

APPENDIX H

COST ESTIMATION

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H.1. Basic Rates and Costs

Information and data on basic costs, including labor and material costs, as well as some unit construction cost, have been collected from various sources such as MPK, DID, JKR, manufacturers, suppliers of equipment and materials and contractors. All cost obtained from the sources referred to above are expressed at 1981 price level in Malaysia. Using these basic cost, unit construction cost have been developed with due consideration for the suitability of materials and construction methods, including availability of local materials and ability of local contractors.

All costs are divided into two categories; i.e., local and foreign currency, based on information obtained in Malaysia. Basic concept of the division is that cost of all imported goods such as machinery to be used for sewerage facilities and/or for construction work or for factories in producing necessary products are deemed to belong to the foreign currency portion and the rest as local currency requirement. Cost for machinery is estimated based on CIF price. Table 6.1 shows labor cost. Tables 6.2 and 6.3 show portions of local currency and foreign price of basic materials and unit cost respectively.

The rates and costs of labor, construction and basic materials are shown in Tables H.1 to H.3.

Table H.1. Day Labor Rates (1981)

Type of Labor	Labor Cost per Day (8 hours) (M\$/day)
Common Laborer	17.0
Skilled Laborer	24.0
Welder	27.0
Mason	27.0
Carpenter	27.0
Mechanic	27.0
Brick Layer	28.0
Concrete Worker	28.0
Steel Bender and Fixer	28.0
Painter	28.0
Lorry Driver	30.0
Equipment Operator	35.0
Foreman	45.0

Table H.2. Unit Construction Costs (1981)

Item	Description	Unit	Rate (M\$)		
			L.C.	F.C.	Total
Excavation	Backhoe	m ³	0.61	1.00	1.61
"	Clamshell	"	1.75	5.33	7.08
"	Manual	"	9.89	0	9.89
Soil Trans- portation	Dump Truck, 11 t	"	1.47	2.44	3.91
Backfilling	Sand	"	22.62	13.98	36.60
"	Excavated Soil	"	5.04	0	5.04
Spreading & Compaction of Soil	Bulldozer	"	0.46	0.90	1.36
Timber Sheeting	ℓ = 2.0 m	m	5.62	0.05	5.67
" "	ℓ = 2.5 m	"	7.55	0.07	7.62
" "	ℓ = 3.0 m	"	9.49	0.08	9.57
" "	ℓ = 3.5 m	"	11.41	0.08	11.49
Steel Sheet Piling Work	SP II ℓ = 5.0 m	"	59.61	113.00	172.61
" "	" "	"	69.15	131.07	200.22
" "	ℓ = 6.0 m	"			
" "	" "	"	77.87	147.64	225.51
" "	ℓ = 7.0 m	"			
" "	" "	m	86.62	164.22	250.84
" "	ℓ = 8.0 m	"			
" "	" "	"	96.95	183.81	280.76
" "	ℓ = 9.0 m	"			
" "	SP III	"	175.00	300.00	475.00
" "	ℓ = 15.0 m	"			
Attaching & Detaching of Steel Work		t	141.63	114.92	256.55

Table H.2. (Cont.)

Item	Description	Unit	Rate (M\$)		
			L.C.	F.C.	Total
Steel Bars	φ 13 mm and below	"	1,716.44	19.37	1,735.81
" "	φ 16 mm and above	"	1,633.79	19.37	1,653.16
Concrete	1 : 1 1/2 : 3	m ³	227.97	15.54	243.51
"	1 : 2 : 4	"	217.57	15.54	233.11
"	1 : 3 : 6	"	203.27	15.54	218.81
Timber Forming		m ²	14.23	0.05	14.28
Bedding	Sand	m ³	22.62	13.98	36.60
"	Crusher-run	"	65.46	13.08	81.54
Restoring	Asphalt Paving	m ²	37.41	10.71	48.12
Masonry	Granite 30 cm	"	35.47	2.61	38.08
Pile Driving	18" x 18", 30m	No	85.09	139.49	224.58
Dewatering	5.5 kW, φ100 mm	day	26.07	32.47	58.54

(Note) L.C.: Local Currency,
F.C.: Foreign Currency

Table H.3. Unit Material Cost (1981)

Item	Description	Unit	Price (M\$)		
			L.C.	F.C.	Total
Cement		t	188.21	7.97	196.18
Sand		m ³	6.22	4.78	11.00
Laterite		"	3.00	0	3.00
Aggregate	9-13 mm	"	30.22	4.78	35.00
"	25-38 mm	"	26.22	4.78	31.00
Crusher-run		"	20.22	4.78	25.00
Diesel Oil		litre	0.46	0	0.46
Light Oil		"	0.50	0	0.50
Timber	Grade A	m ³	206.61	3.39	210.00
"	" B	"	256.61	3.39	260.00
H-shape Beam		t	104.00	996.00	1,100.00
Sheet Pile		"	99.63	934.80	1,034.43
V.C. Pipe	φ 225 mm	m	42.52	0.88	43.40
" "	φ 300 "	"	108.37	1.05	109.42
Concrete Pipe	φ 375 "	"	89.85	0.96	90.81
" "	φ 450 "	"	114.00	1.38	115.38
" "	φ 525 "	"	129.09	2.31	131.40
" "	φ 600 "	"	146.43	2.88	149.31
" "	φ 675 "	"	217.49	3.46	220.95
" "	φ 750 "	"	239.76	4.94	244.70
" "	φ 900 "	"	306.78	6.92	313.70
" "	φ 1,050 "	"	393.28	8.65	401.93
" "	φ 1,200 "	"	448.46	11.54	460.00

(Note) L.C.: Local Currency,
F.C.: Foreign Currency

H.2. Construction Cost

1) Sewer Construction Cost

a) Construction Cost of Sewer Pipe

To develop the cost function for sewers, construction cost of sewer pipes of 225 mm, 300 mm, 600 mm and 900 mm diameter are calculated, considering four depths to invert, 2 m, 4 m, 6 m and 8 m. It is assumed that pipes of 225 mm and 300 mm diameter are clay, and pipes of 600 mm and 900 mm diameter are of centrifugally reinforced-concrete (Hume pipes). Sand foundations will be used for laying the sewers of 225 mm and 300 mm diameter, and plain concrete foundations for laying sewers of 600 mm and 900 mm diameter. The construction cost of 16 cases are estimated, based on these conditions, which are summarized in the following Table H.4.

Table H.4. Specifications for 16 Cases

Case	Inside Diameter (mm)	Depth to Invert (m)	Foundation	Material
1	225	2	Sand	Clay
2	225	4	Sand	Clay
3	225	6	Sand	Clay
4	225	8	Sand	Clay
5	300	2	Sand	Clay
6	300	4	Sand	Clay
7	300	6	Sand	Clay
8	300	8	Sand	Clay
9	600	2	Concrete (90°)	Type II Hume Pipe
10	600	4	Concrete (180°)	Type II Hume Pipe
11	600	6	Concrete (180°)	Type II Hume Pipe
12	600	8	Concrete (180°)	Type II Hume Pipe
13	900	2	Concrete (90°)	Type II Hume Pipe
14	900	4	Concrete (180°)	Type II Hume Pipe
15	900	6	Concrete (180°)	Type II Hume Pipe
16	900	8	Concrete (180°)	Type II Hume Pipe

Cost estimations of the 16 cases are presented in Table H.5. Based on these results, four kinds of cost functions are developed as follows:

Cost function for sewers:

Case A $h < 3$ m, $D \leq 0.3$ m

$$C_{pi} = (6.58h + 13.2) \exp \{(-0.533h + 8.80).D\}$$

Case B $h \geq 3$ m, $D \leq 0.3$ m

$$C_{pi} = (233h - 383) \exp \{(-0.0935h + 2.03).D\}$$

Case C $h < 3$ m, $D \geq 0.375$ m

$$C_{pi} = (1.48h + 111) \exp \{(0.035h + 1.87).D\}$$

Case D $h \geq 3$ m, $D \geq 0.375$ m

$$C_{pi} = (248h - 366) \exp \{(-0.0165h + 0.812).D\}$$

where

C_{pi} : Construction Cost (M\$/m)

h : Depth to Invert (m)

D : Sewer Diameter (m)

Table H.5. Results of Estimation

		(M\$/m)			
Depth to Invert (m)	Diameter (m)	0.225	0.300	0.600	0.900
2.0		150	268	365	653
4.0		797	902	979	1,225
6.0		1,413	1,577	1,721	2,131
8.0		1,976	2,176	2,433	2,984

b) Construction Cost for House Connections

To estimate the total cost of house connections, figures for the number of house connections are taken from the area of land in use within the sub-zones. Construction costs are estimated from multiplying unit cost by the number of house connections. These costs are shown in Table H.6.

c) Construction Cost of Branch and Lateral Sewers

Three residential areas, two of medium density, and of high density, and one commercial area have been selected for the preliminary engineering design of branch and lateral sewers. Estimated costs are based on sewer lengths and dimensions obtained from the preliminary design.

The preliminary engineering design mentioned is shown in Fig. H.1 to Fig. H.3. Branch and lateral sewer construction cost in the other land use areas are estimated on the basis of road length ratios. Road length in each land use area is as follows:

<u>Land Use Category</u>	<u>Road Length</u>
Commercial	250 m/ha
Residential	
High density	180 m/ha
Medium density	150 m/ha
Low density	120 m/ha
Industrial and Port	50 m/ha
Institutional	120 m/ha

Total sewer construction cost by zone is shown in Table H.6 and branch and lateral sewer construction cost are shown in Table H.7.

Table H.6. Total Sewer Costs

(Unit: M\$1,000)

Sewerage Division		Trunk Sewer	House Connection*	Branch Sewer	Total
District	Zone				
Kelang North	1	9,913	11,013 x 500M\$ = 5,506	20,171	35,590
	2	20,336	9,389 x 500M\$ = 4,694	17,090	42,120
Kelang South	1	19,007	6,210 x 500M\$ = 3,105	10,712	32,824
	2	21,440	11,520 x 500M\$ = 5,760	20,468	47,668
Port Kelang	1	12,207	3,596 x 500M\$ = 1,798	9,670	23,675
	2	28,102	11,384 x 500M\$ = 5,692	19,449	55,132
	3			1,889	
North Port	1	2,602	1,028 x 500M\$ = 514	2,697	5,813
	2	1,191	681 x 500M\$ = 340	2,473	4,004
Kapar		9,552	4,140 x 500M\$ = 2,070	5,844	17,466
Meru		8,553	2,587 x 500M\$ = 1,293	4,680	14,526
Total		132,903	30,772	115,143	278,818

* The unit cost of house connections is estimated at 500 M\$/no.

Table H.7. Total Branch Sewer Cost

(Unit: M\$1,000)

Sewerage Division		Residential and Use Category (ha x M\$)							Total
District	Zone	High	Medium	Low	Port	Commercial	Industrial	Institutional	
Kelang North	1	145.6 x 30,900 = 4,499	459.0 x 24,900 = 11,678	-	-	59.7 x 41,500 = 2,477	92.7 x 8,300 = 769	37.6 x 19,900 = 748	20,171
	2	-	260.3 x 24,900 = 6,481	271.6 x 19,900 = 5,405	-	48.4 x 41,500 = 2,009	283.7 x 8,300 = 2,355	42.2 x 19,900 = 840	17,090
Kelang South	1	-	321.1 x 24,900 = 7,995	-	-	40.5 x 41,500 = 1,681	-	52.1 x 19,900 = 1,036	10,712
	2	173.2 x 30,900 = 5,351	522.4 x 24,900 = 13,008	-	-	31.7 x 41,500 = 1,315	-	37.9 x 19,900 = 754	20,468
Port Kelang	1	100.0 x 30,900 = 3,090	0.8 x 24,900 = 19	-	75.6 x 8,300 = 627	45.5 x 41,500 = 1,888	339.6 x 8,300 = 2,819	61.7 x 19,900 = 1,227	9,670
	2	200.7 x 30,900 = 6,201	400.4 x 24,900 = 9,970	-	-	21.9 x 41,500 = 909	116.2 x 8,300 = 964	70.6 x 19,900 = 1,405	19,449
	3	-	50.8 x 24,900 = 1,265	-	-	-	75.2 x 8,300 = 624	-	1,889
North Port	1	-	14.5 x 24,900 = 361	-	75.6 x 8,300 = 627	29.4 x 41,500 = 1,220	-	24.6 x 19,900 = 489	2,697
	2	36.5 x 30,900 = 1,127	-	-	135.4 x 8,300 = 1,124	2.1 x 41,500 = 87	-	6.8 x 19,900 = 135	2,473
Kapar	-	-	37.3 x 24,900 = 929	205.6 x 19,900 = 4,091	-	8.4 x 41,500 = 349	-	23.9 x 19,900 = 475	5,844
Meru	-	-	22.7 x 24,900 = 565	130.4 x 19,900 = 2,595	-	2.3 x 41,500 = 95	156.1 x 8,300 = 1,296	6.5 x 19,900 = 129	4,680
Total		20,268	52,271	12,091	2,378	12,030	8,827	7,278	115,143

Taman Eng Ann

Taman Bukit Raja

LEGEND	
	Trunk sewer (Government contribution)
	Branch & lateral sewer (Government contribution)
Ø 300	Sewer diameter (mm)
3.5%	Slope
	Sewage pumping station

Preliminary Design of
Branch and Lateral Sewers
(Medium Density Residential Area)

Fig. H. 1.



