3m	m		400	0
	New Road (paved)	width=5m	m		900	0
	Restoration (paved)	width=5m	m	7,180	260	1,866,800
	Sub-Total (1.1)					28,664,858
1.2	Branch Sewer (Open cut)	Dia 200 x 3mh	m	86,130	471	40,562,062
	(@270 m/ha x 319 ha)					
	Repair work on roads	width=2m	m	86,130	104	8,957,520
	Sub-Total (1.2)					49,519,582
	Sub-Total(1)					78,184,441
2	Wastewater Treatment Plant					
2.1	Primary Treatment Facilities	Primary Sedimentation	Train	4	4,964,100	19,856,400
2.2	Secondary Treatment Facilities	Trickling Filter etc.,	Train	4	11,958,400	47,833,600
2.3	Common Facilities (1/2)	5/6 of Sludge Beds	Set	0.83	19,959,000	16,565,970
	"	1/2 of Ponds	Set	0.5	1,160,000	580,000
2.4	Common Facilities (2/2)	Buldings, Roads, etc.,	Set	1	4,988,800	4,988,800
	Sub-Total (2)					89,824,770
	Grand Total					168,009,211

Note 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.

2. The above construction cost is fully treated by local currency (L/C).

3. Cost : as of February 1996.

Table O2-6 Detailed Unit Train Cost of Wastewater Treatment Plant for Sewerage System (1/2)

[1] Region : Central (Wastewater Rate of Daily maximum per Unit Train = 13,050 m3/day) (Unit : Quetzal)

No	Item \ Construction Works	Excavation etc.,(Soil-m3) No's	Unit Price	Sub-Total (1)	Concrete & Clay Works (C-m3) No's	Unit Price	Sub-Total (2)	Media (Media-m3) No's	Unit Price	Sub-Total (3)	Filter Bed (m2) No's	Unit Price	Sub-Total (4)	Equipment & Others No's	Unit Price	Sub-Total (5)	Total
1	Primary Treatment Facilities																
1.1	Civil Works																
	Grit Chambers	50	50	2,500	50	2,140	107,000										109,500
	Primary Sedimentation Tanks	1,800	50	90,000	300	2,140	642,000										732,000
	Rough Land Preparation	31,000	50	1,550,000													1,550,000
1.2	Land Preperation (m2)													16,800	11	184,800	184,800
1.3	Landscaping (m2)													8,400	2	16,800	16,800
1.4	Inner Road (5m Unpaved) (m)													520	400	208,000	208,000
1.5	Drainage (m)													1,040	100	104,000	104,000
	Sub-Total (1)	32,850		1,642,500	350		749,000	0		0	0		0			513,600	2,905,100
2	Secondary Treatment Facilities																
2.1	Civil Works																
	Trickling Filters	10,700	50	535,000	1,800	2,140	3,852,000	8,600	120	1,032,000	4,300	50	215,000	3	300,000	900,000	6,534,000
	Middle Sedimentation Tanks	1,800	50	90,000	300	2,140	642,000										732,000
	Final Sedimentation Tanks	3,600	50	180,000	550	2,140	1,177,000										1,357,000
	Rough Land Preparation	37,500	50	1,875,000													1,875,000
2.2	Pipe Laying Works																
	Pipeline (Dia CP: 600) (m)													500	728	364,000	364,000
	Valves (Set)													1		91,000	91,000
2.3	Land Preperation (m2)													20,100	11	221,100	221,100
2.4	Landscaping (m2)													12,600	2	25,200	25,200
2.5	Inner Road (5m Unpaved) (m)													780	400	312,000	312,000
2.6	Drainage (m)													1,560	100	156,000	156,000
	Sub-Total (2)	53,600		2,680,000			5,671,000	8,600		1,032,000	4,300		215,000			2,069,300	11,667,300
	Total (1+2) per Train	86,450		4,322,500			6,420,000	8,600		1,032,000	4,300		215,000			2,582,900	14,572,400
3	Common Facilities (1/2)																
3.1	Sludge Drying Beds	80,000	50	4,000,000	24,000	2,140	51,360,000	40,000	120	4,800,000	96,000	50	4,800,000				64,960,000
3.2	Anaerobic Pond	4,600	50	230,000	600	200	120,000										350,000
3.3	Facultative Pond	51,000	50	2,550,000	7,800	200	1,560,000										4,110,000
	Sub-Total (3)	135,600		6,780,000	32,400		53,040,000	40,000		4,800,000	96,000		4,800,000	0		0	69,420,000
4	Common Facilities (2/2)																
4.1	Building Works																
	Administration Building (m2)													300	3,750	1,125,000	1,125,000
	Warehouse (m2)													30	2,100	63,000	63,000
	Guardhouse (m2)													20	1,500	30,000	30,000
	Sub-Total (4.1)	0		0	0		0	0		0	0		0	350		1,218,000	1,218,000
4.2	Access Road (5m Paved) (m)													1,000	900	900,000	900,000
4.3	Pipe Laying Works																
	Inflow (Dia CP: 3000) (m)													1,500	7,692	11,538,000	11,538,000
	Sludge Pipe (Dia CP: 600) (m)													2,000	728	1,456,000	1,456,000
4.4	Fence (m)													5,000	150	750,000	750,000
	Sub-Total (4)			0			0			0			0			15,862,000	15,862,000

Note: 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of February 1996.

Table O2-6 Detailed Unit Train Cost of Wastewater Treatment Plant for Sewerage System (2/2)

[2] Region : South 3 (Wastewater Rate of Daily maximum per Unit Train = 9,600 m3/day) (Unit : Quetzal)

No	Item \ Construction Works	Excavation etc..(Soil-m3) No's	Unit Price	Sub-Total (1)	Concrete & Clay Works (C-m3) No's	Unit Price	Sub-Total (2)	Media (Media-m3) No's	Unit Price	Sub-Total (3)	Filter Bed (m2) No's	Unit Price	Sub-Total (4)	Equipment & Others No's	Unit Price	Sub-Total (5)	Total
1	Primary Treatment Facilities																
1.1	Civil Works																
	Grit Chambers	50	50	2,500	50	2,140	107,000										109,500
	Primary Sedimentation Tanks	1,000	50	50,000	250	2,140	535,000										585,000
	Rough Land Preparation	75,000	50	3,750,000													3,750,000
1.2	Land Preperation (m2)													13,200	11	145,200	145,200
1.3	Landscaping (m2)													7,200	2	14,400	14,400
1.4	Inner Road (5m Unpaved) (m)													600	400	240,000	240,000
1.5	Drainage (m)													1,200	100	120,000	120,000
	Sub-Total (1)	76,050		3,802,500	300		642,000	0		0			0			519,600	4,964,100
2	Secondary Treatment Facilities																
2.1	Civil Works																
	Trickling Filters	8,200	50	410,000	1,400	2,140	2,996,000	500	120	60,000	3,300	50	165,000	3	300,000	900,000	4,531,000
	Middle Sedimentation Tanks	1,000	50	50,000	250	2,140	535,000										585,000
	Final Sedimentation Tanks	2,000	50	100,000	450	2,140	963,000										1,063,000
	Rough Land Preparation	90,900	50	4,545,000													4,545,000
2.2	Pipe Laying Works																
	Pipeline (Dia CP: 600) (m)													500	728	364,000	364,000
	Valves (Set)													1		91,000	91,000
2.3	Land Preperation (m2)													19,800	11	217,800	217,800
2.4	Landscaping (m2)													10,800	2	21,600	21,600
2.5	Inner Road (5m Unpaved) (m)													900	400	360,000	360,000
2.6	Drainage (m)													1,800	100	180,000	180,000
	Sub-Total (2)	102,100		5,105,000			4,494,000	500		60,000	3,300		165,000			2,134,400	11,958,400
	Total (1+2) per Train	178,150		8,907,500			5,136,000	500		60,000	3,300		165,000			2,654,000	16,922,500
3	Common Facilities (1/2)																
3.1	Sludge Drying Beds	19,200	50	960,000	7,800	2,140	16,692,000	9,600	120	1,152,000	23,100	50	1,155,000				19,959,000
3.2	Anaerobic Pond	1,200	50	60,000	400	200	80,000										140,000
3.3	Facultative Pond	11,600	50	580,000	2,200	200	440,000										1,020,000
	Sub-Total (3)	32,000		1,600,000	10,400		17,212,000	9,600		1,152,000	23,100		1,155,000	0		0	21,119,000
4	Common Facilities (2/2)																
4.1	Building Works																
	Administration Building (m2)													300	3,750	1,125,000	1,125,000
	Warehouse (m2)													30	2,100	63,000	63,000
	Guardhouse (m2)													20	1,500	30,000	30,000
	Sub-Total (4.1)	0		0	0		0	0		0	0		0			1,218,000	1,218,000
4.2	Access Road (5m Paved) (m)													1,000	900	900,000	900,000
4.3	Pipe Laying Works																
	Inflow (Dia CP: 1500) (m)													900	1,648	1,483,200	1,483,200
	Sludge Pipe (Dia CP: 600) (m)													1,700	728	1,237,600	1,237,600
4.4	Fence (m)													1,000	150	150,000	150,000
	Sub-Total (4)	0		0	0		0	0		0	0		0			4,988,800	4,988,800

Note: 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of February 1996.

Table O2-7 Detailed Direct Construction Cost of Sanitation System

[1] Region : Central [Unit : Quetzal]

No	Name of Settlement	Sewer Pipeline	Community Plant	Total
1	Final	1,749,586	248,620	1,998,206
2	El Pilar	5,248,759	601,110	5,849,869
3	El Cambary	793,985	135,992	929,977
4	Campo Seco	650,807	557,431	1,208,238
5	Colinas I & II	762,529	416,596	1,179,125
6	Quintanal	3,150,559	1,477,968	4,628,527
7	Santa Faz	417,601	294,631	712,232
8	Bethania Sec I	1,186,638	605,031	1,791,669
9	Bethania Sec II	1,575,397	843,148	2,418,545
10	Seis de Octubre	1,062,985	668,552	1,731,537
11	Joya I	2,029,548	1,045,701	3,075,249
12	Joya II	2,029,548	1,045,701	3,075,249
13	Joya III	2,029,548	1,045,701	3,075,249
14	La Joya IV	1,122,985	740,552	1,863,537
15	El Tuerto	424,109	263,481	687,590
16	Finca El Carmen	695,279	411,424	1,106,703
17	Modrno San Antonio	755,279	460,341	1,215,619
18	Colon. Arqueta	3,083,295	891,041	3,974,336
19	Jocotales	2,214,158	1,068,751	3,282,908
20	Incienso	2,343,564	1,850,442	4,194,006
	Total	33,326,159	14,672,213	47,998,372

Note: 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of February 1996.

[2] Region : South 3 [Unit : Quetzal]

No	Name of Settlement	Sewer Pipeline	Community Plant	Total
1	Loma Blanca I	924,146	397,401	1,321,547
2	Loma Blanca II	924,146	435,201	1,359,347
3	Plaza de Toros	2,705,530	440,341	3,145,871
	Total	4,553,822	1,272,943	5,826,765

Note: 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of February 1996.

Table O2-8 Detailed Direct Construction Cost of Each Settlement for Sanitation System (1/3)

[1] Region : Central (1/5) (Unit : Quetzal)

No	Item	Description	Unit	Unit Price	1 Final		2 El Pilar		3 El Cambary		4 Campo Seco		5 Colinas I & II	
					Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total
	[Basic Conditions]	Served Population	person	-		500		1,500		300		1,200		900
		Served Area	ha	-		16.13		48.39		7.32		6.00		7.03
		Wastewater Rate	m3/d	Daily Max		90		270		54		216		152
		Unit Generation	lpcd	Daily Max		180		180		150		180		180
1	Sewer Pipeline													
1)	Concrete Pipe (Open cut)													
	"	Dia 200 x 2mh	m	297	3,710	1,102,628	11,130	3,307,885	1,684	500,387	1,380	410,153	1,617	480,563
	"	Dia 200 x 3mh	m	471		0		0		0		0		0
	"	Dia 250 x 2mh	m	350		0		0		0		0		0
	"	Dia 300 x 2mh	m	403		0		0		0		0		0
2)	Manholes													
	"	Dia 1,500 x 2mh	Nob	8,719	74	646,958	223	1,940,874	34	293,598	28	240,654	32	281,966
	"	Dia 1,500 x 3mh	Nob	9,827		0		0		0		0		0
	"	Dia 1,500 x 4mh	Nob	13,342		0		0		0		0		0
3)	Roads (including restoration)													
	New Road (unpaved)	width=3m	m	300		0		0		0		0		0
	"	width=5m	m	400		0		0		0		0		0
	Restoration (paved)	width=5m	m	260		0		0		0		0		0
	Sub-Total [1]					1,749,586		5,248,759		793,985		650,807		762,529
2	Community Plant													
-1	Septic Tank & Anaerobic Filter		m3/d	2,100		0		0	54	113,400	216	453,600	162	340,200
-2	Septic Tank & Absorption Well		m3/d	2,100	90	189,000	270	567,000		0		0		0
-3	Discharge Pipe													
	"	Dia 200 x 2mh	m	297		0		0	10	2,972	100	29,721	30	8,916
	"	Dia 250 x 2mh	m	350		0		0		0		0		0
	"	Dia 300 x 2mh	m	403		0		0		0		0		0
-4	Land Preperation		m2	11	570	6,270	1,260	13,860	570	6,270	1,260	13,860	930	10,230
-5	Fence		m	150	89	13,350	135	20,250	89	13,350	135	20,250	115	17,250
-6	Access Road (unpaved)	Width=3m	m	400	100	40,000		0		0	100	40,000	100	40,000
	Sub-Total [2]					248,620		601,110		135,992		557,431		416,596
	Grand Total					1,998,206		5,849,869		929,977		1,208,238		1,179,125

[1] Region : Central (2/5) (Unit : Quetzal)

No	Item	Description	Unit	Unit Price	6 Quintanal		7 Santa Faz		8 Bethania Sec I		9 Bethania Sec II	
					Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total
	[Basic Conditions]	Served Population	person	-		3,700		600		1,400		2,000
		Served Area	ha	-		23.72		3.85		10.94		13.07
		Wastewater Rate	m3/d	Daily Max		666		108		252		360
		Unit Generation	lpcd	Daily Max		180		180		150		180
1	Sewer Pipeline											
1)	Concrete Pipe (Open cut)											
	"	Dia 200 x 2mh	m	297		0	886	263,182	2,516	747,846		0
	"	Dia 200 x 3mh	m	471		0		0		0		0
	"	Dia 250 x 2mh	m	350		0		0		0	3,006	1,051,173
	"	Dia 300 x 2mh	m	403	5,456	2,199,174		0		0		0
2)	Manholes											
	"	Dia 1,500 x 2mh	Nob	8,719	109	951,385	18	154,420	50	438,792	60	524,224
	"	Dia 1,500 x 3mh	Nob	9,827		0		0		0		0
	"	Dia 1,500 x 4mh	Nob	13,342		0		0		0		0
3)	Roads (including restoration)											
	New Road (unpaved)	width=3m	m	300		0		0		0		0
	"	width=5m	m	400		0		0		0		0
	Restoration (paved)	width=5m	m	260		0		0		0		0
	Sub-Total [1]					3,150,559		417,601		1,186,638		1,575,397
2	Community Plant											
-1	Septic Tank & Anaerobic Filter		m3/d	2,100	0	0	108	226,800	252	529,200	360	756,000
-2	Septic Tank & Absorption Well		m3/d	2,100	666	1,398,600		0		0		0
-3	Discharge Pipe											
	"	Dia 200 x 2mh	m	297		0	100	29,721	100	29,721		0
	"	Dia 250 x 2mh	m	350		0		0		0	100	34,965
	"	Dia 300 x 2mh	m	403	25	10,078		0		0		0
-4	Land Preperation		m2	11	2,790	30,690	1,260	13,860	1,260	13,860	1,580	17,380
-5	Fence		m	150	204	30,600	135	20,250	135	20,250	152	22,800
-6	Access Road (unpaved)	Width=3m	m	400	20	8,000	10	4,000	30	12,000	30	12,000
	Sub-Total [2]					1,477,968		294,631		605,031		843,148
	Grand Total					4,628,527		712,232		1,791,669		2,418,545