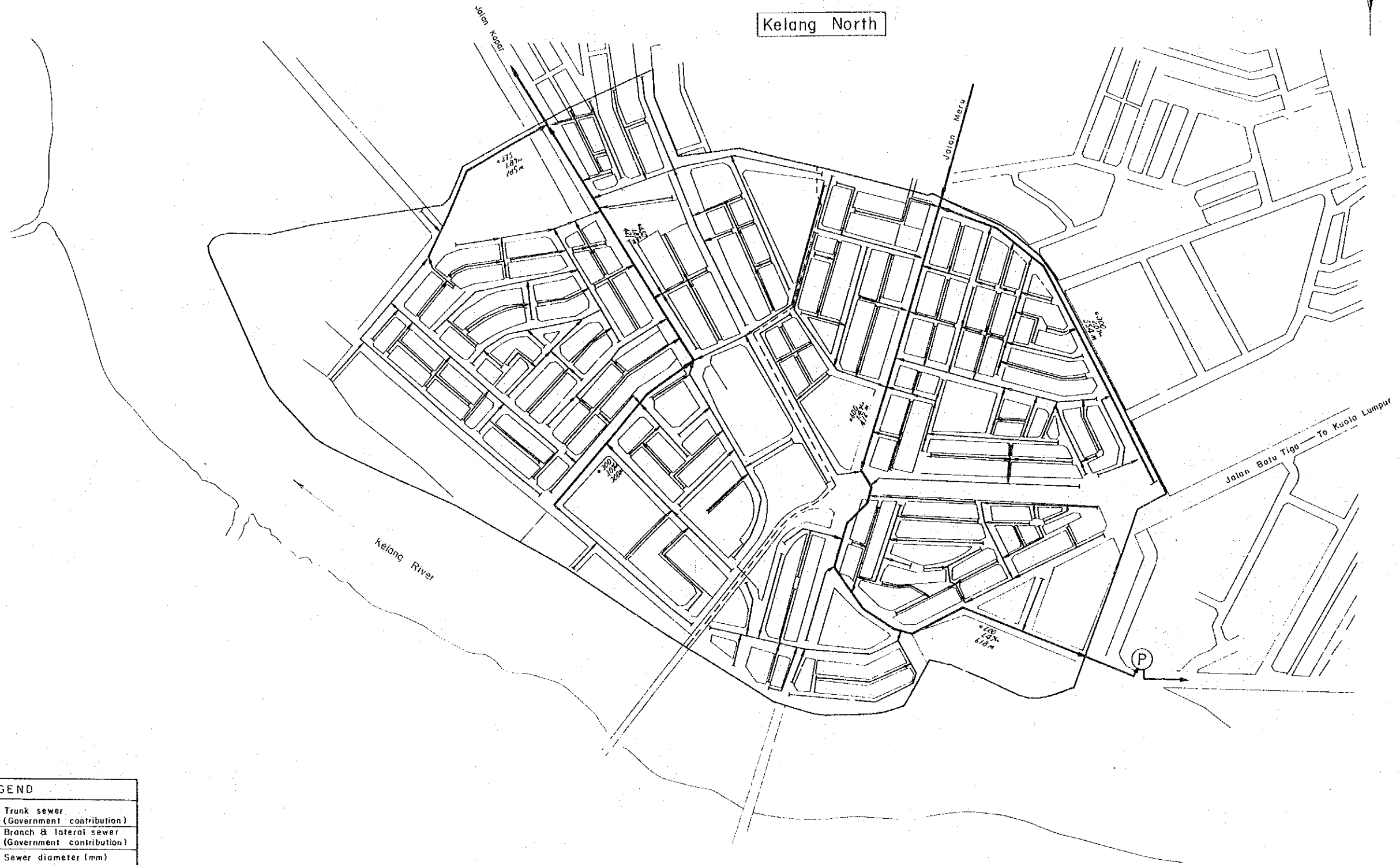
LEGEND	
	Trunk sewer
	Branch & lateral sewer
	Ø375 Sewer diameter
	40% Slope
	100m Sewer length

Note: Unless otherwise shown,
all pipes are 225mm in
diameter and 35% in slope

Preliminary Design of Branch and
Lateral Sewers
(High Density Residential Area)

Fig. H. 2.

Kelang North



LEGEND	
	Trunk sewer (Government contribution)
	Branch & lateral sewer (Government contribution)
• 300	Sewer diameter (mm)
3.0‰	Slope
(P)	Sewage pumping station

Note : Unless otherwise shown, all pipes are 225 mm in diameter

2) Intermediate Pumping Station Cost

The estimated cost of pumping station construction is based on two factors. Civil and structural work cost is calculated from the estimated volume of major materials and unit costs, while the cost for mechanical and electrical works is based on the submitted estimates of two corporations for each pumping station. Total intermediate pumping station construction cost is shown in Table H.8.

3) Treatment Plant Cost

Cost estimation of treatment plants is similar to that of pumping stations. Total treatment plant construction cost is shown in Table H.9.

4) Total Construction Cost

Total construction cost for the sewerage facilities is summarized in Table H.10.

Table H.8. Total Intermediate Pumping Station Cost

(Unit: M\$1,000)

Sewerage Division			Civil Works						Architectural Works (m ² x M\$/m ²)	Mechanical and Electrical Works	Total
District	Zone	Sub-Zone	Concrete			Piling					
			Volume (m ³)	Unit Cost (M\$/m ³)	Cost	Set	Unit Cost (M\$/set)	Cost			
Kelang North	1	1	144	2,000	288	6	1,850	11	192 x 1,250 = 240	780	No. 1 1,319
		2	144	2,000	288	6	1,850	11	190 x 1,250 = 237	750	No. 2 1,286
	2	1	140	2,000	280	6	1,850	11	140 x 1,250 = 175	310	No. 3 776
		3	140	2,000	280	6	1,850	11	110 x 1,250 = 137	290	No. 4 718
Kelang South	1	2	140	2,000	280	6	1,850	11	150 x 1,250 = 187	410	No. 5 888
	2	1	300	2,000	600	10	1,850	18	240 x 1,250 = 300	850	No. 6 1,768
Port Kelang	2,3	1	144	2,000	288	6	1,850	11	180 x 1,250 = 225	410	No. 7 934
		1	350	2,000	700	10	1,850	18	250 x 1,250 = 312	1,030	No. 8 2,060
		2	140	2,000	280	6	1,850	11	140 x 1,250 = 175	410	No. 9 876
Kapar			120	2,000	240	4	1,850	7	100 x 1,250 = 125	170	No. 10 542
			120	2,000	240	4	1,850	7	100 x 1,250 = 125	210	No. 11 582
Meru			120	2,000	240	4	1,850	7	100 x 1,250 = 125	210	No. 12 582
Total			4,004			134			2,363	5,830	12,331

Table H.9. Total Treatment Plant Cost

(Unit: M\$1,000)

Sewerage Division		Civil Works	Architectural Works	Mechanical & Electrical Works	Total
District	Zone				
Kelang North	1	10,694	552	3,684	No.1 14,930
	2	8,310	550	3,600	No.2 12,460
Kelang South	1	8,000	550	3,480	No.3 12,030
	2	8,000	550	3,480	No.4 12,030
Port Kelang	1	5,300	500	2,750	No.5 8,550
	2	8,310	550	3,600	No.6 12,460
	3				
North Port	1	1,833	320	1,400	No.7-a 3,553
	2	2,331	350	1,500	No.7-b 4,181
Kapar		3,680	400	1,320	No.8 5,400
Meru		4,200	400	1,400	No.9 6,000
Total		60,658	4,722	26,214	991,594

Note: Treatment plants for North Port, Kapar and Meru are stabilization pond process. All the other treatment plants are aerated lagoon process.

Table H.10. Total Construction Cost

(Unit: M\$1,000)

Sewerage Division		Sewer	Pumping Station	Treatment Plant	Total
District	Zone				
Kelang North	1	35,590	(Sub-1) 1,319	No.1 14,930	53,125
			(Sub-2) 1,286		
	2	42,120	(Sub-3) 718	No.2 12,460	56,074
			(Sub-2) 776		
Kelang South	1	32,824	(Sub-2) 888	No.3 12,030	45,742
	2	47,668	(Sub-1) 1,768	No.4 12,030	61,466
Port Kelang	1	23,675	-	No.5 8,550	32,225
	2	55,132	(Sub-1) 934 (Sub-1) 2,060 (Sub-2) 876	No.6 12,460	71,462
	3		-		
North Port	1	5,813	-	No.7-a 3,553	9,366
	2	4,004	-	No.7-b 4,181	8,185
Kapar		17,466	542 - 582	No.8 5,400	23,990
Meru		14,526	582	No.9 6,000	21,108
Total		278,818	12,331	91,594	382,743

H.3. Operation and Maintenance Cost

Operation and maintenance cost includes labor, power, fuel, materials and repair.

The procedures adopted for the estimation of these costs are described below.

1) Sewers

In order to estimate operation and maintenance costs for sewers, the following assumptions have been made.

- a) Pipe cleaning will be carried out every four years.
- b) The daily cleaning length will be 200 m.
- c) The life expectancy of cleaning equipment is ten years.
- d) The cleaning of sewers shall be carried out by a six-member team.
- e) The maintenance cost of cleaning equipment is estimated at 5 percent of the purchase price for every year.
- f) The repair cost of sewer pipes is estimated at 0.5 percent of construction costs for each year.
- g) Working days are assumed to be 250 a year.
- h) Day labor rate for general labor is to be M\$15 a day.
- i) The purchase price of equipment will be M\$112,000 per set.

Under the above conditions, the annual operation and maintenance costs are estimated as follows:

Total length of sewer pipes, including trunk and branch sewers,
is 1,142,830 m.

i) Number of Teams

$$\frac{1,142,830 \text{ m}}{4 \text{ year}} = 285,708 \text{ m/year}$$

$$\begin{aligned} \text{No. of Teams} &= \frac{285,708 \text{ m/year}}{200 \text{ m/day} \times 250 \text{ days/year}} \\ &= 6 \text{ teams} \end{aligned}$$

ii) Labor Expenditure

$$\begin{aligned} &(6 \text{ persons} \times 6 \text{ teams}) \times 250 \text{ days/year} \times \text{M\$}15 \\ &= 135,000 \text{ M\$/year} \end{aligned}$$

iii) Depreciation Cost

$$\frac{\text{M\$}112,000}{10 \text{ year}} \times 6 \text{ sets} = 67,200 \text{ M\$/year}$$

iv) Maintenance Cost

$$\text{M\$}112,000 \times 0.05 \times 6 \text{ sets} = 33,600 \text{ M\$/year}$$

v) Repair Cost

$$\text{M\$}278,818 \times 0.005 = 1,394.09/\text{M\$/year}$$

$$\text{Total per year} = \underline{\text{M\$}1,629,890 \text{ (or M\$}1,630,000 \text{ in a round sum)}}$$

Thus, total annual costs of operation and maintenance for sewer pipes are M\$1,630,000 per year, as shown in Table H.11.

Table H.11. Annual Cost of Operation and Maintenance
for Sewer Pipes

Sewerage Division		Area (ha)	Unit (m/ha)	Total Length (m)	Annual Cost (M\$1,000)		
District	Zone				Trunk Sewer	Branch Sewer	Total
Kelang North	1	927	250	231,750	18	312	330
	2	1,277	200	255,400	22	342	364
Kelang South	1	659	150	98,850	24	116	140
	2	827	150	124,050	29	147	176
Port Kelang	1	635	120	76,200	21	87	108
	2,3	1,109	180	199,620	26	258	284
North Port	1	69	120	8,280	2	9	11
	2	45	120	5,400	2	5	7
Kapar		621	120	74,520	11	95	106
Meru		573	120	68,760	8	96	104
Total		6,742	-	1,142,830	163	1,467	1,630

2) Pumping Stations and Treatment Plants

Operation and maintenance cost for pumping stations and treatment plants are estimated by summing up the required labor cost, electricity rates and repair cost.

Required labor for operation and maintenance of treatment plants according to the process adopted and plant capacities is estimated by a function developed by the Study Team, which is shown in Fig. H.4. Operation and maintenance for pumping stations should be carried out by laborers in the treatment plants in the same sewerage zone because of the small capacity of pumps and proximity to the treatment plant. Therefore, labor cost for pumping stations is not considered.

Electricity consumption is calculated based on capacities of motors provided for equipment, such as pumps and aerators as well as running time calculated by daily average flow. A prevailing electricity rate by the National Electricity Board (NEB); i.e., Tariff E for high-voltage industrial consumer, is used for cost estimateion. Electricity rate consists of two parts; namely, initial rate of M\$12 for each kilowatt of maximum demand per month and consumption rate of M\$0.17/kWH.

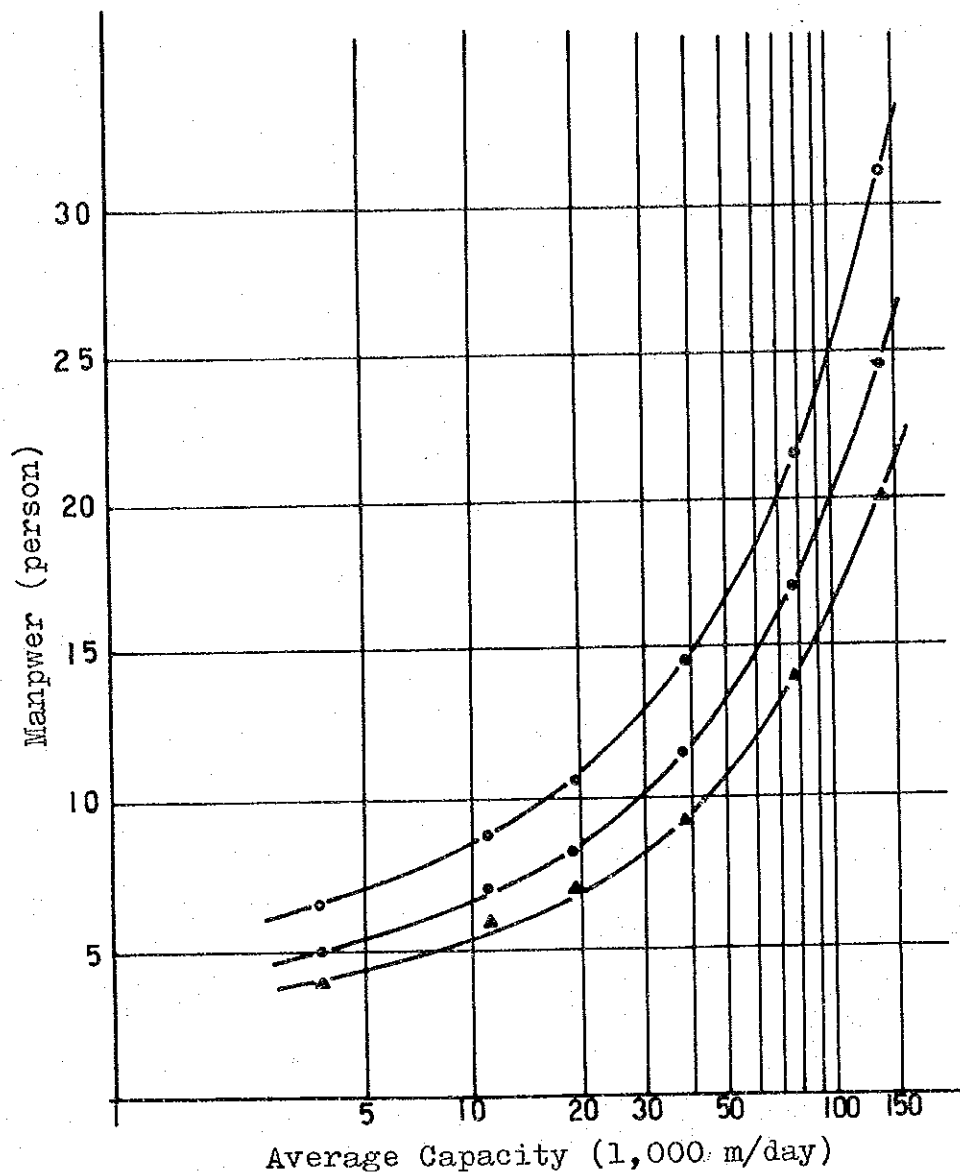
Annual cost for repair of civil works and buildings is assumed to be 0.25 percent of the construction cost and that of mechanical and electrical equipment is assumed to be 2 percent.

Operation and maintenance cost for pumping stations and treatment plants are presented in Tables H.12 and H.13, respectively. Total operation and maintenance cost by zones is summarized in Table H.14.

Table H.12. Operation and Maintenance Cost for Pumping Stations

No.	Maximum Demand (kW)	Power Consumption (kWH/month)	Electricity Rate (M\$/year)	Repair (M\$/year)	Total (M\$/year)
1	150	30,300	83,400	6,000	89,400
2	150	27,300	77,200	6,200	83,400
3	60	9,300	27,600	3,800	31,400
4	120	18,300	54,600	3,500	58,100
5	140	24,300	69,700	4,400	74,100
6	160	33,300	90,900	8,800	99,700
7	120	18,300	54,600	4,600	59,200
8	120	18,300	54,600	9,800	64,400
9	300	51,300	147,800	4,300	152,100
10	50	7,650	22,800	2,600	25,400
11	50	7,650	22,800	2,600	25,400
12	50	7,650	22,800	2,600	25,400
Total			728,800	59,200	788,000

Fig. H.4. Typical Plant Manpower Requirement



Legend

- Oxidation Ditch Process
- Aerated Lagoon Process
- ▲— Stabilization Pond Process

Source: Water Pollution Control Federation

Table H.13. Operation and Maintenance Cost for Wastewater Treatment Plants

No.	Electricity			Labor		Repair Cost (M\$1,000/year)	Total (M\$1,000/year)
	Maximum Demand (kW)	Electricity Consumption (1,000 kWh/month)	Power Rate (M\$1,000/year)	Required Manpower (person)	Labor Cost (M\$1,000/year)		
1	540	286	661	10	39.6	70.7	771.3
2	540	286	661	12	47.5	61.9	770.4
3	520	283	652	10	39.6	59.7	751.3
4	520	283	652	10	39.6	59.7	751.3
5	400	233	533	8	31.6	60.0	624.6
6	540	286	661	12	47.6	61.9	770.4
7-a	125	71	163	5	19.8	17.5	200.3
7-b	135	71	164	6	23.7	20.7	208.4
8	90	9.0	31	6	23.7	27.0	81.7
9	90	10.5	34	7	27.7	30.0	91.7
Total	3,500	1,818.5	4,212	86	340.3	469.1	5,021.4

Table H.14. Total Operation and Maintenance Cost

(Unit: M\$1,000/year)

Sewerage Division		Sewer		Pumping Station	Treatment Plant	Total
District	Zone	Trunk	Branch			
Kelang North	1	18	312	No.1 (Sub-1) 89	No.1 771	1,273
				No.2 (Sub-2) 83		
	2	22	342	No.3 (Sub-3) 31	No.2 770	1,223
				No.4 (Sub-2) 58		
Kelang South	1	24	116	No.5 (Sub-2) 74	No.3 751	965
	2	29	147	No.6 (Sub-2) 100	No.4 751	1,027
Port Kelang	1	21	87		No.5 625	733
	2	26	258	No.7 (Sub-1) 59 No.8 (Sub-2) 64 No.9 (Sub-1) 152	No.6 770	1,329
				-		
	3					
North Port	1	2	9	-	No.7-a 200	211
	2	2	5	-	No.7-b 208	215
Kapar		11	95	No.10 25	No.8 82	238
				No.11 25		
Meru		8	96	No.12 25	No.9 92	221
Total		163	1,467	785	5,020	7,435
		1,630				

H.4. Land Acquisition Costs

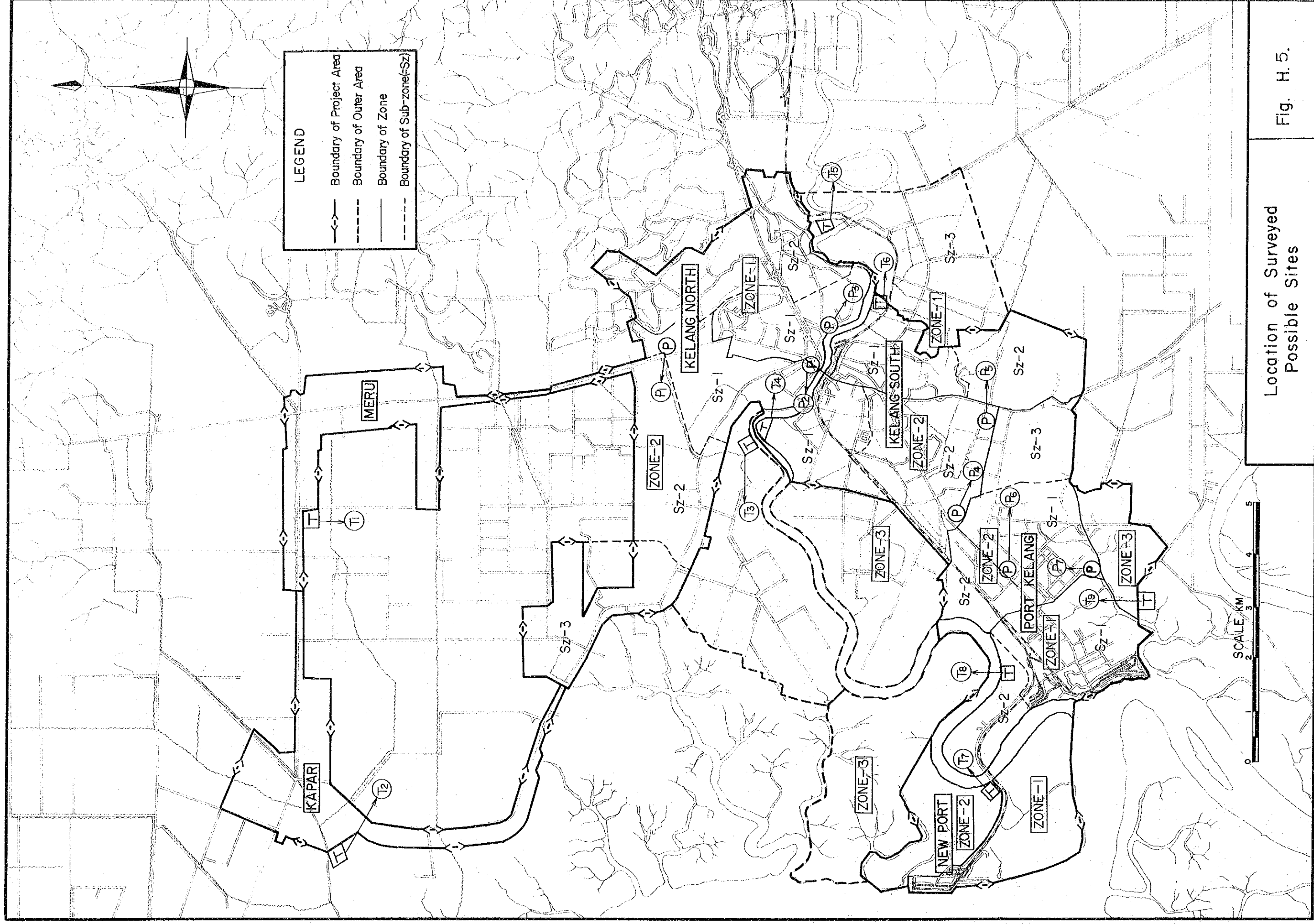
1) Land Purchase Study

Land price of possible pumping station sites and treatment plants are based on information obtained from the Evaluation sections of the state and local government.