Table O2-8 Detailed Direct Construction Cost of Each Settlement for Sanitation System (2/3)

[1] Region : Central (3/5) (Unit : Quetzal)

No	Item	Description	Unit	Unit Price	10 Seis de Octubre		11 Joya I		12 Joya II		13 Joya III		14 La Joya IV	
					Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total
	[Basic Conditions]	Served Population	person	-		1,500		2,500		2,500		2,500		1,500
		Served Area	ha	-		9.80		16.34		16.34		16.34		9.80
		Wastewater Rate	m3/d	Daily Max		270		450		450		450		270
		Unit Generation	lpcd	Daily Max		180		180		180		180		180
1	Sewer Pipeline													
1)	Concrete Pipe (Open cut)													
	"	Dia 200 x 2mh	m	297	2,254	669,917		0		0		0	2,254	669,917
	"	Dia 200 x 3mh	m	471		0		0		0		0		0
	"	Dia 250 x 2mh	m	350		0	3,758	1,314,167	3,758	1,314,167	3,758	1,314,167		0
	"	Dia 300 x 2mh	m	403		0		0		0		0		0
2)	Manholes													
	"	Dia 1,500 x 2mh	No's	8,719	45	393,068	75	655,381	75	655,381	75	655,381	45	393,068
	"	Dia 1,500 x 3mh	No's	9,827		0		0		0		0		0
	"	Dia 1,500 x 4mh	No's	13,342		0		0		0		0		0
3)	Roads (including restoration)													
	New Road (unpaved)	width=3m	m	300		0	200	60,000	200	60,000	200	60,000	200	60,000
	"	width=5m	m	400		0		0		0		0		0
	Restoration (paved)	width=5m	m	260		0		0		0		0		0
	Sub-Total [1]					1,062,985		2,029,548		2,029,548		2,029,548		1,122,985
2	Community Plant													
-1	Septic Tank & Anaerobic Filter		m3/d	2,100		0	450	945,000	450	945,000	450	945,000	270	567,000
-2	Septic Tank & Absorption Well		m3/d	2,100	270	567,000		0		0		0		0
-3	Discharge Pipe													
	"	Dia 200 x 2mh	m	297	200	59,442	50	14,861	50	14,861	50	14,861	200	59,442
	"	Dia 250 x 2mh	m	350		0		0		0		0		0
	"	Dia 300 x 2mh	m	403		0		0		0		0		0
-4	Land Preperation		m2	11	1,260	13,860	1,890	20,790	1,890	20,790	1,890	20,790	1,260	13,860
-5	Fence		m	150	135	20,250	167	25,050	167	25,050	167	25,050	135	20,250
-6	Access Road (unpaved)	Width=3m	m	400	20	8,000	100	40,000	100	40,000	100	40,000	200	80,000
	Sub-Total [2]					668,552		1,045,701		1,045,701		1,045,701		740,552
	Grand Total					1,731,537		3,075,249		3,075,249		3,075,249		1,863,537

[1] Region : Central (4/5) (Unit : Quetzal)

No	Item	Description	Unit	Unit Price	15 El Tuerto		16 Finca El Carmen		17 Molino San Antonio		18 Colon, Arqueta		19 Jocotales	
					Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total	Numbers	Total
	[Basic Conditions]	Served Population	person	-		500		1,000		1,000		2,000		2,600
		Served Area	ha	-		3.91		6.41		6.41		25.58		16.67
		Wastewater Rate	m3/d	Daily Max		90		180		180		360		468
		Unit Generation	lpcd	Daily Max		180		180		180		180		180
1	Sewer Pipeline													
1)	Concrete Pipe (Open cut)													
	"	Dia 200 x 2mh	m	297	899	267,283	1,474	438,180	1,474	438,180		0		0
	"	Dia 200 x 3mh	m	471		0		0		0		0		0
	"	Dia 250 x 2mh	m	350		0		0		0	5,883	2,057,307		0
	"	Dia 300 x 2mh	m	403		0		0		0		0	3,834	1,545,541
2)	Manholes													
	"	Dia 1,500 x 2mh	No's	8,719	18	156,826	29	257,099	29	257,099	118	1,025,988	77	668,617
	"	Dia 1,500 x 3mh	No's	9,827		0		0		0		0		0
	"	Dia 1,500 x 4mh	No's	13,342		0		0		0		0		0
3)	Roads (including restoration)													
	New Road (unpaved)	width=3m	m	300		0		0	200	60,000		0		0
	"	width=5m	m	400		0		0		0		0		0
	Restoration (paved)	width=5m	m	260		0		0		0		0		0
	Sub-Total [1]					424,109		695,279		755,279		3,083,295		2,214,158
2	Community Plant													
-1	Septic Tank & Anaerobic Filter		m3/d	2,100	90	189,000	180	378,000	180	378,000	360	756,000	468	982,800
-2	Septic Tank & Absorption Well		m3/d	2,100		0		0		0		0		0
-3	Discharge Pipe													
	"	Dia 200 x 2mh	m	297	50	14,861	20	5,943	50	14,861	50	14,861	50	14,861
	"	Dia 250 x 2mh	m	350		0		0		0		0		0
	"	Dia 300 x 2mh	m	403		0		0		0		0		0
-4	Land Preperation		m2	11	570	6,270	930	10,230	930	10,230	1,580	17,380	2,190	24,090
-5	Fence		m	150	89	13,350	115	17,250	115	17,250	152	22,800	180	27,000
-6	Access Road (unpaved)	Width=3m	m	400	100	40,000		0	100	40,000	200	80,000	50	20,000
	Sub-Total [2]					263,481		411,424		460,341		891,041		1,068,751
	Grand Total					687,590		1,106,703		1,215,619		3,974,336		3,282,908

Table O2-8 Detailed Direct Construction Cost of Each Settlement for Sanitation System (3/3)

[1] Region : Central (5/5) (Unit : Quetzal)

No	Item	Description	Unit	Unit Price	20 Incienso Numbers	20 Incienso Total
	(Basic Conditions)	Served Population	person	-		4,200
		Served Area	ha	-		18.50
		Wastewater Rate	m3/d	Daily Max		756
		Unit Generation	lpcd	Daily Max		180
1	Sewer Pipeline					
1)	Concrete Pipe (Open cut)	Dia 200 x 2mh	m	297		
	"	Dia 200 x 3mh	m	471		0
	"	Dia 250 x 2mh	m	350		0
	"	Dia 300 x 2mh	m	403	2,128	743,944
	"	Dia 400 x 2mh	m	460	2,128	857,604
2)	Manholes					
	"	Dia 1,500 x 2mh	No's	8,719	85	742,016
	"	Dia 1,500 x 3mh	No's	9,827		0
	"	Dia 1,500 x 4mh	No's	13,342		0
3)	Roads (including restoration)					
	New Road (unpaved)	width=3m	m	300		0
	"	width=5m	m	400		0
	Restoration (paved)	width=5m	m	260		0
	Sub-Total [1]					2,343,564
2	Community Plant					
-1	Septic Tank & Anaerobic Filter		m3/d	2,100	756	1,587,600
-2	Septic Tank & Absorption Well		m3/d	2,100		0
-3	Discharge Pipe	Dia 200 x 2mh	m	297		
	"	Dia 250 x 2mh	m	350		0
	"	Dia 300 x 2mh	m	403		0
	"	Dia 400 x 2mh	m	460	500	201,552
-4	Land Preperation		m2	11	2,790	30,690
-5	Fence		m	150	204	30,600
-6	Access Road (unpaved)	Width=3m	m	400		0
	Sub-Total [2]					1,850,442
	Grand Total					4,194,006

Note: 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of February 1996.

[2] Region : South 3 (1/1) (Unit : Quetzal)

No	Item	Description	Unit	Unit Price	1 Loma Blanca I Numbers	1 Loma Blanca I Total	2 Loma Blanca II Numbers	2 Loma Blanca II Total	3 Plaza de Toros Numbers	3 Plaza de Toros Total
	(Basic Conditions)	Served Population	person	-		900		1,000		1,000
		Served Area	ha	-		8.52		8.52		24.39
		Wastewater Rate	m3/d	Daily Max		162		180		180
		Unit Generation	lpcd	Daily Max		180		180		180
1	Sewer Pipeline									
1)	Concrete Pipe (Open cut)									
	"	Dia 200 x 2mh	m	297	1,960	582,417	1,960	582,417	5,610	1,667,272
	"	Dia 200 x 3mh	m	471		0		0		0
	"	Dia 250 x 2mh	m	350		0		0		0
	"	Dia 300 x 2mh	m	403		0		0		0
2)	Manholes									
	"	Dia 1,500 x 2mh	No's	8,719	39	341,729	39	341,729	112	978,258
	"	Dia 1,500 x 3mh	No's	9,827		0		0		0
	"	Dia 1,500 x 4mh	No's	13,342		0		0		0
3)	Roads (including restoration)									
	New Road (unpaved)	width=3m	m	300		0		0	200	60,000
	"	width=5m	m	400		0		0		0
	Restoration (paved)	width=5m	m	260		0		0		0
	Sub-Total [1]					924,146		924,146		2,705,530
2	Community Plant									
-1	Septic Tank & Anaerobic Filter		m3/d	2,100		0		0	180	378,000
-2	Septic Tank & Absorption Well		m3/d	2,100	162	340,200	180	378,000		0
-3	Discharge Pipe									
	"	Dia 200 x 2mh	m	297	100	29,721	100	29,721	50	14,861
	"	Dia 250 x 2mh	m	350		0		0		0
	"	Dia 300 x 2mh	m	403		0		0		0
-4	Land Preperation		m2	11	930	10,230	930	10,230	930	10,230
-5	Fence		m	150	115	17,250	115	17,250	115	17,250
-6	Access Road (unpaved)	Width=3m	m	400	0	0	0	0	50	20,000
	Sub-Total [2]					397,401		435,201		440,341
	Grand Total					1,321,547		1,359,347		3,145,871

Note: 1. The unit price in above table is derived from the survey results of EMPAGUA and JICA Study Team in Guatemala.
2. The above construction cost is fully treated by local currency.
3. Cost : as of February 1996.

Total Served Items	Unit	[Central]	[South 3]
Served Population	person	33,900	2,900
Served Settlements	No's	20	3
Served Area	ha	282.55	41.43
Wastewater Rate (max)	m3/day	6,102	522

Table O2-9 Detailed Land Acquisition Cost of Sewerage System

(Unit : Quetzal)

Districts \ Cost	Unit Cost (Quetzales/ha)	Area Required (ha)	Total
1 Central	400,000	70.0	28,000,000
2 South 3	600,000	30.0	18,000,000

[Note]

Land acquisition cost of sewerage system is only concerned with the land area required for WWTP. Therefore, land acquisition cost of an access road from nearest existing road to WWTP site is not included.

The unit price in above table is derived from the survey results of EMPAGUA on February 1996.

Table O2-10 Detailed Land Acquisition Cost of Sanitation System

(Unit : Quetzal)

Colonies \ Cost	Unit Cost (Quetzales/ha)	Area Required (ha)	Total
[Central Region]			
1 Final	380,000	0.06	22,800
2 El Pilar	450,000	0.13	58,500
3 El Cambary	260,000	0.06	15,600
4 Campo Seco	320,000	0.13	41,600
5 Colinas I & II	420,000	0.10	42,000
6 Quitanal	400,000	0.28	112,000
7 Santa Faz	350,000	0.13	45,500
8 Bethania Sec I	500,000	0.13	65,000
9 Bethania Sec II	400,000	0.16	64,000
10 Seis de Octubre	350,000	0.13	45,500
11 Joya I	400,000	0.19	76,000
12 Joya II	450,000	0.19	85,500
13 Joya III	450,000	0.19	85,500
14 La Joya IV	500,000	0.13	65,000
15 El Tuerto	650,000	0.06	39,000
16 Finca El Carmen	450,000	0.10	45,000
17 Modmo San Antonio	500,000	0.10	50,000
18 Colan Argueta	380,000	0.16	60,800
19 Jocotales	350,000	0.22	77,000
20 Incienso	500,000	0.28	140,000
Sub Total		2.93	1,236,300
[South 3 Region]			
1 Loma Blanca I	350,000	0.10	35,000
2 Loma Blanca II	300,000	0.10	30,000
3 Plaza de Toros	480,000	0.10	48,000
Sub Total		0.30	113,000
Total		3.23	1,349,300

[Note]

Land acquisition cost of sewerage system is only concerned with the land area required for Community Plant. Therefore, land acquisition cost of an access road from nearest existing road to Community Plant site is not included.

The unit price in above table is derived from the survey results of EMPAGUA on February 1996.

Table O2-11 The Summary of Required Annual O/M Cost for Sewerage System

	Item	Unit	Central	South 3
1	Wastewater Treatment Plant			
-1	Personnel Cost	Quetzal/Year	739,600	376,600
-2	Transportation Cost of sludge	Quetzal/Year	871,562	150,060
-3	Repair Costs (0.5% of C/C)	Quetzal/Year	551,943	449,124
	Sub-Total		2,163,105	975,784
2	Sewer Pipeline			
-1	Personnel Cost	Quetzal/Year	132,000	345,840
-2	Repair Costs (0.5% of C/C)	Quetzal/Year	1,105,678	390,922
	Sub-Total		1,237,678	736,762
	Total O/M Cost	Quetzal/Year	3,400,783	1,712,546

[Note] (1) The data source of "Unit Average Personnel Cost" is accepted by EMPAGUA in February 1996.
(2) The data source of "Unit Transportation Cost" is accepted by Municipality of Mixco in June 1995, it was approved by EMPAGUA promptly.
(3) The interval of maintenance works at the community plant assumed as carried out one time by two workers in every month.
(4) Repair Costs is estimated as 0.5% of direct construction cost .
(5) The Personnel number of maintenance of pipeline is estimated as follows.
The number of time for cleaning and survey workers are assumed as one time every year.
Cleaning Workers = (Pipe Length km) x 15 persons*day/km x (1/365 day)
Survey Workers = (Pipe Length km) x 3 persons*day/km x (1/365 day)
* Results to be calculated in accordance with above formulas, minimum required workers considered as two persons for look to safety if workers are less than two persons.
(6) The outline of facilities for first stage are as follows.
Central : 15 Trains of Primary Treatment Equipment.
South 3 : 4 Trains of Primary & Secondary Treatment Equipment.

Table O2-12 Annual O/M Cost of Wastewater Treatment Plant for Sewerage System

	Item	Unit	Central	South 3
1	Population	person	533,200 ~ 572,600	53,200 ~ 130,600
2	Wastewater Rate (Daily Average	m3/d	160,400 ~ 182,190	13,830 ~ 32,270
3	Sludge Q'ty (as Wc:60%)	ton/Year	22,399 ~ 26,572	1,941 ~ 4,575
4	No's of Trains	No's	15	4
5	Personnel Cost	Quetzal/Year	739,600	376,600
6	Personnel for O/M	person	19	8
	Chief of WWTP (Engineer)	person	1	1
	Technician	person	2	2
	Secretary	person	1	1
	Labor	person	15	4
7	Unit Average Personnel Cost			
	Chief of WWTP (Engineer)	Quetzal/Year	106,000	106,000
	Technician	Quetzal/Year	52,800	52,800
	Secretary	Quetzal/Year	33,000	33,000
	Labor	Quetzal/Year	33,000	33,000
8	Transportation Cost of sludge	Quetzal/Year	734,687 ~ 871,562	63,665 ~ 150,060
9	Unit Sludge Transportation Cost	Quetzal/ton	32.8	32.8
10	Repair Costs (0.5% of C/C)	Quetzal/Year	551,943	449,124
11	Cost of O/M	Quetzal/Year	2,163,105	975,784
12	Unit Cost of O/M	Quetzal/m3	0.03	0.08

[Note] (1) "Unit Cost of O/M" = (Personnel Cost) + (Transportation Cost of sludge) + (Repair Costs)
(2) The sludge including septage from sanitation facilities is estimated as 60% after to dried up in sludge drying beds.