Possible site locations are shown in Fig. H.5, and the land price of possible sites are shown in Table H.15.

2) Total Land Acquisition Costs

Total land acquisition costs are estimated for all pumping stations and treatment plants. Figures are summarized in Table H.16.



Location of Surveyed
Possible Sites

Fig. H.5.

Table H.15 Land Price of Possible Sites

Items No.	District	Zone	Feasible Area (ha)	Land Price		Remarks	
				(M\$/ft ²)	(M\$/m ²)		
Treatment Plant	T-1	Meru	-	11.0	1.00	10.8	Feasible if PKNS plan is amendable
	T-2	Kapar	-	13.7	1.20	12.9	
	T-3	Kelang North	2	16.6	2.20 ~2.50	23.7 ~26.9	
	T-4	Kelang South	2	14.9	2.20 ~2.50	23.7 ~26.9	
	T-5	Kelang North	1	12.7	2.50	26.9	
	T-6	Kelang South	1	11.4	2.50 ~2.80	26.9 ~30.1	
	T-7	North Port	1 2	3.0 3.0	2.1 ~3.7	22.0 ~40.0	
	T-8	Port Kelang	1	12.4	1.20	12.9	
	T-9	Port Kelang	2	15.9	2.00	21.5	
Pumping Station	P-1	Kelang North	2	-	4.00	43.1	
	P-2	Kelang North	2	-	4.00 ~8.00	43.1 ~86.1	
	P-3	Kelang North	1	-	4.00 ~8.00	43.1 ~86.1	
	P-4	Kelang South	2	-	4.00 ~5.00	43.1 ~53.8	
	P-5	Kelang South	2	-	4.00 ~5.00	43.1 ~53.8	
	P-6	Port Kelang	2	-	4.00 ~5.00	43.1 ~53.8	
	P-7	Port Kelang	2	-	3.00 ~3.50	32.3 ~37.7	

Source: Information received from a Chartered Surveyor of the State Evaluation Section and Municipality Valuation Section.

Table H.16. Total Land Costs

(Unit: M\$1,000)

Sewerage Division		Sewer	Pumping Station	Treatment Plant	Total
District	Zone				
Kelang North	1	-	14	No.1 3,416	3,444
			14		
	2	-	9	No.2 4,465	4,485
			11		
Kelang South	1	-	10	No.3 3,431	3,441
	2	-	22	No.4 4,008	4,030
Port Kelang	1	-	-	No.5 1,599	1,599
	2	-	12 9	No.6 3,418	3,457
			18		
	3	-	-		
North Port	1	-	-	No.7-a 800	800
	2	-	-	No.7-b 800	800
Kapar		-	3	No.8 1,767	1,773
			3		
Meru		-	3	No.9 1,188	1,191
Total		-	128	24,892	25,020

H.5. Costs by Sub-Zone

Estimates for sewerage construction costs by sub-zone are based on the methods previously described. The cost of treatment plant construction will be shared by each sub-zone on the basis of wastewater flow rate.

Maintenance cost estimates are based on the assumption that facilities are fully constructed and operative at the planned flow rate.

Details of cost estimation are shown in Tables H.17 to H.22.

Table H.17. Total Costs of Trunk Sewers
for Each Sub-Zone

(Unit: M\$1,000)

Sewerage Division			Trunk Sewer Costs	Total Costs
District	Zone	Sub-zone		
Kelang North	1	1	6,646	9,913
		2	3,267	
	2	1	6,608	20,336
		2	6,778	
		3	6,950	
Kelang South	1	1	8,231	19,007
		2	10,776	
	2	1	9,456	21,440
		2	11,984	
Port Kelang	1	1	9,981	12,207
		2	2,226	
	2	1	21,150	28,102
		2	3,275	
		3	2,045	
	3	-	1,632	
North Port	1	-	2,602	3,793
	2	-	1,191	
Kapar		-	9,552	9,552
Meru		-	8,553	8,553
Total			132,903	132,903

Table H.18. Branch and Lateral Sewer Construction Cost

(Unit: M\$1,000)

Sewerage Division		Land Use Category														Total	Developed Area (%)	Government Contribution
		Residential						Commercial		Industrial		Port Area		Institutional				
		High		Medium		Low												
		District	Sub-Zone	ha	Cost	ha	Cost	ha	Cost	ha	Cost	ha	Cost	ha	Cost	ha	Cost	
Kelang North	1	145.0	4,480	65.0	1,618			57.0	2,366					22.0	438	8,902	81	
Kelang North	1	0.6	19	404.0	10,060			2.7	111	92.7	769			15.6	310	589	60	6,761
Kelang North	2			260.3	6,481	11.2	223	48.4	2,009	77.0	639			4.1	82	401	51	4,811
Kelang South	1			45.4	1,130			36.9	1,531					47.5	945	306	53	1,911
Kelang South	1			275.7	6,865			3.6	149					4.6	92	353	85	6,040
Kelang South	2	3.8	117	233.9	5,824			2.3	95					19.0	378	315	47	3,014
Kelang South	2	169.4	5,234	288.5	7,184			29.4	1,220					20.9	416	512	62	8,713
Port Kelang	1	100.0	3,090	0.8	19			45.5	1,888	141.7	1,176	75.6	627	34.6	688	410	100	7,488
Port Kelang	2	143.4	4,431	171.2	4,263			9.1	378	50.1	416			45.4	903	445	73	7,585
Port Kelang	2	57.3	1,770					10.8	448	66.1	549			8.4	167	186	48	1,408
Sub-Total		19,141		43,444		223		10,195		3,549		627		4,419		81,598		54,941

Table H.19. Branch and Lateral Sewer Construction Cost

(Unit: M\$1,000)

Sewerage Division		Land Use Category														Total	Developed Area (%)	Government Contribution	
		Residential						Commercial		Industrial		Port Area		Institutional					
		High		Medium		Low													
		ha	Cost	ha	Cost	ha	Cost	ha	Cost	ha	Cost	ha	Cost	ha	Cost				
District	Sub-Zone	M\$29.9/ha	M\$24.9/ha	M\$19.9/ha	M\$41.5/ha	M\$8.3/ha	M\$8.3/ha	M\$8.3/ha	M\$8.3/ha	M\$19.9/ha	M\$8.3/ha	M\$8.3/ha	M\$19.9/ha	M\$8.3/ha	M\$19.9/ha				
Kelang North	2	2				236.9	4,714				35.0	291		38.1	758	458	5,763	0	0
	2	3				23.5	468				171.7	1,425				418	1,893	0	0
	1	2									197.9	1,643		27.1	539	225	2,182	1	22
Port Kelang	2	3						2.0	83					16.8	334	248	6,124	29	1,776
Port Kelang	3										75.2	624				230	1,889	0	0
Kapar								8.4	349					23.9	476	621	5,844	14	818
Meru								2.3	95		156.1	1,296		6.5	129	573	4,680	3	140
Sub-Total		0	8,466	11,867	527					5,279	0		2,236	28,375		2,756			
Total		19,141	51,910	12,090	10,722	8,828	627	6,655	109,973	57,697									

Table H.20. Total Sewerage Construction Costs for Each Sub-Zone

Sewerage Division					Sewer			Intermediate Pumping Station	Land for Pumping Station	Wastewater Treatment Plant	Land for Treatment Plant	House Connections	Total
District	Zone	Sub-Zone	Trunk	Branch & Lateral									
Kelang North	1	1	6,646	8,902	1,319	14	12,070	3,416	2,680	35,047			
	1	2	3,267	11,269	1,286	14	2,860	-	2,826	21,522			
	2	1	6,608	9,434	776	11	9,345	4,465	2,365	33,004			
	2	2	6,778	5,763	-	-	1,557	-	2,063	16,161			
	2	3	6,950	1,893	718	9	1,558	-	266	11,394			
	1	1	8,231	3,606	-	-	2,406	-	975	15,218			
Kelang South	1	2	10,776	7,106	888	10	9,624	3,431	2,130	33,965			
	2	1	9,456	6,414	-	-	2,406	-	1,943	20,219			
	2	2	11,984	14,054	1,768	22	9,624	4,008	3,817	45,277			
	1	1	9,981	7,488	-	-	6,840	1,599	1,489	27,397			
Port Kelang	1	2	2,226	2,182	-	-	1,710	-	309	6,427			
	2	1	21,150	10,391	934	12	9,345	3,418	2,801	50,129			
	2	2	3,275	2,934	2,060	18	1,115	-	611	8,820			
	2	3	2,045	6,124	876	9	1,000	-	1,860	11,029			
	3	-	1,632	1,889	-	-	1,000	-	420	4,941			
	1	-	2,602	2,697	-	-	3,553	800	514	10,166			
North Port	2	-	1,191	2,473	-	-	4,181	800	340	8,985			
Kapar	-	-	9,552	5,844	542	3	5,400	1,767	2,070	25,763			
				582	3								
Meru	-	-	8,553	4,680	582	3	6,000	1,188	1,293	22,299			
Total			132,903	115,143	12,331	128	91,594	24,892	30,772	407,763			

(Unit: M\$1,000)

(Unit: M\$1,000)

Table H.21. Total Sewer Operation and Maintenance
Cost for Each Sub-Zone

(Unit: M\$1,000 year)

Unit: RM,000/year

Sewerage Division			Sewer			
District	Zone	Sub-Zone	Trunk		Branch	
Kelang North	1	1	6	18	117	312
	1	2	12		195	
	2	1	8	22	114	342
	2	2	7		114	
	2	3	7		114	
Kelang South	1	1	12	24	54	116
	1	2	12		62	
	2	1	11	29	56	147
	2	2	18		91	
Port Kelang	1	1	13	21	56	87
	1	2	8		31	
	2	1	10	26	103	258
	2	2	5		43	
	2	3	6		57	
	3	-	5		55	
North Port	1	-	-	2	-	9
	2	-	-	2	-	5
Kapar	-	-	-	11	-	95
Meru	-	-	-	8	-	96
Total			163		1,467	
			1,630			

Table H.22. Total Operation and Maintenance Costs

Sewerage Division			Daily Ave. Flow Rate (m ³ /day)	Ratio	Construction Cost (M\$1,000)	Operation & Maintenance Cost (M\$1,000/year)
District	Zone	Sub- Zone				
Kelang North	1	1	16,023	0.479	12,070	369
	1	2	17,455	0.521	2,860	402
	Sub-Total		33,478		14,930	771
Kelang North	2	1	17,492	0.473	9,345	364
	2	2	11,896	0.322	1,557	248
	2	3	7,597	0.205	1,558	158
	Sub-Total		36,985		12,460	770
Kelang South	1	1	19,441	0.670	2,406	503
	1	2	9,578	0.330	9,624	248
	Sub-Total		29,019		12,030	751
Kelang South	2	1	8,419	0.287	2,406	216
	2	2	20,881	0.713	9,624	535
	Sub-Total		29,300		12,030	751
Port Kelang	1	1	17,059	0.668	6,840	418
	1	2	8,477	0.332	1,710	207
	Sub-Total		25,536		8,550	625
Port Kelang	2	1	15,943	0.450	9,345	347
	2	2	6,677	0.189	1,115	146
	2	3	8,022	0.227	1,000	148
	3	-	4,772	0.134	1,000	129
	Sub-Total		35,414		12,460	770
North Port	1	-	4,848	-	3,553	200
	2	-	5,431	-	4,181	208
Kapar	-	-	7,183	-	5,400	82
Meru	-	-	10,476	-	6,000	92
Total			217,670	-	91,594	5,020

H.6. Construction Cost for Non-Phased Areas

Construction costs for non-phased areas; namely, North Port District and remaining zones, are shown in Tables H.23 and H.24.

Table H.23. Summary of sewerage Construction Cost for Non-Phased Program (North Port)

(Unit: M\$1,000 at 1981 Price Level)

Description	Government Contribution	Private Contribution	Total	Remarks
a. Trunk Sewer	-	3,793	3,793	
b. Branch and Lateral Sewer	-	5,170	5,170	
c. House Connection	-	854	854	
d. Pumping Station	-	-	-	
e. Treatment Plant	-	7,734	7,734	
f. Sub-Total	-	17,551	17,551	
g. Engineering Cost				
Design	-	1,755	1,755	(f) x 0.10
Supervision	-	877	877	(f) x 0.05
h. Contingency	-	4,036	4 036	(f+g) x 0.20
i. Land Acquisition	-	1,600	1,600	
Total	-	25,819	25,819	

Table H.24. Summary of Sewerage Construction Costs for
Non-Phased Program (Remaining Sub-Zones)

(Unit: M\$1,000 at 1981 Price Level)

Description	Government Contribution	Private Contribution	Total	Remarks
a. Trunk Sewer	37,736	-	37,736	
b. Branch and Lateral Sewer	2,756	25,619	28,375	
c. House Connection	-	8,281	8,281	
d. Pumping Station	2,424	-	2,424	
e. Treatment Plant	18,225	-	18,225	
f. Sub-Total	52,860	33,900	86,760	
g. Engineering Cost				
Design	5,286	3,390	8,676	(f) x 0.10
Supervision	2,643	1,695	4,338	(f) x 0.05
h. Contingency	12,157	7,797	19,954	(f+g) x 0.20
i. Land Acquisition	2,973	-	2,973	
Total	75,919	46,782	122,701	

H.7. Construction Cost for Phase I

1) Sewers

Construction cost for all sewers, including trunk, branch and lateral, is estimated based on the engineering design from which necessary parameters for cost function, described in the previous section H.2, are obtained. Table H.25 shows construction cost for each trunk sewer and Table H.26 summarizes those for branch and lateral sewers by sewerage unit.

2) Kg. Kuantan Pumping Station

Main components of the pumping station include underground pump well, office and sub-station building, three units of submersible pumps, same number of electric motors and control devices. Construction cost for each component is tabulated in Table H.27.

3) Connaught Wastewater Treatment Plant

Since stabilization pond process is adopted for the Phase I Connaught Wastewater Treatment Plant construction, the plant consists of such facilities as pumping station, inlet tank, distribution tank, stabilization and maturation ponds and an office and laboratory. Retaining wall of reinforced concrete is also required to protect the plant area from erosion by Kelang River water. Construction cost for these facilities are further divided into those of components as described in the former section. Table H.28 presents construction cost by facilities and components.

Table H.25. Trunk Sewer Construction Cost

No. of Sewers	Diameter (mm)	Length (m)	Av. Depth to Invert (m)	Unit Const. Cost (M\$/m)	Const. Cost (M\$)	Remark
8	450	1,113	3.57	288.7	321,323	M=16 CP
9	600	64	4.85	1,551.8	99,315	M= 1 CP
10	600	166	5.15	1,660.3	275,610	M= 2 CP
1	375	300	3.01	244.1	73,230	M= 3 CP
2	450	112	3.19	185.5	31,976	M= 2 CP
3	450	476	3.54	288.4	137,278	M= 5 CP
4	525	234	4.18	343.0	80,262	M= 3 CP
5	600	174	4.19	400.9	69,757	M= 2 CP
6	600	90	4.99	1,601.1	144,099	M= 2 CP
7	600	94	5.21	1,685.1	158,399	M= 1 CP
11	750	170	5.37	2,002.6	340,442	M= 2 CP
12	750	60	5.33	1,988.6	119,316	M= 1 CP
13	750	216	5.49	2,050.2	442,843	M= 3 CP
14	750	121	5.82	2,181.6	263,974	M= 2 CP
15	900	30	6.36	2,722.2	81,666	M= 1 CP
16	450	360	3.98	292.1	105,156	M= 4 CP
17	450	144	4.66	1,274.4	183,514	M= 3 CP
18	450	90	5.27	1,478.4	133,056	M= 1 CP
19	450	180	5.53	1,564.7	281,646	M= 2 CP
20	450	86	5.90	1,687.6	145,134	M= 2 CP
21	450	42	6.12	1,757.2	73,802	M= 2 CP
22	600	950	1.20	350.0	332,500	M= 7 FM
23	900	358	2.70	702.2	251,388	M= 5 CP
24	900	630	5.06	2,161.8	1,361,934	M= 8 CP
25	1,200	190	6.59	3,627.1	689,149	M= 2 CP
26	1,200	210	6.90	3,776.5	793,065	M= 2 CP
Total		6,660			6,989,834	

Note: M; number of manholes, CP; concrete pipe, FM; force main

Table H.26. Branch and Lateral Sewer Construction Cost

Unit	Diameter (mm)	Depth to Invert	Total Length (m)	Unit Cost (M\$/m)	Cost (M\$)
Unit-1	225	less than 3m	8,885	147	1,309,372
	300	less than 3m	514	272	139,572
	300	3m and more	56	640	35,846
	375	less than 3m	286	241	68,933
	375	3m and more	24	247	5,918
	Sub-total		<u>9,765</u>	<u>160</u>	<u>1,559,641</u>
Unit-2	225	less than 3m	9,082	151	1,371,287
	225	3m and more	406	676	274,465
	300	less than 3m	70	549	38,436
	300	3m and more	294	662	194,491
	375	3m and more	434	245	106,323
	450	3m and more	414	813	336,434
	Sub-total		<u>10,700</u>	<u>217</u>	<u>2,321,436</u>
Unit-3	225	less than 3m	10,959	154	1,689,853
	225	3m and more	264	548	144,694
	300	less than 3m	821	299	245,726
	300	3m and more	177	630	111,433
	375	3m and more	26	246	6,386
	Sub-total		<u>12,247</u>	<u>179</u>	<u>2,198,092</u>

Table H.26. (cont.)

Unit	Diameter (mm)	Depth to Invert	Total Length (m)	Unit Cost (M\$/m)	Cost (M\$)
Unit-4	225	less than 3m	7,018	160	1,122,187
	225	3m and more	1,602	1,011	1,619,386
	300	less than 3m	170	262	44,573
	300	3m and more	412	1,020	420,065
	375	3m and more	264	1,645	434,181
	Sub-total		<u>9,466</u>	<u>385</u>	<u>3,640,392</u>
Unit-5	225	less than 3m	14,351	147	2,115,340
	300	less than 3m	220	376	82,670
	375	3m and more	236	245	57,886
	Sub-total		<u>14,807</u>	<u>152</u>	<u>2,255,896</u>
Total			<u>56,985</u>	<u>210</u>	<u>11,975,457</u>

Table II.27. Detail of Kg. Kuantan Pumping Station
Construction Cost

Work	Description	Construction Cost		
		L.C.	F.C.	Total
Sheet Piling	SPIII, h =15 m, l =36 m including redemption and maintenance cost	7,787	25,026	32,813
Earth Work	excavation, back-filling, excess soil disposal	2,270	1,976	4,246
Foundation	crusher-run, concrete	11,595	929	12,524
Underground Structure	reinforced concrete, forming	64,837	3,506	68,343
Dewatering	submersible pump, 200 days	5,214	6,494	11,708
Architectural	total floor space 180 m ²	216,000	24,000	240,000
Miscellaneous	guide rail, metal, plumbing	41,000	23,000	64,000
Inlet Pipe		50,000	10,000	60,000
Outlet Tank	reinforced concrete	10,000	10,000	20,000
Mechanical	submersible pump, including installation	51,290	352,000	403,290
Electrical	including installation	47,250	330,250	377,500
Fence and Road		21,000	4,000	25,000
Total		528,243	791,181	1,319,424

Note: L.C., Local currency, F.C., Foreign currency

Table II.28. Detail of Connaught Wastewater Treatment
Plant Construction Cost

Unit : M\$

Facility	Work	Description	Construction Cost		
			L.C	F.C	Total
Pumping Station	Sheet Piling	SP III, h =12 m, l =66 m including redemption and maintenance cost	25,792	80,514	106,306
	Earthwork	excavation, back-filling, excess soil disposal	15,230	10,625	25,855
	Foundation	crusher-run, concrete	7,192	494	7,686
	Concrete Pile	18' x 18', l =24 m x 22	75,351	3,068	78,419
	Underground Structure	reinforced concrete, forming, steel bar	328,547	17,258	345,805
	Dewatering	submersible pump, 300 days	7,821	9,741	17,562
	Architectural	total floor space 180 m ²	240,000	0	240,000
	Miscellaneous	guide rail, metal, plumbing, etc.	81,067	79,300	160,367
	Inlet Pipe		70,000	30,000	100,000
	Outlet Tank	reinforced concrete	10,000	20,000	30,000
	Mechanical	submersible pump including installation	65,000	447,000	512,000
	Electrical	including installation	122,000	919,000	1,041,000
	Sub-total		<u>1,048,000</u>	<u>1,617,000</u>	<u>2,665,000</u>
Inlet Tank	Earthwork	excavation, back-filling, excess soil disposal	293	486	779
	Structure	reinforced concrete, forming, steel bar	90,716	5,268	95,984
	Concrete Pipe	ø350 mm, class Z, including installation, l =270 m	21,168	528	21,696
	Cast Iron Pipe	ø350 mm, including installation, l =1,620 m	50,522	211,700	262,222
	Gate	ø350 mm, F.C. x 45	0	225,000	225,000
	Sub-total		<u>162,699</u>	<u>442,982</u>	<u>605,681</u>

Note: L.C. Local currency, F.C. Foreign currency

Table H.28. (cont.)

Unit : M\$

Facility	Work	Description	Construction Cost		
			L.C	F.C	Total
Ponds	Preparatory	cutting, uprooting	212,800	-	212,800
	Earthwork	excavation, back-filling, excess soil disposal	2,046,700	1,273,900	3,320,600
	Masonry	granite, concrete, forming	634,500	48,100	682,600
	Sub-total		<u>2,894,000</u>	<u>1,322,000</u>	<u>4,216,000</u>
Distribution Tank	Gate	ø350 mm x 3	0	15,000	15,000
	Structure	reinforced concrete, guide rail, staircase	119,000	20,000	139,000
	Inlet	ø350 mm	40,000	10,000	50,000
	Concrete Pile	18' x 18', 1 =24 m x 12	41,121	1,673	42,794
	Sub-total		<u>200,121</u>	<u>46,673</u>	<u>246,794</u>
Office	Architectural	reinforced concrete, brick 120 m ²	<u>312,000</u>	0	<u>312,000</u>
Miscellaneous		fence, gate, lighting, access road, etc.	<u>602,500</u>	<u>137,500</u>	<u>740,000</u>
Retaining Wall	Foundation	rubble stone, concrete	309,359	20,260	329,619
	Concrete Pile	18' x 18', 1 =24m x 275	941,899	38,359	980,258
	Sheet Pile	SP III, h =10 m, 1 =900 m	161,149	774,756	935,905
	Structure	reinforced concrete, h =3.5 m, 1 =825 m, forming, steel bar	920,976	67,653	988,629
	Access Road	w =5 m, 1 =100 m	16,365	3,270	19,635
	Dewatering	submersible pump, 500 days	13,035	16,235	29,270
	Sub-total		<u>2,362,783</u>	<u>920,533</u>	<u>3,283,316</u>
Grand Total			<u>7,582,103</u>	<u>4,486,688</u>	<u>12,068,791</u>