Table O2-13 Annual O/M Cost of Sewer Pipeline for Sewerage System

	Item	Unit	Central	South 3
1	Lengh of Sewer Pipeline	km	11.0	212.3
-1	Trunk Sewer	km	11.0	17.3
-2	Branch Sewer	km	0.0	195.0
2	Pipe Diameter (Min of Trunk)	mm	--	300
	ditto (Max of Trunk)	mm	3,000	1,500
3	Personnel for O/M	person	4.00	10.48
-1	Cleaning	person	2.00	8.73
-2	Survey	person	2.00	1.75
4	Unit Average Personnel Cost	Quetzal/Year	33,000	33,000
5	Personnel Cost	Quetzal/Year	132,000	345,840
6	Repair Costs (0.5% of C/C)	Quetzal/Year	1,105,678	390,922
	Total O/M Cost	Quetzal/Year	1,237,678	736,762

[Note] (1) Number of Perssonnel required for O/M of Sewers in Central Region is taken into account of the scale of main collectors

Table O2-14 Summary of Required Annual O/M Cost for Sanitation System

	Item	Unit	Central	South 3
1	Community Plant			
-1	Personnel Cost	Quetzal/Year	66,000	33,000
-2	Transportation Cost of sludge	Quetzal/Year	8,704 ~ 43,392	1,088 ~ 3,712
-3	Repair Costs (0.5% of C/C)	Quetzal/Year	73,361	6,365
	Sub-Total		148,065 ~ 182,753	40,453 ~ 43,077
2	Sewer Pipeline			
-1	Personnel Cost	Quetzal/Year	66,000	33,000
-2	Repair Costs (0.5% of C/C)	Quetzal/Year	166,631	22,769
	Sub-Total		232,631	55,769
	Total O/M Cost	Quetzal/Year	380,696 ~ 415,384	96,222 ~ 98,846

[Note] (1) The data source of "Unit Average Personnel Cost" is accepted by EMPAGUA in February 1996.

(2) The data source of "Unit Transportation Cost" is accepted by Municipality of Mixco in June 1995, it was approved by EMPAGUA promptly.

(3) The interval of maintenance works at the community plant assumed as carried out one time by two workers in every month.

(4) Repair Costs is estimated as 0.5% of direct construction cost .

(5) The Personnel number of maintenance of pipeline is estimated as follows.

The number of time for cleaning and survey workers are assumed as one time every year.

Cleaning Workers = (Pipe Length km) x 10 persons*day/km x (1/365 day)

Survey Workers = (Pipe Length km) x 2 persons*day/km x (1/365 day)

* Results to be calculated in accordance with above formulas, minimum required workers considered as two persons for look to safety if workers are less than two persons.

Table O2-15 O/M Cost of Community Plant for Sanitation System

	Item	Unit	Central	South 3
1	Population	person	6,800 ~ 33,900	840 ~ 2,900
2	Wastewater Q'ty (Daily Average)	m3/d	1,050 ~ 5,590	130 ~ 460
3	Sludge Q'ty (as Wc:93%)	ton/Y	272 ~ 1,356	34 ~ 116
4	No's of Community Plant	No's	20	3
5	Personnel Cost	Quetzal/Year	66,000	33,000
6	Personnel for O/M	person	2	1
7	Unit Average Personnel Cost	Quetzal/Year	33,000	33,000
8	Transportation Cost of sludge	Quetzal/Year	8,704 ~ 43,392	1,088 ~ 3,712
9	Unit Sludge Transportation Cost	Quetzal/ton	32	32
10	Repair Costs (0.5% of C/C)	Quetzal/Year	73,361	6,365
11	O/M Cost	Quetzal/Year	148,065 ~ 182,753	40,453 ~ 43,077
12	Unit Cost of O/M	Quetzal/m3	0.39 ~ 0.09	0.85 ~ 0.26

[Note] (1) "Unit Cost of O/M" = (Personnel Cost) + (Transportation Cost of sludge) + (Repair Costs)
(2) Unit Q'ty a capita of sludge generation is estimated as 40 liter (as water contents is 93 %) per capita per year.

Table O2-16 O/M Cost of Sewer Pipeline for Sanitation System

	Item	Unit	Central	South 3
1	Pipe Length	km	65	10
2	Pipe Diameter	mm	200 ~ 400	200
3	Personnel for O/M	person/day	2	1
-1	Cleaning	person/day	1.78	0.27
-2	Survey	person/day	0.36	0.05
4	Unit Average Personnel Cost	Quetzal/Year	33,000	33,000
5	Personnel Cost	Quetzal/Year	66,000	33,000
6	Repair Costs (0.5% of C/C)	Quetzal/Year	166,631	22,769
	Total O/M Cost	Quetzal/Year	232,631	55,769

O3 OTHER DESCRIPTION OF COST DATA

O3.1 Unit Cost of Construction Works and Materials

The unit construction cost of sewer pipeline laying works has been estimated based on the actual results obtained from EMPAGUA, which are shown in Table O3-1, attached at the end of this section.

Unit construction works and materials costs for other items including the tunneling works in the hard rock area are described in Table O3-2, these costs are investigated by JICA Study Team in Guatemala from June 1995 to February 1996.

Land acquisition cost, land preparation and landscaping cost of the wastewater treatment plants for sewerage/sanitation system for each region, are described in Table O3-3. These costs were provided by EMPAGUA in June 1995 and February 1996.

The land cost of sewer pipeline installation is not considered since it will be installed underground the existing roads and under the hills / mountains in principle.

O3.2 Unit Operation and Maintenance (O/M) Cost

The personnel expenses and sludge disposal cost to be applied in the cost estimation are shown in Table O3-4.

O3.3 Exchange Rate and Inflation Rate

The exchange rate, used in this project is average monthly exchange rate obtained from the last one and half (1.5) years data. It is shown in Table O3-5. However, the exchange rate of recent half years from July 1995 to February 1996 is applied in this project.
The inflation rate of past twelve (12) years in Guatemala is described in Table O3-6.

O3.4 Taxes

The kind of applicable tax and ratio in this project are as follows.

a) Import Tax

Varies between 0 ~ 25 percent (%) depending on the type of imported goods. The percentage of major imported goods is mentioned below.

5 % : Pipe, Mechanical (pump, etc.,) and Electric Equipment

20 % : All the Vehicles, Tank Lorries, Vacuum Cars

For imported goods, it is necessary to include the charge of warehouse in addition to Import Tax.

b) Consumption Tax (IVA)

Consumption Tax is applied on all items. It is 10 percent (%) as of February 1996.

c) Withholding Tax

In case the project is financed by the overseas loans, withholding tax will be applied. The ratio is 12 percent (%) of construction cost except the material cost. However, in case the project is selected as grant aid project by agencies such as JICA, US-AID, the above mentioned tax will not be applied.

O3.5 Related Laws and Regulations for Construction Works

The major related laws and regulations, especially which should be considered during construction periods, are shown below.

1) Labor Standard Act
2) Construction Ruling of Guatemala City
3) Regulation of Staffs for EMPAGUA
4) Regulation of Design and Construction works for Sewerage System
5) The Road Traffic Act

O3.6 Industrial Standards to be Applied

Guatemala does not have Industrial Standards in principal. Therefore, Standards considered shall be one of major standard such as ISO, ASTM, DIN, JIS, BS and so on.
For example, in case of "The Rehabilitation Program of Existing Water Supply Facilities (a fictitious name)" being conducted to conducting in Guatemala by JICA, JIS are being applied.

ISO : International Standardization Organization

ASTM : American Standards Test Materials

BS : British Standard

JIS : Japanese Industrial Standard

O3.7 Limitation of the Construction Period

There is no limitation for the construction period, it means construction can be carried out throughout the year in principal. However, especially from May to August, i.e., in the rainy season the efficiency of construction works will be lower than other seasons.

O3.8 Equipment Required to be Imported and Domestic Products

In general, the major equipment required to be imported as the water/wastewater facilities are as follows.

Mechanical equipment : pumps, blowers, fans, etc.,
Electric equipment : motors, panels, cables, etc.,
Vehicles : 4 wheel drive cars, tank lorries, vacuum cars, etc.,

On the other hand, the major materials that can be obtained in Guatemala for this project, are mentioned below.

Pipe : concrete pipe (200 ~ 1,050 mm)
galvanized steel & PVC pipe (15 ~ 300 mm)
[The concrete pipe of more than diameter 1,050 mm will be constructed at the site.]
Civil Works : cements, gravel, sand, steel materials, concrete piles
Building Works : Blocks, bricks

O3.9 Working Conditions for Construction Works

A general working condition of private companies for construction works in this project are described below.

1) Working Hours : Nine (9) hours per day including one hours as a lunch break.
Monday to Friday: 8 AM to 5 PM
Saturday : 8 AM to 12 AM
2) Working Days : Six (6) days per week
3) Holidays : Sunday and National holiday in Guatemala.

However, if necessary, these can be revised by the contracts between client and constructors.

Table O3-1 : Unit Cost of Sewerage Pipeline Laying Works (1/2)

Data Source : EMPAGUA
Date Received : February 15, 1996

No	Item	Description			Labors	Materials		Unit Cost (1)		Unit Cost (2)
		Diameter (mm)	Covering (m)	(a) Length or Depth (m)	(a) (Quetzales)	(b) Cement Cover (Quetzales)	(c) C-Iron Cover (Quetzales)	(d)=(a+b) x 1.2 Cement Cover (Quetzales/No's)	(e)=(a+c) x 1.2 C-Iron Cover (Quetzales/No's)	(f)=(d)/(a) (Quetzales/m)
1	Concrete Pipe	200	2.00	20.00	4,501.48	452.06	0.00	5,944.25	0.00	297.21
2	"	200	3.00	20.00	7,396.90	452.06	0.00	9,418.75	0.00	470.94
3	"	250	2.00	20.00	5,146.16	681.84	0.00	6,993.60	0.00	349.68
4	"	300	2.00	20.00	5,802.16	916.24	0.00	8,062.08	0.00	403.10
5	"	400	2.00	20.00	6,253.23	1,409.32	0.00	9,195.06	0.00	459.75
6	"	400	3.00	20.00	8,616.32	1,409.32	0.00	12,030.77	0.00	601.54
7	"	450	2.00	20.00	6,821.70	1,673.88	0.00	10,194.70	0.00	509.73
8	"	450	3.00	20.00	9,442.24	1,673.88	0.00	13,339.34	0.00	666.97
9	"	500	2.00	20.00	7,320.85	2,116.06	0.00	11,324.29	0.00	566.21
10	"	500	3.00	20.00	9,941.38	2,116.06	0.00	14,468.93	0.00	723.45
11	"	600	2.50	20.00	9,386.77	2,741.72	0.00	14,554.19	0.00	727.71
12	"	600	3.50	20.00	12,284.61	2,741.72	0.00	18,031.60	0.00	901.58
13	"	750	2.50	20.00	12,506.45	5,127.78	0.00	21,161.09	0.00	1,058.05
14	"	750	3.50	20.00	15,180.75	5,127.78	0.00	25,570.24	0.00	1,278.51
15	"	900	3.00	20.00	18,177.34	9,282.12	0.00	32,951.35	0.00	1,647.57
16	"	1,000	3.25	20.00	20,201.67	10,194.18	0.00	36,475.02	0.00	1,823.75
17	"	1,050	3.25	20.00	21,134.24	11,331.44	0.00	38,958.82	0.00	1,947.94
18	Catch Basin from Road		2.00		6,261.32	936.16	2,277.16	8,636.98	10,246.18	
19	"		3.00		8,778.21	1,031.98	2,373.48	11,772.23	13,382.03	
20	Manhole	1,500	2.00		5,837.42	560.70	1,428.70	7,677.74	8,719.34	
21	"	1,500	3.00		6,552.15	768.60	1,636.60	8,784.90	9,826.50	
22	"	1,500	4.00		9,304.32	946.08	1,814.08	12,300.48	13,342.08	
23	"	1,750	2.25		6,499.76	686.94	1,554.94	8,624.04	9,665.64	
24	"	1,750	3.00		7,197.43	847.34	1,715.34	9,653.72	10,695.32	
25	Manhole	1,750	4.00		9,873.28	1,041.90	1,909.90	13,098.22	14,139.82	
26	"	2,000	3.00		7,903.92	997.32	1,865.32	10,681.49	11,723.09	
27	"	2,000	4.00		10,835.88	1,140.64	2,008.64	14,371.82	15,413.42	
28	"	2,250	3.25		9,431.72	1,140.64	2,008.64	12,686.83	13,728.43	
29	"	2,250	4.25		12,334.59	1,526.02	2,394.02	16,632.73	17,674.33	
30	Catch Basin from Household		2.00		4,207.03	332.58	0.00	5,447.53	0.00	
31	" (Tunneling)		2.00		7,008.14	332.58	0.00	8,808.86	0.00	
32	Sewer (Tunneling Type)	1,500		20.00	31,806.75	5,662.32	0.00	44,952.88	0.00	2,248.14
33	"	1,750		20.00	39,652.58	6,367.40	0.00	55,223.98	0.00	2,761.20
34	"	2,000		20.00	50,761.28	8,787.90	0.00	71,459.02	0.00	3,572.95
35	"	2,500		20.00	79,018.73	15,181.48	0.00	113,040.25	0.00	5,652.01
36	"	3,000		20.00	107,951.12	20,241.14	0.00	153,842.71	0.00	7,692.14
37	Vertical Shaft (two stages)	2,500		50.00	78,215.48	20,887.68	0.00	118,923.79	0.00	2,378.48
38	"	2,750		50.00	81,957.80	21,018.80	0.00	123,571.92	0.00	2,471.44
39	"	3,000		50.00	93,016.67	22,505.80	0.00	138,626.96	0.00	2,772.54
40	Vertical Shaft (three stages)	3,500		50.00	102,469.04	24,175.38	0.00	151,973.30	0.00	3,039.47
41	"	4,000		50.00	129,622.24	29,158.10	0.00	190,536.41	0.00	3,810.73

Note : Above unit cost means total construction costs that is including materials, labors costs.