Note: L.C. Local currency, F.C. Foreign currency

APPENDIX I

PRELIMINARY ENGINEERING DESIGN

KELANG NORTH

Zone - 1

Table of Sewage Quantity

Table 1.1.1/3

No. of Sewers	No. of Joint Sewers	Area		Population			Peaking Factor	Length		Design Flow				Designed Sewer						Remarks				
		Increment	Total	ha	persons	Increment		Total	m	m	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation		Ground Surface Elevation	Earth Covering
													Area	Total							m ³ /sec	ha		
1				2484	5323	3.94	300	300	0.063			0.002	0.065	375	2.10	300	0.81	0.080	1.349	0.719	4.65	2.87		
2				3870	8294	3.70	112	412	0.092			0.003	0.095	450	1.90	112	0.86	0.124	0.644	0.431	4.29	3.14		
3				4502	9648	3.62	476	888	0.105			0.004	0.109	450	1.90	476	0.88	0.124	0.431	-0.474	4.18	3.24		
4				7117	15249	3.39	234	1122	0.155			0.006	0.161	525	1.80	234	0.95	0.182	-0.549	-0.970	3.89	3.84		
5				7765	16638	3.35	174	1296	0.168			0.006	0.174	600	1.70	174	0.97	0.253	-1.045	-1.341	4.15	4.52		
6				8366	17925	3.31	90	1386	0.178			0.007	0.185	600	1.70	90	0.98	0.253	-2.245	-2.398	3.20	4.77		
7				8600	18426	3.30	94	1480	0.183			0.007	0.190	600	1.70	94	0.98	0.253	-2.398	-2.558	3.48	5.20		
				Flow to	11																3.35	5.23		
8				5600	6075	3.86	1113	1113	0.070			0.005	0.075	450	1.90	1113	0.82	0.124	0.991	-1.893	3.80	2.30		
9				11211	15578	3.38	64	1177	0.158			0.009	0.167	600	1.50	64	0.91	0.238	-2.378	-2.474	3.10	4.80		
10				11500	16068	3.36	166	1343	0.163			0.009	0.172	600	1.50	166	0.92	0.238	-2.474	-2.723	3.10	4.90		
11	7			20100	34494	3.02	170	1650	0.313			0.016	0.329	750	1.40	170	1.05	0.417	-2.873	-3.111	3.35	5.40		
12				20386	35026	3.01	60	1710	0.317			0.017	0.334	750	1.40	60	1.05	0.417	-3.111	-3.195	3.08	5.35		
13				21409	36940	2.99	216	1926	0.332			0.017	0.349	750	1.40	216	1.06	0.417	-3.195	-3.498	2.96	5.32		
14				21978	38004	2.97	121	2047	0.340			0.018	0.358	750	1.40	121	1.06	0.417	-3.498	-3.667	3.00	5.66		
15				25700	44978	2.90	30	2077	0.393			0.021	0.414	900	1.20	30	1.05	0.627	-4.063	-4.099	3.15	6.22	Flow into pumping station	
				Flow to	22																3.40	6.50		
16				5398	5921	3.88	360	360	0.069			0.004	0.073	450	1.90	360	0.82	0.124	-0.877	-1.561	3.07	3.44		
17				5917	6490	3.83	144	504	0.075			0.005	0.080	450	1.90	144	0.83	0.124	-1.561	-1.834	3.58	4.63		
18				6532	7165	3.77	90	594	0.082			0.005	0.087	450	1.90	90	0.85	0.124	-2.563	-2.734	3.27	5.32		
19				6955	7627	3.74	180	774	0.086			0.006	0.092	450	1.90	180	0.86	0.124	-2.763	-3.105	3.00	5.25		
20				7883	8634	3.67	86	860	0.096			0.006	0.102	450	1.90	86	0.87	0.124	-3.105	-3.268	3.22	5.81		
																					3.24	6.00		

KELANG NORTH

Table of Sewage Quantity

Table I.2 2/3

No. of Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks					
	Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface Elevation	Earth Covering			
									ha	ha						m				m	m ³ /sec	m ³ /sec
(21)		81.00	8871	3.66	42	902	0.097			0.007	0.104	ø 450	1.90	42	0.88	0.124	-3.268	-3.248	3.24	6.00	Flow into pumping station	
(22)	(15)	338.00	53849	2.83	950	3027	0.459			0.027	0.486	ø 600		950	1.72	0.486	1.525	3.526	3.40	6.24		
(22)		33.1	371.1	2.81	470	3570	0.475	0.002	33.1	0.030	0.507	ø 900	0.9	543	0.85	0.543	1.769	1.280	5.40	2.66	Force Main	
(23)		21.1	392.2	2.80	630	4200	0.486	0.003	21.1	0.031	0.520	ø 900	0.9	630	0.85	0.543	1.280	0.431	4.28	2.00		
		Flow to (36)																	3.66	2.23		
(24)		69.2		3.98	630		0.059	0.004		0.006	0.069	ø 375	2.4	630	0.78	0.086	2.748	1.236	5.18	2.00		
(25)		16.9	86.1	3.86	410	1040	0.071	0.005		0.007	0.083	ø 375	2.4	410	0.78	0.086	1.236	0.252	5.15	3.48		
(26)		17.4	103.5	3.76	360	1400	0.083	0.006		0.008	0.097	ø 450	1.9	360	0.78	0.124	0.177	-0.507	4.69	4.00		
(27)		22.2	125.7	3.66	250	1650	0.098	0.008		0.010	0.116	ø 450	1.9	250	0.78	0.124	-0.507	-1.674	3.77	3.76		
		Flow to (35)																	3.75	4.91		
(28)		24.0		4.63	580		0.024	0.001		0.002	0.027	ø 300	2.4	580	0.67	0.047	1.616	0.224	3.96	2.00		
		Flow to (30)																	4.57	4.00		
(29)		21.2		4.72	360		0.021	0.001		0.002	0.024	ø 300	2.4	360	0.67	0.047	3.090	2.226	5.79	2.36		
(30)	(21)	4.9	50.1	4.17	130	710	0.045	0.003		0.004	0.062	ø 375	2.4	130	0.78	0.086	0.149	-0.163	4.57	3.99		
		Flow into Pumping Station and to (33)																	3.90	3.63		
(31)		292.4		3.24	360		0.203	0.018		0.024	0.245	ø 600	1.6	360	0.87	0.246	1.895	1.051	4.57	2.00		
		Flow into Pumping Station and to (33)																	3.90	2.17		
(32)		14.4		4.98	490		0.015	0.001		0.001	0.017	ø 225	3.0	490	0.62	0.025	9.744	1.144	12.50	2.50		
(33)	(30)(31)	—	356.9	25.376	3.15	490	1200	0.241	0.019		0.029	0.289	ø 375	—	490	—	—	2.468	9.568	3.90	1.00	
(34)		34.7	391.6	27843	3.11	320	1520	0.261	0.021		0.032	0.314	ø 675	1.4	320	0.88	0.315	9.243	1.993	12.50	2.50	
(35)	(27)	11.6	528.9	37605	2.98	420	2070	0.337	0.033		0.043	0.413	ø 900	1.0	420	0.90	0.572	-2.124	-2.544	3.75	4.87	
(36)	(23)	5.9	927.0	95698	2.61	340	4540	0.752	0.037		0.075	0.864	ø 1200	0.7	340	0.91	1.032	-2.844	-3.225	3.66	5.18	
																			4.72	6.62		

[illegible]

KELANG NORTH

Table of Sewage Quantity

Table I.4. 1/4

No. of Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer					Remarks					
	Increment	Total			Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface Elevation	Earth Covering			
								ha	ha						m				m	m ³ /sec	ha
1	148.3		505	5.51	1330		0.009	0.045	140.3	0.011	0.065	375	2.0	1330	0.71	0.078	0.168	-2.482	3.10	2.50	
	Flow to		3																3.10	2.08	
2	58.9		123	4.37	440		0.004	0.016	50.9	0.004	0.024	300	2.0	440	0.61	0.043	0.756	-0.124	3.10	2.88	
3	28.4	228.1	794	5.17	780	2,110	0.014	0.071	220.6	0.010	0.103	450	1.8	780	0.76	0.121	-2.567	-3.971	3.40	5.15	
4	16.0		57	7.53	180		0.001	0.052	16.0	0.001	0.054	375	2.0	180	0.71	0.078	1.518	0.318	3.40	2.15	
5	34.4	271.0	975	5.02	850	2,980	0.016	0.088	271.0	0.022	0.126	525	1.5	850	0.77	0.167	-4.046	-5.321	3.40	5.33	
	Flow into Pumping Station and to		(6)																3.43	1.80	
6	72.6	243.1	1236	4.05	1800	4,710	0.020	0.111	243.6	0.028	0.159	675	1.4	1800	0.88	0.315	1.873	-2.577	3.85	4.87	
	Flow to		8																2.44	2.58	
7	50.8		211	4.24	390		0.004	0.019	50.8	0.005	0.028	300	2.0	390	0.61	0.043	-0.404	-1.104	3.85	3.89	
8	15.4	418.8	1510	4.71	300	5060	0.024	0.135	418.8	0.034	0.193	675	1.4	300	0.88	0.315	-2.577	-2.997	3.85	4.87	
	Flow into Pumping Station and to		(9)																3.20	5.44	
9	11.5	429.5	1081	4.57	310	5270	0.020	0.136	429.5	0.035	0.199	675	1.4	310	0.88	0.315	-2.997	-3.431	3.85	5.72	
	Flow to		11																2.44	2.58	
10	28.4		976	5.02	480		0.015	0.002	28.4	0.002	0.019	300	2.0	480	0.61	0.043	-0.404	-1.284	3.85	3.91	
11	19.2	478.1	3505	4.18	590	5860	0.046	0.139	478.1	0.039	0.224	750	1.3	590	0.91	0.401	-3.506	-4.273	3.35	4.79	
	Flow into Pumping Station and to		(13)																3.35	4.79	
12	31.9		1723	4.63	330		0.024	0.003	31.9	0.004	0.031	300	2.0	330	0.61	0.043	0.616	-0.044	3.35	3.88	
	Flow into Pumping Station and to		(13)																3.35	3.88	
13	81.3	111.9	7827	3.72	600	1510	0.081	0.147	111.9	0.050	0.280	750	1.3	600	0.91	0.401	-0.400	-1.268	3.57	4.88	
	Flow into Pumping Station and to		(11)(12)																3.57	4.88	
14	18.0	129.9	8525	3.68	370	1,930	0.061	0.148	129.9	0.051	0.295	750	1.3	370	0.91	0.401	-1.268	-1.789	3.35	4.26	
	Flow to		22																4.65	3.88	
15	19.1		2284	4.44	630		0.031	0.004	19.1	0.006	0.041	300	2.0	630	0.61	0.043	1.306	0.046	3.96	3.57	
	Flow to		17																3.66	2.58	
16	39.0		1294	4.02	390		0.019	0.002	39.0	0.003	0.024	300	2.0	390	0.61	0.043	2.816	0.036	3.96	3.58	

No. of Sewers	No. of Joint Sewers	Area		Population	Pecking Factor	Length		Design Flow				Designed Sewer					Remarks					
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation		Ground Surface	Earth Covering	
										ha	persons							ha	m ³ /sec			m ³ /sec
(17)	(15)	12.8	120.9	4013	4.10	660	1200	0.050	0.007	120.9	0.010	0.067	0.067	375	1.0	660	0.67	0.074	-0.039	-1.227	3.96	3.57
		Flow to		(19)																	3.30	4.10
(18)		45.1		1497	4.72	310		0.021	0.003	45.1	0.004	0.028	0.028	300	2.0	310	0.61	0.043	0.816	0.196	3.30	2.76
(19)	(17)	12.5	178.5	5926	3.00	660	1950	0.069	0.011	178.5	0.014	0.094	0.094	450	1.0	660	0.76	0.121	-1.302	-2.490	3.30	2.89
		Flow to		(21)																	3.45	5.43
(20)		45.1		1497	4.72	280		0.021	0.003	45.1	0.004	0.028	0.028	300	2.0	280	0.61	0.043	0.316	-0.244	3.45	3.35
(21)	(19)	5.5	229.1	7106	3.74	170	2120	0.006	0.014	229.1	0.019	0.119	0.119	450	1.0	170	0.76	0.121	-2.400	-2.796	3.45	5.63
(22)	(18)	17.1	276.0	11734	3.24	90	7020	0.170	0.162	276.0	0.071	0.403	0.403	900	1.0	90	0.94	0.600	-3.246	-3.396	3.35	5.60
(23)		61.0	307.0	23834	3.10	800	7820	0.230	0.172	307.0	0.076	0.478	0.478	900	1.0	800	0.94	0.600	-3.396	-4.196	3.00	5.40
		Flow to		(25)																	3.35	1.55
(24)		263.1		791	5.23	540		0.372	0.032	263.1	0.016	0.420	0.420	750	1.5	540	0.98	0.431	-1.658	-2.418	3.10	4.00
(25)	(23)	6.6	314.7	40283	2.87	270	8000	0.417	0.204	314.7	0.092	0.714	0.714	1050	0.9	270	0.95	0.819	-4.346	-4.589	3.35	6.53
		Flow to		(30)																	2.54	5.97
(26)		400		144	6.59	420		0.092	0.006	400	0.003	0.101	0.101	450	1.0	420	0.76	0.121	0.617	-0.139	3.10	2.00
		Flow to		(28)																	2.59	2.22
(27)		21.8		78	7.20	140		0.055	0.003	21.8	0.002	0.060	0.060	375	1.0	140	0.67	0.074	0.118	-0.134	2.55	2.00
(28)	(26)	36.1	979	352	5.00	420	840	0.199	0.015	36.1	0.008	0.222	0.222	600	1.6	420	0.87	0.246	-0.359	-1.031	2.59	2.27
(29)		11.4	1143	411	5.68	780	1120	0.227	0.018	114.3	0.009	0.354	0.354	675	1.4	780	0.88	0.315	-1.106	-2.081	2.81	3.17
(30)	(25)	0	1211.0	61545	2.70	380	8470	0.516	0.202	1211.0	0.102	0.840	0.840	1200	0.8	380	0.98	1.103	-4.739	-5.043	2.54	4.76
		Flow into Treatment Plant																			3.40	7.12