Table O3-1 Unit Cost of Sewerage Pipeline Laying Works (2/2)

Data Source : EMPAGUA
Date Received : June 08, 1995

No	Item	Description			Labors	Materials		Unit Cost (1)		Unit Cost (2)
		Diameter (mm)	Covering (m)	(n) Length or Depth (m)	(a) (Quetzales)	(b) Cement Cover (Quetzales)	(c) C-Iron Cover (Quetzales)	(d)=(a+b) x 1.2 Cement Cover (Quetzales/No's)	(e)=(a+c) x 1.2 C-Iron Cover (Quetzales/No's)	(f)=(d)/(n) (Quetzales/m)
1	Concrete Pipe	200	2.00	20.00	2,665.77	441.30	0.00	3,728.48	0.00	186.42
2	"	200	3.00	20.00	4,488.52	441.30	0.00	5,915.78	0.00	295.79
3	"	250	2.00	20.00	3,242.93	415.70	0.00	4,390.36	0.00	219.52
4	"	300	2.00	20.00	3,668.29	892.70	0.00	5,473.19	0.00	273.66
5	"	400	2.00	20.00	4,178.40	1,383.60	0.00	6,674.40	0.00	333.72
6	"	400	3.00	20.00	5,399.78	1,383.60	0.00	8,140.06	0.00	407.00
7	"	450	2.00	20.00	4,270.23	1,673.40	0.00	7,132.36	0.00	356.62
8	"	450	3.00	20.00	5,895.68	1,673.40	0.00	9,082.90	0.00	454.14
9	"	500	2.00	20.00	4,591.65	2,072.80	0.00	7,997.34	0.00	399.87
10	"	500	3.00	20.00	6,224.27	2,072.80	0.00	9,956.48	0.00	497.82
11	"	600	2.50	20.00	5,877.31	2,686.10	0.00	10,276.09	0.00	513.80
12	"	600	3.50	20.00	7,658.87	2,686.10	0.00	12,413.95	0.00	620.70
13	"	750	2.50	20.00	6,896.65	5,064.40	0.00	14,353.26	0.00	717.66
14	"	750	3.50	20.00	9,193.30	5,064.40	0.00	17,109.24	0.00	855.46
15	"	900	3.00	20.00	11,396.47	9,202.60	0.00	24,718.88	0.00	1,235.94
16	"	1,000	3.25	20.00	12,636.21	10,103.90	0.00	27,288.13	0.00	1,364.41
17	"	1,050	3.25	20.00	13,214.76	11,226.20	0.00	29,329.15	0.00	1,466.46
18	Catch Basin from Road		2.00		3,428.36	829.80	2,171.30	5,109.79	6,719.59	
19	"		3.00		4,426.56	754.15	2,295.65	6,216.85	8,066.65	
20	Manhole	1,500	2.00		3,636.32	527.10	1,320.10	4,996.10	5,947.70	
21	"	1,500	3.00		4,266.14	697.50	1,490.50	5,956.37	6,907.97	
22	"	1,500	4.00		5,198.98	885.90	1,679.90	7,303.06	8,254.66	
23	"	1,750	2.25		4,319.61	665.70	1,458.70	5,982.37	6,933.97	
24	"	1,750	3.00		4,771.18	803.70	1,596.70	6,689.86	7,641.46	
25	Manhole	1,750	4.00		5,365.35	987.25	1,780.25	7,623.12	8,574.72	
26	"	2,000	3.00		5,442.59	871.00	1,664.00	7,576.31	8,527.91	
27	"	2,000	4.00		7,450.89	1,125.25	1,918.25	10,291.37	11,242.97	
28	"	2,250	3.25		7,118.15	1,124.00	1,917.00	9,890.58	10,842.18	
29	"	2,250	4.25		8,211.42	1,338.30	2,125.30	11,459.66	12,404.06	
30	Catch Basin from Household		2.00		1,390.86	353.05	0.00	2,092.69	0.00	
31	" (Tunnelling)		2.00		3,738.09	893.05	0.00	5,557.37	0.00	
32	Sewer (Tunnelling Type)	1,500		20.00	20,902.63	4,986.80	0.00	31,067.32	0.00	1,553.37
33	"	1,750		20.00	24,898.42	5,639.55	0.00	36,645.56	0.00	1,832.28
34	"	2,000		20.00	33,048.05	7,766.40	0.00	48,977.34	0.00	2,448.87
35	"	2,500		20.00	47,249.56	13,376.20	0.00	72,750.91	0.00	3,637.55
36	"	3,000		20.00	64,089.91	17,789.50	0.00	98,255.29	0.00	4,912.76
37	Vertical Shaft (two stages)	2,500		50.00	59,478.17	19,695.85	0.00	95,008.82	0.00	1,900.18
38	"	2,750		50.00	64,156.51	20,754.40	0.00	101,893.09	0.00	2,037.86
39	"	3,000		50.00	70,083.51	22,183.30	0.00	110,720.17	0.00	2,214.40
40	Vertical Shaft (three stages)	3,500		50.00	84,692.91	25,952.30	0.00	132,774.25	0.00	2,655.49
41	"	4,000		50.00	107,135.62	29,158.10	0.00	163,552.46	0.00	3,271.05

Note : Above unit cost means total construction costs that is including materials, labors costs.

Table O3-2 Other Unit Construction Cost

[Q : Quetzal]

No	Works	Item	Description	Unit	Unit Cost	Remarks
1	Pipe Laying	1) PVC: Poly Vinyl Pipe	PVC : 100 mm	Q/m	80.00	
		"	PVC : 150 mm	Q/m	110.00	
		"	PVC : 200 mm	Q/m	180.00	
		"	PVC : 250 mm	Q/m	225.00	
		"	PVC : 300 mm	Q/m	300.00	
		2) Tunneling Works	Dia 3,000mm (Hard Rock Area)	Q/m	38,500.00	by Blast with Dynamite
2	Civil	1) Concrete Tanks	V=100 m3	Q	280,000.00	
		"	V=300 m3	Q	630,000.00	
		"	V=500 m3	Q	750,000.00	
		"	V=1000 m3	Q	1,050,000.00	
		2) Concrete Works	Reinforced Concrete	Q/C-m3	2,140.00	
		3) Excavation	by machine	Q/m3	50.00	
		"	by human power	Q/m3	120.00	
		4) Disposal	L=10 km, by Track	Q/m3	65.00	
		5) Backfilling	by machine	Q/m3	50.00	
		"	by human power	Q/m3	120.00	
		6) Drainage Channels		Q/m	160.00	
		7) Fence	Nets & Pole	Q/m	150.00	
		9) Water Bridge	L=20m, Dia=3m	Set	253,000.00	including sewer pipe
		9) Inverted Siphon	L=10m, Dia=3m	Set	45,000.00	
		10) Steep Slope Sewer Pipe	Dia=3m	Q/m	4,510.00	
3	Road	1) New Road Construction	Unpaved Width=5 m	Q/m	400.00	
		"	Paved Width=5 m	Q/m	900.00	
		2) Restoration	Paved Width=5 m	Q/m	260.00	
4	Building	Administration Buildings	Reinforced Concrete	Q/m2	3,750.00	
		Administration Buildings	by Block	Q/m2	2,100.00	
		Guardhouse	by Brick	Q/m2	1,500.00	
5	Others	1) Material Cost				
		Steel : Reinforcement Bar	Grade 40	ton	5,100.00	
		"	Grade 50	ton	5,500.00	
		Mooring Wire		kg	0.98	
		Nail	4 "	kg	1.10	
		Galvanized Steel Pipe	1 1/4" * 20' (6 m)	No	132.94	
		"	4" * 20' (6 m)	No	501.72	
		Angular	1/8" * 1" *20' (6 m)	No	25.98	
		Steel Black Sheet	1/4" * 4" * 8' (2.4m)	No	739.82	
		Portland Cement	42.5 kg	No	28.00	
		Gravel	3/4"	m3	120.00	
		Sand	from river	m3	120.00	
		Ready Mix Concrete	2,500 PSI	m3	390.00	
		"	3,500 PSI	m3	450.00	
		"	4,000 PSI	m3	485.00	
		"	5,000 PSI	m3	650.00	
		Concrete Block	9 x 19 x 39cm	1000 No's	2,400.00	
		"	14 x 19 x 39cm	"	3,000.00	
		"	19 x 19 x 39cm	"	3,800.00	
		Perforated Brick	6.5 x 14 x 29cm	"	680.00	
		"	11 x 14 x 29cm	"	1,100.00	
		"	6.5 x 11 x 23cm	"	1,200.00	
		Paving Stone	10 x 22 x 24cm	"	3,100.00	
		Pine Wood	Rustic	No	3.15	
		"	Form	No	3.75	
		Plywood	4' * 8' * 1/2"	No	175.00	
		Tablex	4' * 8' * 1/2"	No	75.00	
		Glass	Ordinary Glass 3mm	No	6.50	
		2) Personnel Expense	Local Staff (Draft man)	Q/e/Month	1,500-3,000	
			" (Secretary bilingual)	Q/e/Month	1,500-3,000	
			" (Interpreter)	Q/e/Month	3,000.00	
			" (OA Operator)	Q/e/Month	3,000.00	
			" (Driver)	Q/e/Month	2,000.00	
			" (Office Boy)	Q/e/Month	1,500.00	
		3) Fuel	Gasoline (Regular)	Q/liter	2.48	
		"	Gasoline (Special)	Q/liter	2.60	
		"	Light oil	Q/liter	2.00	
		4) Electricity Power		Q/kwh	0.50	
		5) Lease Vehicle	2 ton Track	Q/Month	19,000.00	
		"	4 ton Track	Q/Month	22,000.00	
		"	8 ton Track	Q/Month	30,000.00	
		"	4 WD Car	Q/Month	21,000.00	
		"	Sedan	Q/Month	18,800.00	
		6) Office Rental	100 m2	Q/Month	4,000.00	
		7) Office Goods	Copy, Phone, Fax	Q/Month	4,500.00	

(Note) 1. Data Source : Surveyed Results of JICA STUDY TEAM in Guatemala.
2. Cost : As of February 1996.

Table O3-3 Unit Land Acquisition Cost and Others

[Land Acquisition Cost]

[1] WWTP Site of Sewerage System

	Districts	Unit Cost (Quetzales/ha)
1	Central	400,000
2	South 3	600,000

[2] Community Plant Site of Sanitation System

[Central Region]

	Colonies	Unit Cost (Quetzales/ha)		Colonies	Unit Cost (Quetzales/ha)
1	Final	380,000	11	Joya I	400,000
2	El Pilar	450,000	12	Joya II	450,000
3	El Cambary	260,000	13	Joya III	450,000
4	Campo Seco	320,000	14	La Joya IV	500,000
5	Colinas I & II	420,000	15	El Tuerto	650,000
6	Quitanal	400,000	16	Finca El Carmen	450,000
7	Santa Faz	350,000	17	Modrno San Antonio	500,000
8	Bethania Sec I	500,000	18	Colan Argueta	380,000
9	Bethania Sec III & IV	400,000	19	Jocotales	350,000
10	Seis de Octubre	350,000	20	Incienso	500,000

[South 3 Region]

1	Loma Blanca I	350,000
2	Loma Blanca II	300,000
3	Plaza de Toros	480,000

Note : Data Source : EMPAGUA
Date Received : February 20, 1996.

[Land Preparation and Landscaping Costs]

System	Land Preparation (Quetzales/ha)
Sewerage	11.0
Sanitation	11.0

Note : Data Source : EMPAGUA
Date Received : June 12 , 1995

Table O3-4 Unit Cost for Operation and Maintenance

No	Description	Unit	Unit Cost	Remarks
1	Personnel Expense			
-1	Engineer	Quetzales/c/Year	106,000	
-2	Unskilled Labor (A)	Quetzales/c/Year	52,800	
-3	Unskilled Labor (B)	Quetzales/c/Year	33,000	
-4	Unskilled Labor (C)	Quetzales/c/Year	15,800	
2	Sludge Disposal Cost			
-1	Sewerage System	Quetzales/ton	32.8	as dry sludge
-2	Sanitation System	Quetzales/m3	32.0	as wet sludge

(Note)

1. Data Source : From EMPAGUA in February, 1996.
2. The data source of "disposal cost" of the sanitation system was prepared by the Municipality of Mixco in June,1995. It was approved by EMPAGUA promptly.
3. Transport distance to disposal place of sludge is assumed to be about ten (10) km.

Table O3-5 Exchange Rate in Recent Years

Year	Month	Quetzales/US$	Yen/US$	Yen/Quetzales
1994	5	5.74	106.99	18.64
	6	5.73	105.72	18.45
	7	5.65	101.57	17.98
	8	5.66	102.87	18.17
	9	5.79	101.85	17.59
	10	5.77	101.45	17.58
	11	5.73	101.00	17.63
	12	5.63	103.20	18.33
1995	1	5.73	102.77	17.94
	2	5.71	101.33	17.75
	3	5.69	93.87	16.50
	4	5.72	86.41	15.11
	5	5.73	87.96	15.35
	6	5.75	87.34	15.19
	7	5.76	90.00	15.63
	8	5.80	95.60	16.48
	9	5.88	101.43	17.25
	10	5.95	101.74	17.10
	11	5.99	103.02	17.20
	12	5.92	102.90	17.38
Average	95.7-95.12	5.88	99.12	16.84

Data Source : 1) Quetzales/US$: Banco de Guatemala
Departamento de Cambios e Internacional, Mesa de Cambio
2) Yen/US$: Bank of Tokyo

Table O3-6 Inflation Rate in Guatemala

Year	Inflation Rate (%/Year)
1984	3.30
1985	19.18
1986	32.78
1987	10.85
1988	10.30
1989	12.99
1990	41.01
1991	35.11
1992	10.24
1993	13.36
1994	12.51
1995	8.37

Data Source
Instituto Nacional de Etadistica de Guatemala in November1995

O4 IMPLEMENTATION PROGRAM OF THE FIRST STAGE

O4.1 Outline of Facilities to be Constructed

It is evident from the results in the chapter 12 that sewerage system of South 3 Region has been selected as first stage project. An outline of the facilities to be constructed in first stage are described below.

Sewer Pipeline : Trunk sewer as the collector and branch sewers are proposed to be constructed by open cut and tunneling methods (diameter : 1.5 m, length : about 10 km). The diameter of the trunk sewer varies from 300 to 1,500 mm and diameter of branch sewer is 200 mm.

WWTP : Treatment plant up to secondary treatment level is proposed to be built in the first stage. The sludge generated in the WWTP will be transferred after drying process to another site for final disposal.

O4.2 Construction Methods

Sewer Pipeline : Sewer pipelines will be constructed mainly three (3) different methods. The sewer of 1,500 mm diameter (dia) as the main collector will be constructed by the tunneling methods which is usually adopted in Guatemala and the sewers of 1,200 mm diameter and below are considered to be constructed by the open cut methods.
The sewer pipeline needs to cross Pinula and Guadron river each at one point. Pinula River crossing will be of 70 m length and that of the Guadron River will be 40 m.

WWTP : The main construction works of WWTP is composed of civil works, building works and the pipe laying works. The civil works are carried out for land preparation, construction of the access road, the primary and secondary treatment facilities and other facilities. The building works are considered for administration building, warehouses and guardhouse. The pipe laying works include inflow pipe of the sewer, discharge pipe of the treated wastewater from WWTP to Villalobos river and various pipeline in the WWTP.

O4.3 Planning of Construction Works

a) Implementation Schedule

The development plan of the project is scheduled as follows.
From the result of feasibility study mentioned in previous section, sewerage system of South 3 Region will be carried out at the first stage, although the project has three (3) stages. Detailed design and construction periods for the first stage is estimated to be six (6) years from 1998 to 2003.

[First Stage]	1998	:	Detailed Design Period
	1999 ~ 2003	:	Construction Period
	2002	:	Commissioning

b) Construction Works for Each Year

Facilities to be constructed from the year 1998 to 2003 are shown in Table O4-1.

Table O4-1 Implementation Ratio/Volume of Construction Works

Serial No	Year	Sewer Pipeline			WWTP
		Trunk Sewer		Branch Sewer	
		dia 1500 mm	dia 300 ~1200	dia 200 mm	
1	1998	----	----	----	----
2	1999	3,340 m	one-third	20,000 m	one-third
3	2000	3,340 m	one-third	20,000 m	one-third
4	2001	3,340 m	one-third	20,000 m	one-third
5	2002	----	----	13,000 m	----
6	2003	----	----	13,000 m	----

O4.4 Cost Estimation

a) Total Investment Cost

The total investment cost of implementation program of the first stage is shown in Table O4-2.

Table O4-2 Total Investment Cost

(Unit :Quetzal)

Region / Costs Item	South 3		
	I/C	F/C	Total
1. Direct Construction	168,009,211	0	168,009,211
1.1 Sewerage System	168,009,211	0	168,009,211
(1) Sewer Pipeline	78,184,441	0	78,184,441
(2) WWTP	89,824,770	0	89,824,770
1.2 Sanitation System	0	0	0
(1) Sewer Pipeline	0	0	0
(2) Community Plant	0	0	0
2. Land Acquisition	18,000,000	0	18,000,000
2.1 Sewerage System	18,000,000	0	18,000,000
2.2 Sanitation System	0	0	0
3. Engineering Fee	3,360,184	10,080,553	13,440,737
4. Administration Fee	5,040,276	0	5,040,276
5. Physical Contingency	16,800,921	0	16,800,921
Total	211,210,592	10,080,553	221,291,145

b) Disbursement Schedule

The proposed disbursement schedule of the project cost in the first stage is shown in Table O4-3. Land required for WWTP has been assumed to be acquired in year 1999 and 2000.

Table O4-3 Disbursement Schedule of First Stage for South 3 Region

(Unit : Quetzal)

No	Costs Item	1998			1999			2000			2001			2002			2003			Total		
		L/C	F/C	Sub-Total	L/C	F/C	Sub-Total	L/C	F/C	Sub-Total	L/C	F/C	Sub-Total	L/C	F/C	Sub-Total	L/C	F/C	Sub-Total	L/C	F/C	Grand Total
1	Direct Construction	0	0	0	50,842,541	0	50,842,541	50,842,541	0	50,842,541	50,842,541	0	50,842,541	7,740,794	0	7,740,794	7,740,794	0	7,740,794	168,009,211	0	168,009,211
-1	Sewer Pipeline	0	0	0	20,900,951	0	20,900,951	20,900,951	0	20,900,951	20,900,951	0	20,900,951	7,740,794	0	7,740,794	7,740,794	0	7,740,794	78,184,441	0	78,184,441
	(1) Trunk Sewer	0	0	0	9,554,953	0	9,554,953	9,554,953	0	9,554,953	9,554,953	0	9,554,953	0	0	0	0	0	0	28,664,858	0	28,664,858
	(2) Branch Sewer	0	0	0	11,345,998	0	11,345,998	11,345,998	0	11,345,998	11,345,998	0	11,345,998	7,740,794	0	7,740,794	7,740,794	0	7,740,794	49,519,582	0	49,519,582
	Branch Sewer (1/2)	0	0	0	11,345,998	0	11,345,998	11,345,998	0	11,345,998	11,345,998	0	11,345,998	0	0	0	0	0	0	34,037,993	0	34,037,993
	Branch Sewer (2/2)	0	0	0	0	0	0	0	0	0	0	0	0	7,740,794	0	7,740,794	7,740,794	0	7,740,794	15,481,589	0	15,481,589
-2	WWTP	0	0	0	29,941,590	0	29,941,590	29,941,590	0	29,941,590	29,941,590	0	29,941,590	0	0	0	0	0	0	89,824,770	0	89,824,770
2	Land Acquisition	0	0	0	9,000,000	0	9,000,000	9,000,000	0	9,000,000	0	0	0	0	0	0	0	0	0	18,000,000	0	18,000,000
3	Engineering Fee	1,344,074	4,032,221	5,376,295	672,037	2,016,111	2,688,147	672,037	2,016,111	2,688,147	672,037	2,016,111	2,688,147	0	0		0	0		3,360,184	10,080,553	13,440,737
4	Administration Fee	0	0	0	1,525,276	0	1,525,276	1,525,276	0	1,525,276	1,525,276	0	1,525,276	232,224	0	232,224	232,224	0	232,224	5,040,276	0	5,040,276
5	Physical Contingency	0	0	0	5,084,254	0	5,084,254	5,084,254	0	5,084,254	5,084,254	0	5,084,254	774,079	0	774,079	774,079	0	774,079	16,800,921	0	16,800,921
	Total	1,344,074	4,032,221	5,376,295	67,124,108	2,016,111	69,140,218	67,124,108	2,016,111	69,140,218	58,124,108	2,016,111	60,140,218	8,747,098	0	8,747,098	8,747,098	0	8,747,098	211,210,592	10,080,553	221,291,145

Not : L/C : Local Currency, F/C : Foreign Currency

SUPPORTING REPORT P

ECONOMIC AND FINANCIAL EVALUATION

SUPPORTING REPORT P
FINANCIAL AND ECONOMIC EVALUATION

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P FINANCIAL AND ECONOMIC EVALUATION

P1 Avoidable Number of Death, Inpatients and Outpatients Owing to Sewerage and Sanitation Systems

According to a public health report, "Medical Environment and Public Health for Metropolitan Development Plan (El Saneamiento del Medio y las Metas de Salud, Propuesta para el Plan de Desarrollo Metropolitano), 1972, Dr. Raúl Paredez López", public health in the metropolitan areas was exacerbated in accordance to development expansion. This analysis is used to quantify the number of avoidable medical losses owing to sewerage and sanitation system in the project areas by Region until the target year 2015. The number of deaths due to water-borne diseases under "without project" for eliminating water contamination was estimated on the basis of past mortality, which was analyzed in the above report. Once the project was implemented, the mortality rate would be reduced to 2.16 per 1000 population at the first year and finally to 0.48 per 1,000 population in the area of implementation in the target year. In the original report, it was planned the project would start in 1982 and finish in 1991. In this study, these conditions were translated as for starting in 2001 and finishing in 2015. As a result, 17,782 and 5,236 people could avoid death from water-borne diseases in Central and South 3 Regions respectively, as shown in Table P-1.

The number of patients suffering from water-borne diseases is also estimated in the same way. Patients were classified into two categories: inpatients and outpatients. According to the estimates, the number of inpatients due to water-borne diseases could be reduced by 42,124 in Central Region and 12,426 in South 3 Region in the 14 years till 2015, as shown in Table P-2. The number of outpatients could be reduced by 73,652 in Central Region and 21,726 in South 3 Region, as shown in Table P-3.

Table P-4 shows the past trend of consumer price indices in urban areas between 1976 and 1994, which was presented by INE and GAPLAN. The indices in 1995 and 1996 were extrapolated as 1,100 and 1,150 to the base 1976, because of data availability.

Table P-5 shows a employment rate which is a rate of a employed population to the total population. The employment rate was estimated at 36.1%, according to the report by INE in 1991.

Table P-1 Avoidable Number of Death Owing to Sewerage System: 2001-2015

Year	Projected Population		Number of Death In Case of Constant Mortality*1		Projected Mortality Rate *2	Number of Death In Case of Projected Mortality*1		Avoidable Number of Death Owing to Sewerage System	
	Central	South 3	Central	South 3		Central	South 3	Central	South 3
2001	752,100	182,300	1,940	470	2.16	1,625	394	316	77
2002	759,900	189,200	1,961	488	1.94	1,474	367	486	121
2003	767,700	196,100	1,981	506	1.74	1,338	342	643	164
2004	775,500	203,000	2,001	524	1.56	1,214	318	787	206
2005	783,300	209,900	2,021	542	1.41	1,101	295	920	247
2006	791,100	216,800	2,041	559	1.26	999	274	1,042	286
2007	798,900	223,700	2,061	577	1.13	906	254	1,155	324
2008	806,700	230,600	2,081	595	1.02	821	235	1,260	360
2009	814,500	237,500	2,101	613	0.91	745	217	1,357	396
2010	822,300	244,400	2,122	631	0.82	675	201	1,446	430
2011	830,100	251,300	2,142	648	0.74	612	185	1,529	463
2012	837,900	258,200	2,162	666	0.66	555	171	1,607	495
2013	845,700	265,100	2,182	684	0.60	503	158	1,679	526
2014	853,500	272,000	2,202	702	0.53	456	145	1,746	556
2015	861,400	279,000	2,222	720	0.48	413	134	1,809	586
Total			31,220	8,924		13,437	3,689	17,782	5,236

Source: (1) Estudio de Factibilidad del Plan Maestro de Alcantarillado Ciemca del Pacifico, 1976, Guatemala City, IDB
(2) El Saneamiento del Medio y las Metas de Salud, Propuesta para el Plan de Desarrollo Metropolitano, 1972, Dr. Raúl Paredez Lóp

Note: *1 Mortality Rate: 2.58 per 1000 population
*2 Persons per 1000 population

Table P-2 Avoidable Number of Inpatients Owing to Sewerage System: 2001-2015

Year	Projected Population		Number of Inpatients In Case of Constant Morbidity*1		Projected Morbidity Rate *2	Number of Death In Case of Projected Morbidity*1		Avoidable Number of Inpatients Owing to Sewerage System	
	Central	South 3	Central	South 3		Central	South 3	Central	South 3
2001	752,100	182,300	5,814	1,409	6.69	5,032	1,220	782	190
2002	759,900	189,200	5,874	1,463	6.24	4,743	1,181	1,131	282
2003	767,700	196,100	5,934	1,516	5.82	4,470	1,142	1,465	374
2004	775,500	203,000	5,995	1,569	5.43	4,212	1,103	1,782	467
2005	783,300	209,900	6,055	1,623	5.07	3,969	1,064	2,086	559
2006	791,100	216,800	6,115	1,676	4.73	3,740	1,025	2,376	651
2007	798,900	223,700	6,175	1,729	4.41	3,523	987	2,652	743
2008	806,700	230,600	6,236	1,783	4.11	3,319	949	2,917	834
2009	814,500	237,500	6,296	1,836	3.84	3,126	912	3,170	924
2010	822,300	244,400	6,356	1,889	3.58	2,944	875	3,412	1,014
2011	830,100	251,300	6,417	1,943	3.34	2,773	839	3,644	1,103
2012	837,900	258,200	6,477	1,996	3.12	2,611	805	3,866	1,191
2013	845,700	265,100	6,537	2,049	2.91	2,458	771	4,079	1,279
2014	853,500	272,000	6,598	2,103	2.71	2,315	738	4,283	1,365
2015	861,400	279,000	6,659	2,157	2.53	2,179	706	4,479	1,451
Total			93,538	26,739		51,414	14,313	42,124	12,426

Source: (1) Estudio de Factibilidad del Plan Maestro de Alcantarillado Ciemca del Pacifico, 1976, Guatemala City, IDB
(2) El Saneamiento del Medio y las Metas de Salud, Propuesta para el Plan de Desarrollo Metropolitano, 1972, Dr. Raúl Paredez Lóp

Note: *1 Mortality Rate: 7.73 per 1000 population
*2 Persons per 1000 population

Table P-3 Avoidable Number of Outpatients Owing to Sewerage System: 2001-2015

Year	Projected Population		Number of Inpatients In Case of Constant Morbidiity*1		Projected Morbidity Rate *2	Number of Death In Case of Projected Morbidity*1		Avoidable Number of Inpatients Owing to Sewerage System	
	Central	South 3	Central	South 3		Central	South 3	Central	South 3
2001	752,100	182,300	10,229	2,479	11.78	8,860	2,147	1,369	332
2002	759,900	189,200	10,335	2,573	11.00	8,357	2,081	1,978	492
2003	767,700	196,100	10,441	2,667	10.27	7,882	2,013	2,559	654
2004	775,500	203,000	10,547	2,761	9.58	7,433	1,946	3,114	815
2005	783,300	209,900	10,653	2,855	8.95	7,009	1,878	3,644	976
2006	791,100	216,800	10,759	2,948	8.35	6,609	1,811	4,150	1,137
2007	798,900	223,700	10,865	3,042	7.80	6,231	1,745	4,635	1,298
2008	806,700	230,600	10,971	3,136	7.28	5,873	1,679	5,098	1,457
2009	814,500	237,500	11,077	3,230	6.80	5,536	1,614	5,541	1,616
2010	822,300	244,400	11,183	3,324	6.35	5,218	1,551	5,965	1,773
2011	830,100	251,300	11,289	3,418	5.92	4,918	1,489	6,372	1,929
2012	837,900	258,200	11,395	3,512	5.53	4,634	1,428	6,761	2,084
2013	845,700	265,100	11,502	3,605	5.16	4,367	1,369	7,135	2,237
2014	853,500	272,000	11,608	3,699	4.82	4,114	1,311	7,494	2,388
2015	861,400	279,000	11,715	3,794	4.50	3,876	1,256	7,839	2,539
Total			164,568	47,044		90,916	25,317	73,652	21,726

Source: (1) Estudio de Factibilidad del Plan Maestro de Alcantarillado Ciemca del Pacifico, 1976, Guatemala City, IDB
(2) El Saneamiento del Medio y las Metas de Salud, Propuesta para el Plan de Desarrollo Metropolitano, 1972, Dr. Raúl Paredez Lóp

Note: *1 Mortality Rate: 13.6 per 1000 population
*2 Persons per 1000 population

Table P-4 Consumer Price Index in Urban Areas: 1976-1994

Year	Total	Food	Housing	Clothing	Furniture	Transportation	Others
I. Base: 1975 = 100							
1976	110.7	109.6	109.7	124.7	111.8	103.5	106.7
1977	124.6	121.7	131.1	147.1	121.2	107.7	118.2
1978	134.5	127.3	147.3	163.2	124.2	112.6	132.3
1979	150.0	140.4	171.4	181.9	131.7	119.0	149.4
1980	166.1	156.1	198.7	194.7	137.8	139.3	162.8
1981	185.1	173.7	223.7	218.4	143.0	155.4	182.0
1982	185.4	168.8	225.8	219.2	141.1	179.9	186.5
1983 *1	184.5	164.6	221.7	226.4	141.0	193.5	185.8
II. Base: 1983 (March-April) = 100							
1983	105.2	106.0	101.4	106.9	105.2	101.9	107.8
1984	108.8	108.1	186.4	112.7	111.3	105.9	114.0
1985	129.1	130.4	111.5	137.1	135.2	126.4	154.2
1986	176.8	181.5	129.8	203.6	191.3	178.1	203.6
1987	198.6	219.8	141.6	224.4	198.4	192.7	218.7
1988 *2	211.8	229.1	147.9	235.5	207.1	194.2	231.4
1989	234.7	261.6	190.7	243.5	221.0	202.4	244.0
1990	331.0	384.8	252.5	294.9	291.4	315.6	322.1
1991	447.2	509.3	339.3	402.5	379.3	482.7	435.2
1992	493.0	546.1	386.5	464.8	435.3	520.4	490.5
1993	558.9	625.2	463.1	515.2	495.7	562.2	549.7
1994 Sep.	626.2	743.8	521.7	550.7	553.1	592.4	616.8

Source: INE and GAPLAN

Note: *1 Average of March and April in 1983
*2 Average of January to March in 1988

Table P-5 Indicators Related to Employment

	Item	Number
1	Total Number of Households	348,098
2	Population	1,890,196
3	Male	911,625
4	Female	978,571
5	Family Number per Household	4.9
6	Population Aged 10 or Above	1,375,572
7	Male	646,646
8	Female	728,926
9	Economically Active Population	704,429
10	Male	461,329
11	Female	243,100
12	Employed Population	681,428
13	Population of Full Employment	476,850
14	Population of Part-Time Employment (Visible)	64,702
15	Population of Part-Time Employment (Invisible)	139,876
16	Unemployed Population	23,001
17	Employment Rate of Total Population ((12)/(2))	36.1%
18	Employment Rate of Economically Active Population ((12)/(6))	49.5%

Source: Metropolitan Area Employment Survey, 1991, INE

P2 Agricultural Crop Production in Plant Sites

The areas of sewage treatment plant sites in Central and South 3 Regions were enumerated as 90 ha and 30 ha, respectively. At present, a part of the plant sites of Central and South 3 Regions are used for residential land and crop lands, and other areas are still left as waste lands. Table P-6 shows the details of present land use.

Table P-6 Present Land Utilization of Proposed Plant Sites

(Unit: ha)

	Central Region	South 3 Region
Residential Land	2.0	2.0
Crop Land	34.0	18.0
Maize	11.3	6.0
Beans	22.7	12.0
Waste Land	54.0	10.0
Total	90.0	30.0

Note: Estimated by Study Team

The crops cultivated in crop lands at the plant sites are assumed to be maize and beans as representative products, referring to the site inspection results. Table P-7 and P-8 enumerated production cost, yield, farm gate price and value added (VA) of Maize and Beans which were cultivated in metropolitan areas. VAs of maize and beans are estimated at Q2,220/ha and Q970/ha, respectively.

Table P-7 Value Added and Production Cost of Maize in metropolitan Areas: 1995

(Unit:Quetzals per manzana*1)

	Item	Unit	Quantity	Unit Price	Total
I.	Direct Cost				1,773.48
1	Land Rent				150.00
2	Labor				760.80
a)	Land Preparation	Hour	9.00	18.50	166.50
b)	Fertilization, Cropping, etc.	Day	32.00	15.60	499.20
c)	Others				95.10
3	Machinery and Equipment				155.02
a)	Balance Plough	Hour	2.00	1.50	3.00
b)	Tracker	Hour	1.50	1.50	2.25
c)	Sowing Machine	Hour	1.50	25.00	37.50
d)	Splinkler	Hour	5.00	1.96	9.80
e)	Wagon	Hour	0.50	4.00	2.00
f)	Thresher	Hour	1.00	25.72	25.72
g)	Tractor	Hour	11.50	6.50	74.75
4	Input				707.66
a)	Seed	Pound	25.00	1.80	45.00
b)	Fuel	Galon	10.00	8.70	87.00
c)	Lubricant	Galon	1.20	8.54	10.25
d)	Fertilizer	Pound	200.00	1.58	315.00
e)	Insecticide	Liter	1.80	74.79	134.62
f)	Fungicide	Pound	1.90	18.47	35.09
g)	Herbicide	Liter	1.00	63.20	63.20
h)	Container	Bag	5.00	3.50	17.50
II.	Indirect Cost				410.05
1)	Administration (1% of I.)				17.73
2)	Social Security Fee (6% of I.-2)				45.65
3)	Finance (20% of I. 6M.)				221.69
4)	Contingencies (1% of I.)				17.73
5)	Stumps				
6)	Municipal Fee (0.15 x Yield)				9.75
7)	Transportation (1.5 x Yield)				97.50
III.	Total Cost				2,183.54
	Yield	65 quintals per manzana*2 4.24 tons per hectare			
IV.	Total Cost per Hectare (Quetzals per ha)				3,141.78
V.	Production Value (Quetzals per ha)				5,611.51
	Farm-gate Price	1,323 Quetzals per ton			
VI.	Value Added (Quetzals per ha)				2,469.73
VII.	Value Added in Economic Term (Quetzals per ha)*3				2,220.00

Source: MAFF, Bank of Guatemala

Note: *1 1 manzana = 6,950 sq.m.