KELANG NORTH Zone - 2

Table I 6. 3/4

Table of Sewage Quantity

TABLE OF SEWER CAPACITY																									
No of Sewers	No of Joint Sewers	Area		Population	Pecking Factor	Length		Design Flow				Designed Sewer						Remarks							
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Area Flow	Total	Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface	Earth Covering		
										ha	persons									m	m			m ³ /sec	m ³ /sec
9	Sub-2		11.5	381	4.57			0.005	0.001		0.001	0.007													
	Sub-3		418.0	1,510	4.57			0.023	0.135		0.024	0.192													
		Total	429.5	1,891				0.028	0.136		0.035	0.199													
11	Sub-2		10.1	1,905	4.18			0.025	0.004		0.005	0.034													
	Sub-3		418.0	1,510	4.18			0.021	0.135		0.024	0.190													
		Total		3,505				0.046	0.139		0.039	0.224													
13	Sub-2		191.3	1,417	3.72			0.072	0.012		0.016	0.100													
	Sub-3		418.0	1,510	3.72			0.018	0.135		0.024	0.180													
		Total	611.3	7,927				0.091	0.147		0.050	0.280													
14	Sub-2		211.3	7,015	3.18			0.078	0.013		0.017	0.108													
	Sub-3		418.0	1,510	3.18			0.018	0.135		0.024	0.187													
		Total	629.3	8,525				0.096	0.148		0.051	0.295													
22	Sub-2		458.0	15,294	3.24			0.153	0.027		0.037	0.217													
	Sub-3		418.0	1,510	3.24			0.017	0.135		0.024	0.186													
		Total	876.0	11,794				0.170	0.162		0.071	0.403													
23	Sub-1		11.0	7,100	3.18			0.018	0.010		0.005	0.083													

Table of Sewage Quantity

[illegible]

KELANG SOUTH Zone - I

Table of Sewage Quantity

Table I.8. 1/3

No. of Sewers	Area		No. of Joint Sewers	Length		Design Flow				Designed Sewer						Remarks						
	Increment	Total		Population	Pecking Factor	Length		Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface	Earth Covering	
						ha	m			m ³ /sec	ha							m ³ /sec	Area			Flow
1	16.6			430		4,373	4.78			16.6	0.001	0.021	225	3.0	430	0.62	0.025	3.644	2.114	8.70	4.80	
2	13.3	29.9		380	81.0	2,473	4.39			29.9	0.002	0.035	300	2.5	380	0.68	0.048	2.039	0.839	4.60	2.22	
3	14.9	44.8		690	1,500	3,705	4.15			44.8	0.004	0.050	375	2.4	690	0.78	0.086	0.764	-0.892	4.50	3.30	
	Flow to					7														4.55	5.01	
4	20.3			520		1,679	4.64			20.3	0.002	0.025	300	2.6	520	0.70	0.049	3.616	2.016	7.70	3.74	
5	13.2	33.5		360	88.0	2,770	4.32			33.5	0.003	0.039	300	2.6	360	0.70	0.049	2.016	0.832	4.70	2.34	
6	5.5	39.0		350	1,230	3,225	4.23			39.0	0.003	0.044	300	2.6	350	0.70	0.049	0.832	-0.078	4.60	3.42	
7	3.6	87.4		280	1,780	7,228	3.77			87.4	0.007	0.089	450	2.4	280	0.88	0.140	-0.967	-1.639	4.55	5.00	
	Flow to					13														4.50	5.63	
8	27.5			400		2,274	4.45			27.5	0.002	0.032	300	2.5	400	0.68	0.048	2.456	0.956	4.80	2.60	
9	7.2	34.7		350	750	2,870	4.30			34.7	0.003	0.040	300	2.5	350	0.68	0.048	0.956	0.981	4.80	3.50	
	Flow to					11														4.80	4.38	
10	3.3			150		273	6.02			3.3	0.000	0.005	225	3.0	150	0.62	0.025	3.544	3.094	4.80	1.00	
11	8.8	46.8		380	1,130	3,870	4.12			46.8	0.004	0.052	375	2.5	380	0.79	0.088	0.006	-0.944	4.80	4.36	
12	8.2	55.0		290	1,520	4,549	4.03			55.0	0.004	0.059	375	2.5	300	0.79	0.088	-0.944	-1.919	4.70	5.21	
13	2.6	145.0		200	1,980	11,992	3.51			145.0	0.012	0.139	450	2.4	200	0.88	0.140	-1.994	-2.474	4.50	5.98	
	Flow to					16														4.35	6.31	
14	16.7			350		1,381	4.77			16.7	0.001	0.021	225	3.0	350	0.62	0.025	3.744	2.694	7.70	3.70	
15	14.1	30.8		390	740	2,547	4.37			30.8	0.002	0.036	300	2.5	390	0.68	0.048	2.619	1.644	4.70	1.74	
16	22.9	53.7		620	1,360	4,441	4.04			53.7	0.004	0.058	375	2.0	620	0.71	0.078	1.569	-0.692	4.60	2.61	
17	7.3	61.0		320	1,680	5,045	3.97			61.0	0.005	0.065	375	2.0	320	0.71	0.078	-0.692	-1.332	4.80	2.60	
18	9.3	215.3		480	2,460	17,805	3.31			215.3	0.017	0.194	600	2.0	480	0.97	0.275	-2.624	-3.584	4.55	4.81	
																				4.35	6.30	

KELANG SOUTH Zone - I

Table of Sewage Quantity

Table I.9.2/3

No of Sewers	No of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks				
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface	Earth Covering		
										ha	ha						m				m	m ² /sec
		Flow into Pumping Station and to																				
(19)		30.5	2,522	4.38		400		0.033			30.5	0.002	0.035	300	2.5	400	0.68	0.048	2.506	1.506	4.85	2.00
(20)		12.2	42.7	3.531	4.18	320	720	0.044			42.7	0.003	0.047	375	2.4	320	0.78	0.086	1.431	0.663	4.69	2.83
(21)		36.2	78.9	6.525	3.82	340	1,060	0.075			78.9	0.006	0.081	375	2.4	340	0.78	0.086	0.663	-0.153	4.60	3.51
(22)		11.4	90.3	7.468	3.75	300	1,360	0.084			90.3	0.007	0.091	450	2.0	300	0.80	0.128	-0.228	-0.822	4.50	4.22
		Flow to																				
(23)		44.8	1,224	4.86		650		0.018			14.8	0.001	0.019	225	3.0	650	0.62	0.025	13.444	11.494	15.20	1.50
(24)		26.6	41.4	3.424	4.19	620	1,270	0.043			41.4	0.003	0.046	225	3.0	620	0.62	0.025	11.494	2.814	15.20	3.45
(25)		6.0	137.7	11.388	3.53	430	1,790	0.121			137.7	0.011	0.132	525	2.0	430	0.89	0.192	-0.903	-1.763	4.27	4.58
		Flow into Pumping Station and to																				
(26)		(56.7)	(56.7)	(2.652)	3.05	620	3,080	0.248			(56.7)	(0.005)	(0.031)	675	2.0	620	1.05	0.376	2.513	1.273	4.27	1.00
(27)		(47.6)	(47.6)	(5.246)	3.02	580	3,660	0.265			(104.3)	(0.008)	(0.056)	675	2.0	580	1.05	0.376	1.273	-0.113	4.27	4.79
(28)		(226.5)	(226.5)	(16.639)	2.90	430	4,090	0.255			(330.8)	(0.029)	(0.172)	750	1.8	430	1.07	0.472	-0.188	-0.962	4.27	3.63
(29)		(268.5)	(268.5)	(30.145)	2.79	520	4,610	0.245			(599.3)	(0.049)	(0.301)	900	1.6	520	1.14	0.724	-1.112	-1.944	3.35	3.46
		Flow to																				
(30)		85.0	5,755	3.89		910		0.067			85.0	0.007	0.074	375	2.4	910	0.78	0.086	2.418	0.234	4.85	2.00
		Flow to																				
(31)		38.3	2,593	4.36		750		0.034			38.3	0.003	0.037	300	2.5	750	0.68	0.048	2.506	0.381	4.65	2.00
(32)		7.2	130.5	8.835	3.66	360	1,270	0.097			130.5	0.011	0.108	450	2.0	360	0.80	0.128	0.159	-1.153	6.40	5.73
		Flow to																				
(33)		32.4	2,193	4.47		450		0.030			32.4	0.003	0.033	300	2.5	450	0.68	0.048	0.356	-1.844	3.20	2.50
(34)		90.8	253.7	17.175	3.33	700	1,970	0.172			253.7	0.021	0.193	525	2.0	700	0.89	0.192	-2.069	-3.469	3.20	4.68

KELANG SOUTH Zone -

Table of Sewage Quantity

Table I.O. 3/3

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer					Remarks							
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Area Flow	Total	Diameter	Slope	Length		Full Velocity	Full Capacity	Invert Elevation		Ground Surface	Earth Covering	
										ha	ha									m	m			m ³ /sec
35		52.3	306.0	20,722	3.24	540	2,510	0.202		306.0	0.025	0.227	Ø 600	1.8	540	0.92	0.261	-3.544	-4.516	2.66	2.59	6.43		
36		(58.3)	(563.3)	(29,932)				(0.202)		(563.3)	(0.025)	(0.232)												
37	29	(31.4)	(689.0)	(24,648)	3.18	240	2,750	0.199		306.0	0.025	0.224	Ø 600	1.8	240	0.92	0.261	-4.516	-4.948	2.59	2.59	7.42		
38		—	659.0	49,919	2.65	520	5,130	0.398		659.0	0.054	0.432	Ø 1050	1.4	520	1.18	1.022	-5.398	-6.126	3.35	3.35	8.31		
			(689.0)	(24,648)				(0.276)		(689.0)	(0.056)	(0.332)												
			659.0	49,919	2.65	260	5,390	0.398		659.0	0.054	0.432	Ø 1050	1.4	260	1.18	1.022	-6.126	-6.490	3.35	3.35	8.93		
		Flow into Treatment Plant																						
37	Sub-1	306.0	20,722	2.65				0.165			0.025	0.087												
	Sub-2	353.0	29,197	2.65				0.233			0.029	0.117												
	Total	659.0	49,919					0.398			0.054	0.204												
38	Sub-1	306.0	20,722	2.65				0.233			0.025	0.087												
	Sub-2	353.0	29,197	2.65				0.165			0.029	0.117												
	Total	659.0	49,917					0.398			0.054	0.204												