*2 Equivalent to 4.24 tons/ha

1 Quintal = 100 pound = 45.36 kg.

*3 SCF: 90%

Table P-8 Value Added and Production Cost of Beans in Metropolitan Areas: 1995

(Unit:Quetzals per manzana*1)

	Item	Unit	Quantity	Unit Price	Total
I.	Direct Cost				1,749.53
1	Land Rent				100.00
2	Labor				757.14
a)	Land Preparation	Hour	5.80	12.50	72.50
b)	Fertilization, Cropping, etc.	Day	47.20	12.50	590.00
c)	Others				94.64
3	Machinery and Equipment				129.14
a)	Balance Plough	Hour	2.20	1.50	3.30
b)	Tracker	Hour	2.00	1.50	3.00
c)	Cultivation	Hour	1.80	1.50	2.70
d)	Splinkler	Hour	100.00	0.30	30.14
g)	Tractor	Hour	6.00	15.00	90.00
4	Input				763.25
a)	Seed	Pound	100.00	1.90	190.00
b)	Fertilizer	Pound	200.00	1.07	213.00
c)	Insecticide	Liter	1.00	119.29	119.29
d)	Fungicide	Pound	1.90	104.45	198.46
e)	Adherent	Liter	1.50	19.00	28.50
f)	Container	Bag	4.00	3.50	14.00
II.	Indirect Cost				301.51
1)	Administration (1% of I.)				17.50
2)	Social Security Fee (6% of I.-2)				45.43
3)	Finance (20% of I. 6M.)				218.69
4)	Contingencies (1% of I.)				17.50
5)	Municipal Fee (0.15 x Yield)				2.40
III.	Total Cost				2,051.03
	Yield	16 quintals per manzana*2 1.04 tons per hectare			
IV.	Total Cost per Hectare				2,951.13
V.	Production Value (Quetzals per ha)				4,028.78
	Farm-gate Price	3,858 Quetzals per ton			
VI.	Value Added (Quetzals per ha)				1,077.65
VII.	Value Added in Economic Term (Quetzals per ha)*3				970.00

Source: MAFF, Bank of Guatemala

Note: *1 1 manzana = 6,950 sq.m.

*2 Equivalent to 4.24 tons/ha

1 Quintal = 100 pound = 45.36 kg.

*3 SCF: 90%

P3 Financial Internal Rate of Return

FIRRs of the projects for charge alternatives were calculated in Table P-9 to P12. These tables correspond to the financial streams of revenue and expenditure for Charge I and III in Table 12-27 in Main Report.

P4 Financial Stream of Cash Balance

Table P-13 to P-16 shows the cash balance accumulated by the end of economic life of the schemes in Central Region. These tables cover only Case 1-2a, 1-2b, 1-2c and 1-2d. Table P-17 to P-20 shows the cash balance in South 3 Region. These tables cover only Case 4-2a, 4-2b, 4-2c and 4-2d. Other cases are saved in computer diskettes.

Table P-9 Financial Expenditure and Revenue Stream: Central Region

In Case of Charge I

(Unit:Q million)

Serial No.	Year	Expenditure			Revenue			Balance
		Construction	O/M	Total	Domestic	Industry	Total	
1	1998	9.1	0.0	9.1	0.0	0.0	0.0	-9.1
2	1999	172.1	0.0	172.1	0.0	0.0	0.0	-172.1
3	2000	149.8	0.0	149.8	0.0	0.0	0.0	-149.8
4	2001	149.8	0.0	149.8	0.0	0.0	0.0	-149.8
5	2002		3.6	3.6	12.9	0.9	13.7	10.1
6	2003		3.7	3.7	13.3	0.9	14.2	10.5
7	2004		3.7	3.7	13.7	0.9	14.6	10.9
8	2005		3.8	3.8	14.2	0.9	15.0	11.3
9	2006		3.8	3.8	14.4	0.9	15.2	11.4
10	2007		3.8	3.8	14.5	0.9	15.3	11.5
11	2008		3.8	3.8	14.6	0.9	15.4	11.6
12	2009		3.8	3.8	14.7	0.9	15.5	11.7
13	2010		3.8	3.8	14.8	0.9	15.6	11.8
14	2011		3.8	3.8	14.8	0.9	15.7	11.9
15	2012		3.8	3.8	14.9	0.9	15.7	11.9
16	2013		2.7	2.7	14.9	0.9	15.8	13.1
17	2014		3.8	3.8	15.0	0.9	15.9	12.1
18	2015		3.8	3.8	15.0	0.9	15.9	12.1
19	2016		3.8	3.8	15.0	0.9	15.9	12.1
20	2017		3.8	3.8	15.0	0.9	15.9	12.1
21	2018		3.8	3.8	15.0	0.9	15.9	12.1
22	2019		3.8	3.8	15.0	0.9	15.9	12.1
23	2020		3.8	3.8	15.0	0.9	15.9	12.1
24	2021		3.8	3.8	15.0	0.9	15.9	12.1
25	2022		3.8	3.8	15.0	0.9	15.9	12.1
26	2023		3.8	3.8	15.0	0.9	15.9	12.1
27	2024		3.8	3.8	15.0	0.9	15.9	12.1
28	2025		3.8	3.8	15.0	0.9	15.9	12.1
29	2026		3.8	3.8	15.0	0.9	15.9	12.1
30	2027		3.8	3.8	15.0	0.9	15.9	12.1
31	2028		3.8	3.8	15.0	0.9	15.9	12.1
32	2029		3.8	3.8	15.0	0.9	15.9	12.1
33	2030		3.8	3.8	15.0	0.9	15.9	12.1
34	2031		3.8	3.8	15.0	0.9	15.9	12.1

FIRR: -1.7%

Table P-10 Financial Expenditure and Revenue Stream: Central Region

In Case of Charge III

(Unit:Q million)

Serial No.	Year	Expenditure			Revenue			Balance
		Const.	O/M	Total	Domestic	Industry	Total	
1	1998	9.1	0.0	9.1	0.0	0.0	0.0	-9.1
2	1999	172.1	0.0	172.1	0.0	0.0	0.0	-172.1
3	2000	149.8	0.0	149.8	0.0	0.0	0.0	-149.8
4	2001	149.8	0.0	149.8	0.0	0.0	0.0	-149.8
5	2002		3.6	3.6	38.6	2.6	41.2	37.5
6	2003		3.7	3.7	39.9	2.6	42.5	38.8
7	2004		3.7	3.7	41.2	2.6	43.8	40.1
8	2005		3.8	3.8	42.6	2.6	45.1	41.4
9	2006		3.8	3.8	43.1	2.6	45.7	41.9
10	2007		3.8	3.8	43.4	2.6	46.0	42.2
11	2008		3.8	3.8	43.7	2.6	46.3	42.5
12	2009		3.8	3.8	44.0	2.6	46.6	42.8
13	2010		3.8	3.8	44.3	2.6	46.9	43.1
14	2011		3.8	3.8	44.4	2.6	47.0	43.2
15	2012		3.8	3.8	44.6	2.6	47.2	43.4
16	2013		2.7	2.7	44.8	2.6	47.3	44.6
17	2014		3.8	3.8	45.0	2.6	47.6	43.8
18	2015		3.8	3.8	45.0	2.6	47.6	43.8
19	2016		3.8	3.8	45.0	2.6	47.6	43.8
20	2017		3.8	3.8	45.0	2.6	47.6	43.8
21	2018		3.8	3.8	45.0	2.6	47.6	43.8
22	2019		3.8	3.8	45.0	2.6	47.6	43.8
23	2020		3.8	3.8	45.0	2.6	47.6	43.8
24	2021		3.8	3.8	45.0	2.6	47.6	43.8
25	2022		3.8	3.8	45.0	2.6	47.6	43.8
26	2023		3.8	3.8	45.0	2.6	47.6	43.8
27	2024		3.8	3.8	45.0	2.6	47.6	43.8
28	2025		3.8	3.8	45.0	2.6	47.6	43.8
29	2026		3.8	3.8	45.0	2.6	47.6	43.8
30	2027		3.8	3.8	45.0	2.6	47.6	43.8
31	2028		3.8	3.8	45.0	2.6	47.6	43.8
32	2029		3.8	3.8	45.0	2.6	47.6	43.8
33	2030		3.8	3.8	45.0	2.6	47.6	43.8
34	2031		3.8	3.8	45.0	2.6	47.6	43.8

FIRR: 7.1%

Table P-11 Financial Expenditure and Revenue Stream: South 3 Region

In Case of Charge I

(Unit:Q million)

Serial No.	Year	Expenditure			Revenue			Balance
		Construction	O/M	Total	Domestic	Industry	Total	
1	1998	5.6	0.0	5.6	0.0	0.0	0.0	-5.6
2	1999	86.3	0.0	86.3	0.0	0.0	0.0	-86.3
3	2000	68.2	0.0	68.2	0.0	0.0	0.0	-68.2
4	2001	68.2	0.0	68.2	0.0	0.0	0.0	-68.2
5	2002		1.7	1.7	1.5	0.8	2.3	0.6
6	2003		1.7	1.7	1.6	0.8	2.4	0.7
7	2004		1.7	1.7	1.9	0.8	2.8	1.0
8	2005		1.8	1.8	2.3	0.8	3.1	1.4
9	2006		1.8	1.8	2.7	0.8	3.5	1.8
10	2007		1.8	1.8	2.8	0.8	3.6	1.9
11	2008		1.8	1.8	2.9	0.8	3.7	2.0
12	2009		1.8	1.8	3.0	0.8	3.8	2.1
13	2010		1.8	1.8	3.1	0.8	4.0	2.2
14	2011		1.8	1.8	3.3	0.8	4.1	2.3
15	2012		1.8	1.8	3.4	0.8	4.2	2.4
16	2013		1.8	1.8	3.6	0.8	4.4	2.6
17	2014		1.8	1.8	3.7	0.8	4.5	2.7
18	2015		1.8	1.8	3.8	0.8	4.7	2.8
19	2016		1.8	1.8	3.8	0.8	4.7	2.8
20	2017		1.8	1.8	3.8	0.8	4.7	2.8
21	2018		1.8	1.8	3.8	0.8	4.7	2.8
22	2019		1.8	1.8	3.8	0.8	4.7	2.8
23	2020		1.8	1.8	3.8	0.8	4.7	2.8
24	2021		1.8	1.8	3.8	0.8	4.7	2.8
25	2022		1.8	1.8	3.8	0.8	4.7	2.8
26	2023		1.8	1.8	3.8	0.8	4.7	2.8
27	2024		1.8	1.8	3.8	0.8	4.7	2.8
28	2025		1.8	1.8	3.8	0.8	4.7	2.8
29	2026		1.8	1.8	3.8	0.8	4.7	2.8
30	2027		1.8	1.8	3.8	0.8	4.7	2.8
31	2028		1.8	1.8	3.8	0.8	4.7	2.8
32	2029		1.8	1.8	3.8	0.8	4.7	2.8
33	2030		1.8	1.8	3.8	0.8	4.7	2.8
34	2031		1.8	1.8	3.8	0.8	4.7	2.8

FIRR: -5.5%

Table P-12 Financial Expenditure and Revenue Stream: South 3 Region

In Case of Charge III

(Unit:Q million)

Serial No.	Year	Expenditure			Revenue			Balance
		Construction	O/M	Total	Domestic	Industry	Total	
1	1998	5.6	0.0	5.6	0.0	0.0	0.0	-5.6
2	1999	86.3	0.0	86.3	0.0	0.0	0.0	-86.3
3	2000	68.2	0.0	68.2	0.0	0.0	0.0	-68.2
4	2001	68.2	0.0	68.2	0.0	0.0	0.0	-68.2
5	2002		1.7	1.7	3.0	1.6	4.6	2.9
6	2003		1.7	1.7	3.2	1.6	4.8	3.1
7	2004		1.7	1.7	3.9	1.6	5.5	3.8
8	2005		1.8	1.8	4.7	1.6	6.3	4.5
9	2006		1.8	1.8	5.5	1.6	7.1	5.3
10	2007		1.8	1.8	5.7	1.6	7.3	5.5
11	2008		1.8	1.8	5.9	1.6	7.5	5.7
12	2009		1.8	1.8	6.1	1.6	7.7	5.9
13	2010		1.8	1.8	6.3	1.6	7.9	6.2
14	2011		1.8	1.8	6.6	1.6	8.2	6.4
15	2012		1.8	1.8	6.8	1.6	8.5	6.7
16	2013		1.8	1.8	7.1	1.6	8.8	7.0
17	2014		1.8	1.8	7.4	1.6	9.1	7.3
18	2015		1.8	1.8	7.7	1.6	9.4	7.5
19	2016		1.8	1.8	7.7	1.6	9.4	7.5
20	2017		1.8	1.8	7.7	1.6	9.4	7.5
21	2018		1.8	1.8	7.7	1.6	9.4	7.5
22	2019		1.8	1.8	7.7	1.6	9.4	7.5
23	2020		1.8	1.8	7.7	1.6	9.4	7.5
24	2021		1.8	1.8	7.7	1.6	9.4	7.5
25	2022		1.8	1.8	7.7	1.6	9.4	7.5
26	2023		1.8	1.8	7.7	1.6	9.4	7.5
27	2024		1.8	1.8	7.7	1.6	9.4	7.5
28	2025		1.8	1.8	7.7	1.6	9.4	7.5
29	2026		1.8	1.8	7.7	1.6	9.4	7.5
30	2027		1.8	1.8	7.7	1.6	9.4	7.5
31	2028		1.8	1.8	7.7	1.6	9.4	7.5
32	2029		1.8	1.8	7.7	1.6	9.4	7.5
33	2030		1.8	1.8	7.7	1.6	9.4	7.5
34	2031		1.8	1.8	7.7	1.6	9.4	7.5

FIRR: -0.8%

Table P-13 Financial Stream of Income and Expenditure: Central Region

Case 1-2a: Charge II with 100% of Financial Capital Covered by Loan 1

(Unit: Q Million)

Serial No.	Year	Capital Balance					Revenue Balance								Cash Balance *1	Accumulated Cash Balance
		Revenue	Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Construc-tion Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreci-ation*2	Interest of Loan	Total			
1	1998	9.1	9.1	0.0	9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	-0.7	-0.7	-0.7
2	1999	172.1	172.1	0.0	172.1	0.0	0.0	0.0	0.0	0.0	0.0	14.7	14.7	-14.7	-14.7	-15.4
3	2000	149.8	149.8	0.0	149.8	0.0	0.0	0.0	0.0	0.0	0.0	26.8	26.8	-26.8	-26.8	-42.2
4	2001	149.8	149.8	0.0	149.8	0.0	0.0	0.0	0.0	0.0	0.0	39.0	39.0	-39.0	-39.0	-81.2
5	2002			0.0	0.0	0.0	25.7	1.7	27.5	3.6	14.4	39.0	57.0	-29.6	-15.1	-96.3
6	2003			32.1	32.1	-32.1	26.6	1.7	28.3	3.7	14.4	36.4	54.5	-26.1	-43.8	-140.1
7	2004			32.1	32.1	-32.1	27.5	1.7	29.2	3.7	14.4	33.8	51.9	-22.7	-40.3	-180.4
8	2005			32.1	32.1	-32.1	28.4	1.7	30.1	3.8	14.4	31.2	49.3	-19.2	-36.9	-217.3
9	2006			32.1	32.1	-32.1	28.7	1.7	30.5	3.8	14.4	28.6	46.8	-16.3	-33.9	-251.2
10	2007			32.1	32.1	-32.1	28.9	1.7	30.6	3.8	14.4	26.0	44.2	-13.5	-31.2	-282.4
11	2008			32.1	32.1	-32.1	29.1	1.7	30.9	3.8	14.4	23.4	41.6	-10.7	-28.4	-310.8
12	2009			32.1	32.1	-32.1	29.3	1.7	31.0	3.8	14.4	20.8	39.0	-7.9	-25.6	-336.4
13	2010			32.1	32.1	-32.1	29.5	1.7	31.3	3.8	14.4	18.2	36.4	-5.2	-22.8	-359.1
14	2011			32.1	32.1	-32.1	29.6	1.7	31.3	3.8	14.4	15.6	33.8	-2.5	-20.1	-379.2
15	2012			32.1	32.1	-32.1	29.7	1.7	31.4	3.8	14.4	13.0	31.2	0.2	-17.4	-396.6
16	2013			32.1	32.1	-32.1	29.8	1.7	31.5	2.7	14.4	10.4	27.5	4.0	-13.6	-410.2
17	2014			32.1	32.1	-32.1	30.0	1.7	31.7	3.8	14.4	7.8	26.0	5.7	-11.9	-422.2
18	2015			32.1	32.1	-32.1	30.0	1.7	31.7	3.8	14.4	5.2	23.4	8.3	-9.3	-431.5
19	2016			32.1	32.1	-32.1	30.0	1.7	31.7	3.8	14.4	2.6	20.8	10.9	-6.7	-438.2
20	2017			32.1	32.1	-32.1	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	-4.1	-442.4
21	2018			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-414.4
22	2019			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-386.5
23	2020			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-358.6
24	2021			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-330.7
25	2022			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-302.7
26	2023			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-274.8
27	2024			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-246.9
28	2025			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-219.0
29	2026			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-191.0
30	2027			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-163.1
31	2028			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-135.2
32	2029			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-107.3
33	2030			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-79.4
34	2031			0.0	0.0	0.0	30.0	1.7	31.7	3.8	14.4	0.0	18.2	13.5	27.9	-51.4

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 1

Interest:	8.1% p.a.
Repayment Period:	20 Years
Grace Period:	5 Years

Table P-14 Financial Stream of Income and Expenditure: Central Region

Case 1-2b: Charge II with Financial Source of both 90% of Loan 1 and 10% of Donation

(Unit: Q Million)

Serial No.	Year	Capital Balance							Revenue Balance								Cash Accumulated Balance *1	Cash Accumulated Cash Balance
		Revenue			Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Grant (10%)	Total	Construction Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreciation *2	Interest of Loan	Total			
1	1998	8.2	0.9	9.1	9.1	0.0	9.1	-0.9	0.0	0.0	0.0	0.0	0.0	0.7	0.7	-0.7	-1.6	-1.6
2	1999	154.9	17.2	172.1	172.1	0.0	172.1	-17.2	0.0	0.0	0.0	0.0	0.0	13.2	13.2	-13.2	-30.4	-32.0
3	2000	134.9	15.0	149.8	149.8	0.0	149.8	-15.0	0.0	0.0	0.0	0.0	0.0	24.1	24.1	-24.1	-39.1	-71.1
4	2001	134.9	15.0	149.8	149.8	0.0	149.8	-15.0	0.0	0.0	0.0	0.0	0.0	35.1	35.1	-35.1	-50.0	-121.1
5	2002					0.0	0.0	0.0	25.7	1.7	27.5	3.6	13.0	35.1	51.7	-24.2	-11.2	-132.4
6	2003					28.9	28.9	-28.9	26.6	1.7	28.3	3.7	13.0	32.7	49.4	-21.1	-36.9	-169.3
7	2004					28.9	28.9	-28.9	27.5	1.7	29.2	3.7	13.0	30.4	47.1	-17.9	-33.7	-203.1
8	2005					28.9	28.9	-28.9	28.4	1.7	30.1	3.8	13.0	28.0	44.8	-14.7	-30.6	-233.6
9	2006					28.9	28.9	-28.9	28.7	1.7	30.5	3.8	13.0	25.7	42.5	-12.0	-27.9	-261.5
10	2007					28.9	28.9	-28.9	28.9	1.7	30.6	3.8	13.0	23.4	40.1	-9.5	-25.4	-286.9
11	2008					28.9	28.9	-28.9	29.1	1.7	30.9	3.8	13.0	21.0	37.8	-7.0	-22.8	-309.7
12	2009					28.9	28.9	-28.9	29.3	1.7	31.0	3.8	13.0	18.7	35.5	-4.4	-20.3	-330.0
13	2010					28.9	28.9	-28.9	29.5	1.7	31.3	3.8	13.0	16.4	33.1	-1.9	-17.8	-347.7
14	2011					28.9	28.9	-28.9	29.6	1.7	31.3	3.8	13.0	14.0	30.8	0.5	-15.3	-363.1
15	2012					28.9	28.9	-28.9	29.7	1.7	31.4	3.8	13.0	11.7	28.5	3.0	-12.9	-376.0
16	2013					28.9	28.9	-28.9	29.8	1.7	31.5	2.7	13.0	9.3	25.0	6.5	-9.4	-385.3
17	2014					28.9	28.9	-28.9	30.0	1.7	31.7	3.8	13.0	7.0	23.8	7.9	-7.9	-393.3
18	2015					28.9	28.9	-28.9	30.0	1.7	31.7	3.8	13.0	4.7	21.5	10.3	-5.6	-398.9
19	2016					28.9	28.9	-28.9	30.0	1.7	31.7	3.8	13.0	2.3	19.1	12.6	-3.3	-402.1
20	2017					28.9	28.9	-28.9	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	-0.9	-403.1
21	2018					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-375.2
22	2019					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-347.2
23	2020					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-319.3
24	2021					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-291.4
25	2022					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-263.5
26	2023					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-235.5
27	2024					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-207.6
28	2025					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-179.7
29	2026					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-151.8
30	2027					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-123.8
31	2028					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-95.9
32	2029					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-68.0
33	2030					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-40.1
34	2031					0.0	0.0	0.0	30.0	1.7	31.7	3.8	13.0	0.0	16.8	14.9	27.9	-12.2

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 1

Interest:	8.1% p.a.
Repayment Period:	20 Years
Grace Period:	5 Years

Table P-15 Financial Stream of Income and Expenditure: Central Region

Case 1-2c: Charge II with Financial Source of both 80% of Loan I and 20% of Donation

(Unit: Q Million)

Serial No.	Year	Capital Balance							Revenue Balance								Cash Balance *1	Accumulated Cash Balance
		Revenue			Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Grant (20%)	Total	Construc-tion Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreci-ation*2	Interest of Loan	Total			
1	1998	7.3	1.8	9.1	9.1	0.0	9.1	-1.8	0.0	0.0	0.0	0.0	0.0	0.6	0.6	-0.6	-2.4	-2.4
2	1999	137.7	34.4	172.1	172.1	0.0	172.1	-34.4	0.0	0.0	0.0	0.0	0.0	11.7	11.7	-11.7	-46.2	-48.6
3	2000	119.9	30.0	149.8	149.8	0.0	149.8	-30.0	0.0	0.0	0.0	0.0	0.0	21.5	21.5	-21.5	-51.4	-100.0
4	2001	119.9	30.0	149.8	149.8	0.0	149.8	-30.0	0.0	0.0	0.0	0.0	0.0	31.2	31.2	-31.2	-61.1	-161.1
5	2002					0.0	0.0	0.0	25.7	1.7	27.5	3.6	11.5	31.2	46.3	-18.9	-7.4	-168.5
6	2003					25.6	25.6	-25.6	26.6	1.7	28.3	3.7	11.5	29.1	44.3	-16.0	-30.1	-198.6
7	2004					25.6	25.6	-25.6	27.5	1.7	29.2	3.7	11.5	27.0	42.3	-13.1	-27.2	-225.7
8	2005					25.6	25.6	-25.6	28.4	1.7	30.1	3.8	11.5	24.9	40.2	-10.1	-24.2	-250.0
9	2006					25.6	25.6	-25.6	28.7	1.7	30.5	3.8	11.5	22.9	38.2	-7.7	-21.8	-271.8
10	2007					25.6	25.6	-25.6	28.9	1.7	30.6	3.8	11.5	20.8	36.1	-5.5	-19.6	-291.3
11	2008					25.6	25.6	-25.6	29.1	1.7	30.9	3.8	11.5	18.7	34.0	-3.2	-17.3	-308.6
12	2009					25.6	25.6	-25.6	29.3	1.7	31.0	3.8	11.5	16.6	32.0	-0.9	-15.0	-323.6
13	2010					25.6	25.6	-25.6	29.5	1.7	31.3	3.8	11.5	14.5	29.9	1.4	-12.7	-336.4
14	2011					25.6	25.6	-25.6	29.6	1.7	31.3	3.8	11.5	12.5	27.8	3.5	-10.6	-346.9
15	2012					25.6	25.6	-25.6	29.7	1.7	31.4	3.8	11.5	10.4	25.7	5.7	-8.4	-355.3
16	2013					25.6	25.6	-25.6	29.8	1.7	31.5	2.7	11.5	8.3	22.6	9.0	-5.1	-360.4
17	2014					25.6	25.6	-25.6	30.0	1.7	31.7	3.8	11.5	6.2	21.6	10.2	-4.0	-364.4
18	2015					25.6	25.6	-25.6	30.0	1.7	31.7	3.8	11.5	4.2	19.5	12.2	-1.9	-366.3
19	2016					25.6	25.6	-25.6	30.0	1.7	31.7	3.8	11.5	2.1	17.4	14.3	0.2	-366.1
20	2017					25.6	25.6	-25.6	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	2.3	-363.8
21	2018					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-335.9
22	2019					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-308.0
23	2020					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-280.0
24	2021					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-252.1
25	2022					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-224.2
26	2023					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-196.3
27	2024					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-168.3
28	2025					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-140.4
29	2026					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-112.5
30	2027					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-84.6
31	2028					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-56.6
32	2029					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-28.7
33	2030					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	-0.8
34	2031					0.0	0.0	0.0	30.0	1.7	31.7	3.8	11.5	0.0	15.4	16.4	27.9	27.1

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 1

Interest:	8.1% p.a.
Repayment Period:	20 Years
Grace Period:	5 Years

Table P-16 Financial Stream of Income and Expenditure: Central Region

Case 1-2d: Charge II with Financial Source of both 70% of Loan 1 and 30% of Donation

(Unit: Q Million)

Serial No.	Year	Capital Balance							Revenue Balance								Cash Balance *1	Accumulated Cash Balance
		Revenue			Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Grant (30%)	Total	Construction Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreciation*2	Interest of Loan	Total			
1	1998	6.4	2.7	9.1	9.1	0.0	9.1	-2.7	0.0	0.0	0.0	0.0	0.0	0.5	0.5	-0.5	-3.2	-3.2
2	1999	120.5	51.6	172.1	172.1	0.0	172.1	-51.6	0.0	0.0	0.0	0.0	0.0	10.3	10.3	-10.3	-61.9	-65.1
3	2000	104.9	45.0	149.8	149.8	0.0	149.8	-45.0	0.0	0.0	0.0	0.0	0.0	18.8	18.8	-18.8	-63.7	-128.9
4	2001	104.9	45.0	149.8	149.8	0.0	149.8	-45.0	0.0	0.0	0.0	0.0	0.0	27.3	27.3	-27.3	-72.2	-201.1
5	2002					0.0	0.0	0.0	25.7	1.7	27.5	3.6	10.1	27.3	41.0	-13.6	-3.5	-204.5
6	2003					22.4	22.4	-22.4	26.6	1.7	28.3	3.7	10.1	25.4	39.2	-10.9	-23.3	-227.8
7	2004					22.4	22.4	-22.4	27.5	1.7	29.2	3.7	10.1	23.6	37.4	-8.2	-20.6	-248.4
8	2005					22.4	22.4	-22.4	28.4	1.7	30.1	3.8	10.1	21.8	35.7	-5.6	-17.9	-266.3
9	2006					22.4	22.4	-22.4	28.7	1.7	30.5	3.8	10.1	20.0	33.9	-3.4	-15.8	-282.0
10	2007					22.4	22.4	-22.4	28.9	1.7	30.6	3.8	10.1	18.2	32.1	-1.4	-13.8	-295.8
11	2008					22.4	22.4	-22.4	29.1	1.7	30.9	3.8	10.1	16.4	30.2	0.6	-11.7	-307.5
12	2009					22.4	22.4	-22.4	29.3	1.7	31.0	3.8	10.1	14.5	28.4	2.6	-9.7	-317.3
13	2010					22.4	22.4	-22.4	29.5	1.7	31.3	3.8	10.1	12.7	26.6	4.6	-7.7	-325.0
14	2011					22.4	22.4	-22.4	29.6	1.7	31.3	3.8	10.1	10.9	24.8	6.5	-5.8	-330.8
15	2012					22.4	22.4	-22.4	29.7	1.7	31.4	3.8	10.1	9.1	23.0	8.5	-3.9	-334.7
16	2013					22.4	22.4	-22.4	29.8	1.7	31.5	2.7	10.1	7.3	20.1	11.5	-0.9	-335.5
17	2014					22.4	22.4	-22.4	30.0	1.7	31.7	3.8	10.1	5.5	19.4	12.4	0.0	-335.5
18	2015					22.4	22.4	-22.4	30.0	1.7	31.7	3.8	10.1	3.6	17.6	14.2	1.8	-333.7
19	2016					22.4	22.4	-22.4	30.0	1.7	31.7	3.8	10.1	1.8	15.7	16.0	3.7	-330.0
20	2017					22.4	22.4	-22.4	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	5.5	-324.5
21	2018					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-296.6
22	2019					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-268.7
23	2020					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-240.8
24	2021					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-212.8
25	2022					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-184.9
26	2023					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-157.0
27	2024					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-129.1
28	2025					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-101.1
29	2026					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-73.2
30	2027					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-45.3
31	2028					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	-17.4
32	2029					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	10.6
33	2030					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	38.5
34	2031					0.0	0.0	0.0	30.0	1.7	31.7	3.8	10.1	0.0	13.9	17.8	27.9	66.4

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)

*2 30 years depreciation

Terms of Source Alternative 1

Interest:	8.1% p.a.
Repayment Period:	20 Years
Grace Period:	5 Years

Table P-17 Financial Stream of Income and Expenditure: South 3 Region

Case 4-2a: Charge II with 100% of Financial Capital Covered by Loan 2

(Unit: Q Million)

Serial No.	Year	Capital Balance					Revenue Balance								Cash Balance *1	Accumulated Balance
		Revenue	Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Construction Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreciation*2	Interest of Loan	Total			
1	1998	5.6	5.6	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.1	-0.1	-0.1
2	1999	86.3	86.3	0.0	86.3	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.3	-2.3	-2.3	-2.4
3	2000	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	-4.0	-4.0	-6.4
4	2001	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	5.7	5.7	-5.7	-5.7	-12.2
5	2002			0.0	0.0	0.0	2.2	1.2	3.4	1.7	6.9	5.7	14.3	-10.8	-4.0	-16.1
6	2003			0.0	0.0	0.0	2.4	1.2	3.6	1.7	6.9	5.7	14.3	-10.7	-3.8	-20.0
7	2004			0.0	0.0	0.0	2.9	1.2	4.2	1.7	6.9	5.7	14.3	-10.1	-3.3	-23.3
8	2005			0.0	0.0	0.0	3.5	1.2	4.7	1.8	6.9	5.7	14.3	-9.6	-2.8	-26.0
9	2006			0.0	0.0	0.0	4.1	1.2	5.3	1.8	6.9	5.7	14.3	-9.0	-2.2	-28.2
10	2007			0.0	0.0	0.0	4.3	1.2	5.5	1.8	6.9	5.7	14.3	-8.9	-2.0	-30.2
11	2008			11.4	11.4	-11.4	4.4	1.2	5.6	1.8	6.9	5.7	14.3	-8.7	-13.3	-43.5
12	2009			11.4	11.4	-11.4	4.6	1.2	5.8	1.8	6.9	5.4	14.1	-8.3	-12.8	-56.3
13	2010			11.4	11.4	-11.4	4.7	1.2	6.0	1.8	6.9	5.1	13.8	-7.8	-12.4	-68.7
14	2011			11.4	11.4	-11.4	4.9	1.2	6.1	1.8	6.9	4.9	13.5	-7.4	-11.9	-80.6
15	2012			11.4	11.4	-11.4	5.1	1.2	6.3	1.8	6.9	4.6	13.2	-6.9	-11.4	-92.1
16	2013			11.4	11.4	-11.4	5.3	1.2	6.6	1.8	6.9	4.3	12.9	-6.4	-10.9	-103.0
17	2014			11.4	11.4	-11.4	5.6	1.2	6.8	1.8	6.9	4.0	12.7	-5.9	-10.4	-113.4
18	2015			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	3.7	12.4	-5.4	-9.9	-123.4
19	2016			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	3.4	12.1	-5.1	-9.7	-133.0
20	2017			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	3.1	11.8	-4.8	-9.4	-142.4
21	2018			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	2.9	11.5	-4.5	-9.1	-151.5
22	2019			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	2.6	11.2	-4.2	-8.8	-160.3
23	2020			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	2.3	10.9	-3.9	-8.5	-168.8
24	2021			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	2.0	10.7	-3.7	-8.2	-177.0
25	2022			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	1.7	10.4	-3.4	-7.9	-184.9
26	2023			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	1.4	10.1	-3.1	-7.7	-192.6
27	2024			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	1.1	9.8	-2.8	-7.4	-200.0
28	2025			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	0.9	9.5	-2.5	-7.1	-207.0
29	2026			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	0.6	9.2	-2.2	-6.8	-213.8
30	2027			11.4	11.4	-11.4	5.8	1.2	7.0	1.8	6.9	0.3	8.9	-1.9	-6.5	-220.4
31	2028			0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.9	0.0	8.7	-1.7	5.2	-215.2
32	2029			0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.9	0.0	8.7	-1.7	5.2	-210.0
33	2030			0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.9	0.0	8.7	-1.7	5.2	-204.8
34	2031			0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.9	0.0	8.7	-1.7	5.2	-199.6

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 2

Interest:	2.5% p.a.
Repayment Period:	30 Years
Grace Period:	10 Years

Table P-18 Financial Stream of Income and Expenditure: South 3 Region

Case 4-2b: Charge II with Financial Source of both 90% of Loan 2 and 10% of Donation

(Unit: Q Million)

Serial No.	Year	Capital Balance							Revenue Balance								Cash Balance *1	Accumulated Cash Balance
		Revenue			Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Grant (10%)	Total	Construc-tion Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreci-ation*2	Interest of Loan	Total			
1	1998	5.0	0.6	5.6	5.6	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.1	-0.1	-0.1
2	1999	77.7	8.6	86.3	86.3	0.0	86.3	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.1	-2.1	-2.1	-2.2
3	2000	61.4	6.8	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.6	-3.6	-3.6	-5.8
4	2001	61.4	6.8	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	5.1	5.1	-5.1	-5.1	-10.9
5	2002					0.0	0.0	0.0	2.2	1.2	3.4	1.7	6.2	5.1	13.0	-9.6	-3.4	-14.4
6	2003					0.0	0.0	0.0	2.4	1.2	3.6	1.7	6.2	5.1	13.0	-9.4	-3.3	-17.6
7	2004					0.0	0.0	0.0	2.9	1.2	4.2	1.7	6.2	5.1	13.0	-8.9	-2.7	-20.3
8	2005					0.0	0.0	0.0	3.5	1.2	4.7	1.8	6.2	5.1	13.1	-8.3	-2.2	-22.5
9	2006					0.0	0.0	0.0	4.1	1.2	5.3	1.8	6.2	5.1	13.1	-7.8	-1.6	-24.1
10	2007					0.0	0.0	0.0	4.3	1.2	5.5	1.8	6.2	5.1	13.1	-7.6	-1.4	-25.5
11	2008					10.3	10.3	-10.3	4.4	1.2	5.6	1.8	6.2	5.1	13.1	-7.5	-11.6	-37.1
12	2009					10.3	10.3	-10.3	4.6	1.2	5.8	1.8	6.2	4.9	12.8	-7.0	-11.2	-48.3
13	2010					10.3	10.3	-10.3	4.7	1.2	6.0	1.8	6.2	4.6	12.6	-6.6	-10.7	-59.0
14	2011					10.3	10.3	-10.3	4.9	1.2	6.1	1.8	6.2	4.4	12.3	-6.2	-10.3	-69.3
15	2012					10.3	10.3	-10.3	5.1	1.2	6.3	1.8	6.2	4.1	12.1	-5.7	-9.8	-79.1
16	2013					10.3	10.3	-10.3	5.3	1.2	6.6	1.8	6.2	3.9	11.8	-5.3	-9.4	-88.5
17	2014					10.3	10.3	-10.3	5.6	1.2	6.8	1.8	6.2	3.6	11.6	-4.8	-8.9	-97.4
18	2015					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	3.3	11.3	-4.3	-8.4	-105.8
19	2016					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	3.1	11.1	-4.1	-8.2	-114.0
20	2017					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	2.8	10.8	-3.8	-7.9	-121.9
21	2018					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	2.6	10.5	-3.5	-7.7	-129.6
22	2019					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	2.3	10.3	-3.3	-7.4	-137.0
23	2020					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	2.1	10.0	-3.0	-7.1	-144.1
24	2021					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	1.8	9.8	-2.8	-6.9	-151.0
25	2022					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	1.5	9.5	-2.5	-6.6	-157.6
26	2023					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	1.3	9.3	-2.3	-6.4	-164.0
27	2024					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	1.0	9.0	-2.0	-6.1	-170.1
28	2025					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	0.8	8.7	-1.7	-5.9	-175.9
29	2026					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	0.5	8.5	-1.5	-5.6	-181.5
30	2027					10.3	10.3	-10.3	5.8	1.2	7.0	1.8	6.2	0.3	8.2	-1.2	-5.3	-186.9
31	2028					0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.2	0.0	8.0	-1.0	5.2	-181.7
32	2029					0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.2	0.0	8.0	-1.0	5.2	-176.5
33	2030					0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.2	0.0	8.0	-1.0	5.2	-171.3
34	2031					0.0	0.0	0.0	5.8	1.2	7.0	1.8	6.2	0.0	8.0	-1.0	5.2	-166.1

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 2

Interest:	2.5% p.a.
Repayment Period:	30 Years
Grace Period:	10 Years

Table P-19 Financial Stream of Income and Expenditure: South 3 Region

Case 4-2c: Charge II with Financial Source of both 80% of Loan 2 and 20% of Donation

(Unit: Q Million)

Serial No.	Year	Capital Balance							Revenue Balance								Cash Balance *1	Accumulated Cash Balance
		Revenue			Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Grant (10%)	Total	Construc-tion Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreci-ation*2	Interest of Loan	Total			
1	1998	4.4	1.1	5.6	5.6	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.1	-0.1	-0.1
2	1999	69.1	17.3	86.3	86.3	0.0	86.3	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8	-1.8	-1.8	-1.9
3	2000	54.6	13.6	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.2	-3.2	-3.2	-5.2
4	2001	54.6	13.6	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	4.6	4.6	-4.6	-4.6	-9.7
5	2002					0.0	0.0	0.0	2.2	1.2	3.4	1.7	5.5	4.6	11.8	-8.3	-2.8	-12.6
6	2003					0.0	0.0	0.0	2.4	1.2	3.6	1.7	5.5	4.6	11.8	-8.2	-2.7	-15.3
7	2004					0.0	0.0	0.0	2.9	1.2	4.2	1.7	5.5	4.6	11.8	-7.6	-2.2	-17.4
8	2005					0.0	0.0	0.0	3.5	1.2	4.7	1.8	5.5	4.6	11.8	-7.1	-1.6	-19.0
9	2006					0.0	0.0	0.0	4.1	1.2	5.3	1.8	5.5	4.6	11.8	-6.5	-1.0	-20.0
10	2007					0.0	0.0	0.0	4.3	1.2	5.5	1.8	5.5	4.6	11.8	-6.4	-0.9	-20.9
11	2008					9.1	9.1	-9.1	4.4	1.2	5.6	1.8	5.5	4.6	11.8	-6.2	-9.9	-30.8
12	2009					9.1	9.1	-9.1	4.6	1.2	5.8	1.8	5.5	4.3	11.6	-5.8	-9.5	-40.2
13	2010					9.1	9.1	-9.1	4.7	1.2	6.0	1.8	5.5	4.1	11.4	-5.4	-9.1	-49.3
14	2011					9.1	9.1	-9.1	4.9	1.2	6.1	1.8	5.5	3.9	11.2	-5.0	-8.7	-58.0
15	2012					9.1	9.1	-9.1	5.1	1.2	6.3	1.8	5.5	3.7	10.9	-4.6	-8.2	-66.2
16	2013					9.1	9.1	-9.1	5.3	1.2	6.6	1.8	5.5	3.4	10.7	-4.1	-7.8	-74.0
17	2014					9.1	9.1	-9.1	5.6	1.2	6.8	1.8	5.5	3.2	10.5	-3.7	-7.3	-81.4
18	2015					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	3.0	10.3	-3.3	-6.9	-88.3
19	2016					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	2.7	10.0	-3.0	-6.7	-95.0
20	2017					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	2.5	9.8	-2.8	-6.5	-101.4
21	2018					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	2.3	9.6	-2.6	-6.2	-107.6
22	2019					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	2.1	9.3	-2.3	-6.0	-113.6
23	2020					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	1.8	9.1	-2.1	-5.8	-119.4
24	2021					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	1.6	8.9	-1.9	-5.5	-125.0
25	2022					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	1.4	8.7	-1.7	-5.3	-130.3
26	2023					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	1.1	8.4	-1.4	-5.1	-135.3
27	2024					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	0.9	8.2	-1.2	-4.9	-140.2
28	2025					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	0.7	8.0	-1.0	-4.6	-144.8
29	2026					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	0.5	7.8	-0.7	-4.4	-149.2
30	2027					9.1	9.1	-9.1	5.8	1.2	7.0	1.8	5.5	0.2	7.5	-0.5	-4.2	-153.4
31	2028					0.0	0.0	0.0	5.8	1.2	7.0	1.8	5.5	0.0	7.3	-0.3	5.2	-148.2
32	2029					0.0	0.0	0.0	5.8	1.2	7.0	1.8	5.5	0.0	7.3	-0.3	5.2	-143.0
33	2030					0.0	0.0	0.0	5.8	1.2	7.0	1.8	5.5	0.0	7.3	-0.3	5.2	-137.8
34	2031					0.0	0.0	0.0	5.8	1.2	7.0	1.8	5.5	0.0	7.3	-0.3	5.2	-132.6

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 2

Interest:	2.5% p.a.
Repayment Period:	30 Years
Grace Period:	10 Years

Table P-20 Financial Stream of Income and Expenditure: South 3 Region

Case 4-2d: Charge II with Financial Source of both 70% of Loan 2 and 30% of Donation

(Unit: Q Million)

Serial No.	Year	Capital Balance							Revenue Balance								Cash Balance *1	Accumulated Cash Balance
		Revenue			Expenditure			Balance	Revenue			Expenditure				Balance		
		Foreign Loan	Grant (10%)	Total	Construc-tion Cost	Repayment of Principal	Total		Domestic Sewage	Industry Sewage	Total	O/M Expenses	Depreci-ation*2	Interest of Loan	Total			
1	1998	3.9	1.7	5.6	5.6	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.1	-0.1	-0.1
2	1999	60.4	25.9	86.3	86.3	0.0	86.3	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	-1.6	-1.6	-1.7
3	2000	47.8	20.5	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	-2.8	-2.8	-4.5
4	2001	47.8	20.5	68.2	68.2	0.0	68.2	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	-4.0	-4.0	-8.5
5	2002					0.0	0.0	0.0	2.2	1.2	3.4	1.7	4.8	4.0	10.5	-7.1	-2.3	-10.8
6	2003					0.0	0.0	0.0	2.4	1.2	3.6	1.7	4.8	4.0	10.5	-6.9	-2.1	-12.9
7	2004					0.0	0.0	0.0	2.9	1.2	4.2	1.7	4.8	4.0	10.5	-6.4	-1.6	-14.5
8	2005					0.0	0.0	0.0	3.5	1.2	4.7	1.8	4.8	4.0	10.6	-5.8	-1.0	-15.5
9	2006					0.0	0.0	0.0	4.1	1.2	5.3	1.8	4.8	4.0	10.6	-5.2	-0.4	-16.0
10	2007					0.0	0.0	0.0	4.3	1.2	5.5	1.8	4.8	4.0	10.6	-5.1	-0.3	-16.3
11	2008					8.0	8.0	-8.0	4.4	1.2	5.6	1.8	4.8	4.0	10.6	-4.9	-8.1	-24.4
12	2009					8.0	8.0	-8.0	4.6	1.2	5.8	1.8	4.8	3.8	10.4	-4.6	-7.8	-32.2
13	2010					8.0	8.0	-8.0	4.7	1.2	6.0	1.8	4.8	3.6	10.2	-4.2	-7.4	-39.6
14	2011					8.0	8.0	-8.0	4.9	1.2	6.1	1.8	4.8	3.4	10.0	-3.8	-7.0	-46.7
15	2012					8.0	8.0	-8.0	5.1	1.2	6.3	1.8	4.8	3.2	9.8	-3.4	-6.6	-53.3
16	2013					8.0	8.0	-8.0	5.3	1.2	6.6	1.8	4.8	3.0	9.6	-3.0	-6.2	-59.5
17	2014					8.0	8.0	-8.0	5.6	1.2	6.8	1.8	4.8	2.8	9.4	-2.6	-5.8	-65.3
18	2015					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	2.6	9.2	-2.2	-5.4	-70.7
19	2016					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	2.4	9.0	-2.0	-5.2	-75.9
20	2017					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	2.2	8.8	-1.8	-5.0	-80.9
21	2018					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	2.0	8.6	-1.6	-4.8	-85.7
22	2019					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	1.8	8.4	-1.4	-4.6	-90.3
23	2020					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	1.6	8.2	-1.2	-4.4	-94.7
24	2021					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	1.4	8.0	-1.0	-4.2	-98.9
25	2022					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	1.2	7.8	-0.8	-4.0	-102.9
26	2023					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	1.0	7.6	-0.6	-3.8	-106.7
27	2024					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	0.8	7.4	-0.4	-3.6	-110.3
28	2025					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	0.6	7.2	-0.2	-3.4	-113.7
29	2026					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	0.4	7.0	0.0	-3.2	-116.9
30	2027					8.0	8.0	-8.0	5.8	1.2	7.0	1.8	4.8	0.2	6.8	0.2	-3.0	-119.9
31	2028					0.0	0.0	0.0	5.8	1.2	7.0	1.8	4.8	0.0	6.6	0.4	5.2	-114.7
32	2029					0.0	0.0	0.0	5.8	1.2	7.0	1.8	4.8	0.0	6.6	0.4	5.2	-109.5
33	2030					0.0	0.0	0.0	5.8	1.2	7.0	1.8	4.8	0.0	6.6	0.4	5.2	-104.3
34	2031					0.0	0.0	0.0	5.8	1.2	7.0	1.8	4.8	0.0	6.6	0.4	5.2	-99.1

Note: *1 (Capital Balance)+(Revenue Balance)+(Depreciation)
*2 30 years depreciation

Terms of Source Alternative 2

Interest:	2.5% p.a.
Repayment Period:	30 Years
Grace Period:	10 Years

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