KELANG SOUTH
Zone - 2

Table of Sewage Quantity

Table I.11. 1/5

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer					Remarks			
		Increment	Total			Infiltration	Area	Flow	Total	Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation			Ground Surface	Earth Covering	
															Begin Point	End Point				
1		16.7		2,173	4.48	400		16.7	0.001	0.030	300	2.5	400	0.68	0.048	1.506	0.506	3.35	1.50	
2		7.3	24.0	3,172	4.25	540	940	7.3	0.001	0.041	300	2.5	540	0.68	0.048	0.506	-0.844	3.20	2.35	
		Flow to		0														3.20	3.70	
3		11.2		7,962	3.72	510		11.2	0.005	0.094	450	1.8	510	0.76	0.121	1.297	0.209	3.35	2.55	
4		9.8	71.0	9,237	3.64	350	910	71.0	0.006	0.107	450	1.8	350	0.76	0.121	0.289	-0.341	3.35	2.55	
		Flow to		0														3.20	3.03	
5		57.8		7,520	3.75	250		57.8	0.005	0.090	450	1.8	250	0.76	0.121	0.687	0.237	3.20	2.45	
6		13.1	70.9	9,224	3.64	280	530	70.9	0.006	0.107	450	1.8	280	0.76	0.121	0.237	-0.267	3.20	2.95	
7		5.9	74.0	9,992	3.60	320	850	74.0	0.006	0.114	450	1.8	320	0.76	0.121	-0.267	-0.843	3.20	2.95	
8		13.3	185.1	24,082	3.17	540	1,480	185.1	0.015	0.245	600	1.8	540	0.92	0.261	-1.144	-2.116	3.81	5.25	
9		8.6	222.7	29,103	3.09	520	2,000	222.7	0.018	0.289	675	1.8	520	1.00	0.357	-2.191	-3.127	3.81	5.24	
		Flow to		16														3.24	5.61	
10		8.0		1,041	4.97	160		8.0	0.001	0.017	225	3.0	160	0.62	0.025	2.384	1.904	4.14	1.58	
11		0.9	16.9	2,199	4.47	400	560	0.9	0.001	0.031	300	2.5	400	0.68	0.048	1.827	0.827	3.81	1.64	
12		7.0	23.9	3,109	4.25	390	950	7.0	0.002	0.042	300	2.5	390	0.68	0.048	0.827	-0.148	3.35	2.18	
		Flow to		15														3.24	3.04	
13		21.1		2,745	4.33	490		21.1	0.002	0.038	300	2.5	490	0.68	0.048	1.796	0.571	3.64	1.58	
14		4.5	25.1	3,331	4.21	270	760	25.1	0.002	0.045	375	2.0	270	0.71	0.078	0.496	-0.044	3.32	2.41	
15		1.7	51.2	4,661	3.81	180	1,330	51.2	0.004	0.088	450	1.8	180	0.76	0.121	-0.208	-0.622	3.24	2.85	
16		1.4	246.3	32,044	3.05	170	2,170	246.3	0.020	0.314	675	1.8	170	1.00	0.357	-3.127	-3.433	3.24	3.95	
		Flow to		24														3.02	5.61	
17		17.8		2,316	4.43	300		17.8	0.001	0.022	300	2.5	300	0.68	0.048	1.086	0.336	3.43	2.00	
		Flow to		0														3.66	2.98	

KELANG SOUTH Zone - 2

Table I.12 2/5

Table of Sewage Quantity

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks			
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface	Earth Covering	
										ha	ha						m				m
(18)		17.7	35.5	4,119	4.02	450	750	0.056		35.5	0.003	375	2.0	450	0.71	0.070	0.261	-0.099	3.66	2.97	
(19)		31.7	172	8,743	3.17	730	1,020	0.097		17.2	0.003	450	1.8	730	0.76	0.121	-0.974	-2.280	4.11	4.58	
(20)		10.0	772	10,044	3.10	390	1,070	0.109		77.2	0.006	450	1.8	390	0.76	0.121	-2.280	-2.990	4.11	5.89	
		Flow	7.0	(24)															3.82	6.30	
(21)		18.4		2,394	4.41	410		0.032		18.4	0.001	300	2.5	410	0.68	0.048	2.586	1.481	3.61	1.79	
(22)		16.6	35.0	4,554	4.03	410	820	0.055		25.0	0.003	375	2.0	410	0.71	0.070	1.486	0.586	3.77	2.73	
(23)		7.1	42.1	5,477	3.92	310	1,130	0.065		42.1	0.030	375	2.0	310	0.71	0.070	0.586	-0.034	3.82	3.42	
(24)	(18, 20)	12.2	377.8	49,152	2.07	570	2,740	0.425		377.8	0.331	750	1.7	570	1.04	0.459	-3.508	-4.477	2.90	6.54	
		Flow	7.0	(31)																	
(25)		15.7		2,043	4.51	330		0.020		15.7	0.001	300	2.5	330	0.10	0.048	1.164	0.341	3.20	2.09	
(26)		20.9	36.6	4,742	4.00	530	810	0.057		36.6	0.003	375	2.0	530	0.71	0.070	0.266	-0.794	3.20	3.56	
(27)		15.0	49.6	1,253	3.85	290	1,150	0.075		49.6	0.004	450	1.8	290	0.76	0.121	-0.069	-1.391	3.20	4.08	
(28)		21.3	70.9	9,226	3.14	110	1,760	0.101		70.9	0.006	450	1.8	110	0.76	0.121	-1.391	-2.489	3.20	5.13	
(29)		11.6	82.5	19,735	3.56	400	2,160	0.115		82.5	0.007	525	1.6	400	0.80	0.172	-2.514	-3.204	3.20	5.17	
		Flow	7.0	(31)															2.90	5.51	
(30)		19.6		2,550	4.37	340		0.036		19.6	0.002	300	2.5	340	0.10	0.048	-0.104	-0.954	2.74	2.50	
(31)	(24, 29)	5.4	485.3	13,190	2.77	310	3,050	0.527		485.3	0.339	900	1.6	310	1.14	0.724	-4.627	-5.123	2.90	6.53	
		Flow	7.0	(35)															2.74	6.06	
(32)		6.6		859	5.11	300		0.013		6.6	0.001	225	3.0	300	0.62	0.025	1.944	1.044	3.20	1.80	
(33)		8.3	14.9	1,930	4.55	400	700	0.027		14.9	0.001	300	2.5	400	0.60	0.048	0.969	-0.031	3.00	1.89	
(34)		11.0	26.7	3,874	4.19	640	1,040	0.044		26.7	0.002	375	2.0	640	0.71	0.070	-0.106	-1.386	2.90	2.57	
(35)	(31)	2.0	514.0	16,792	2.74	160	3,210	0.551		0.041	0.592	900	1.6	160	1.14	0.724	-5.123	-5.379	2.74	6.06	

Zone - 2

Table I.13. 3/5

Zone - 2		Table of Sewage Quantity										Table I.13.3/s									
No. of Sewers	Area		No. of Joint Sewers	Length		Design Flow				Designed Sewer					Remarks						
	Increment	Total		Peaking Factor	Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface Elevation	Earth Covering	
									ha	ha							m ³ /sec	m ³ /sec			ha
	Flow to																				
(36)	26.2	2,114	4.49	410		0.029		26.2	0.002	0.031	2.5	410	0.60	0.048	0.206	-0.819	3.05	2.50			
	Flow to																				
(37)	11.0	880	5.09	170		0.014		11.0	0.001	0.015	3.0	170	0.62	0.025	0.794	0.284	3.05	2.00			
(38)	24.3	1,15	4,963	500	910	0.059		61.5	0.005	0.064	2.0	500	0.71	0.078	-0.894	-1.894	2.90	3.36			
(39)	12.1	73.6	5,840	320	1,240	0.049		73.6	0.004	0.076	1.8	320	0.76	0.121	-1.969	-2.563	2.56	4.02			
(40)	9.8	588.4	72,796	110	3,220	0.594		588.4	0.047	0.641	1.6	110	1.14	0.724	-5.379	-5.555	2.50	4.55			
	Flow to																				
(41)	13.7	1,106	4.93	320		0.016		13.7	0.001	0.017	3.0	320	0.62	0.025	1.314	0.354	3.57	2.00			
(42)	10.5	24.2	4.54	350	670	0.027		24.2	0.002	0.029	2.5	350	0.68	0.048	-1.444	-2.319	3.00	4.10			
(43)	17.2	129.8	74,337	580	3,800	0.617		129.8	0.051	0.660	1.6	580	1.14	0.724	-5.555	-6.451	2.40	6.96			
	Flow into Pumping Station and to																				
(44)	31.0	2,502	4.39	570		0.033		31.0	0.003	0.036	2.5	570	0.60	0.040	1.236	-3.119	3.50	2.00			
	Flow into Pumping Station and to																				
(45)	21.2	1,771	4.43	510		0.024		21.2	0.002	0.026	2.0	510	0.61	0.043	0.166	-2.524	3.27	2.23			
	Flow into Pumping Station and to																				
(46)	18.3	700.2	21,227	430	4,310	0.150		700.3	0.056	0.714	1.6	430	1.14	0.724	0.470	-0.210	2.47	1.00			
(47)	1.6	701.9	81,956	170	4,400	0.659		701.9	0.056	0.714	1.6	170	1.14	0.724	-0.210	-0.490	2.13	1.35			
	Flow to																				
(48)	28.0	2,324	4.43	550		0.031		28.0	0.002	0.033	2.5	550	0.60	0.048	0.556	-0.819	2.90	2.00			
(49)	18.0	38.8	3,131	130	180	0.040		38.8	0.003	0.043	2.5	130	0.60	0.048	-0.819	-1.144	2.29	2.77			
(50)	4.5	785.0	85,450	290	4,770	0.102		785.2	0.060	0.742	1.4	290	1.10	1.022	-1.894	-2.300	2.13	2.86			
	Flow to																				

KELANG SOUTH Zone - 2

Table of Sewage Quantity

Table I.14. 4/5

Zone = 2														Inlet to Compound									
No. of Sewers	No. of Joint Sewers	Area		Population	Pecking Factor	Length		Design Flow				Designed Sewer					Remarks						
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation		Ground Surface	Earth Covering		
				ha	ha					m	m							m ³ /sec	m ³ /sec			ha	m ³ /sec
(51)		31.4		2,534	4.70	540		0.033		31.4	0.003	0.036	300	2.5	540	0.10	0.040	0.391	-2.584	2.29	2.09		
(52)	(50)	11.7	708.3	8,020	2.63	520	5,290	0.705		708.3	0.063	0.710	1,050	1.4	520	1.10	1.022	-3.304	-4.072	2.44	5.35		
		Flow to		(54)																			
(53)		17.0		1,436	4.75	400		0.021		17.0	0.001	0.022	225	3.0	400	0.62	0.025	0.124	-1.016	2.44	2.09		
(54)	(52)	20.9	827.0	9,230	2.62	550	5,840	0.727		827.0	0.067	0.734	1,050	1.4	550	1.10	1.022	-4.072	-4.862	2.44	5.35		
		Flow into Treatment Plant																					
(35)	Sub-1		2.0	161	2.74			0.001		2.0	0.000	0.001											
	Sub-2		512.0	4,434	2.74			0.550		512.0	0.041	0.591											
		Total		514.0	4,595			0.551		514.0	0.041	0.592											
(40)	Sub-1		76.4	1,115	2.71			0.050		76.4	0.006	0.056											
	Sub-2		512.0	4,434	2.71			0.544		512.0	0.041	0.585											
		Total		588.4	5,549			0.594		588.4	0.047	0.641											
(43)	Sub-1		117.0	9,504	2.69			0.077		117.0	0.010	0.087											
	Sub-2		512.0	4,434	2.69			0.540		512.0	0.041	0.581											
		Total		629.0	13,938			0.617		629.0	0.051	0.610											
(46)	Sub-1		100.3	15,196	2.67			0.122		100.3	0.015	0.127											

KELANG SOUTH
Zone - 2

Table of Sewage Quantity

Table I.15. 5/5

No of Sewers	No of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks							
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Area Flow	Flow Total	Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface Elevation	Earth Covering		
										Begin Point	End Point														
	Sub-2	512.0	14,631	2.67				0.536		512.0	0.041	0.577													
		Total	700.3	21,027				0.650		700.3	0.056	0.714													
47	Sub-1	149.9	15,328	2.66				0.123		149.9	0.015	0.130													
	Sub-2	512.0	14,631	2.66				0.535		512.0	0.041	0.575													
		Total	701.9	21,956				0.650		701.9	0.056	0.714													
50	Sub-1	232.2	10,819	2.65				0.150			0.019	0.169													
	Sub-2	512.0	14,631	2.65				0.532			0.041	0.573													
		Total	744.2	25,450				0.682			0.060	0.742													
52	Sub-1	276.3	22,207	2.63				0.177			0.022	0.199													
	Sub-2	512.0	14,631	2.63				0.528			0.041	0.569													
		Total	788.3	36,838				0.705			0.063	0.768													
54	Sub-1	315.0	25,407	2.62				0.201			0.026	0.227													
	Sub-2	512.0	14,631	2.62				0.526			0.041	0.567													
		Total	827.0	40,038				0.727			0.067	0.794													

PORT KELANG

Zone -

Table of Sewage Quantity

Table I.16. 1/3

No. of Sewers		No. of Joint Sewers		Area		Population		Pecking Factor		Length		Design Flow				Designed Sewer					Remarks								
												Increment	Total	Domestic Waste	Other	Infiltration		Area Flow	Total	Diameter		Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface	Earth Covering
																ha	ha									m ³ /sec	m ³ /sec		
1		73.9		6,134	3.86	600		0.071	0.022	73.9	0.006	0.099	450	1.9	600	0.76	0.121	-0.563	-1.643	2.95	3.00								
2		15.9	89.8	7,453	3.75	380	980	0.084	0.026	89.8	0.007	0.117	450	1.8	380	0.76	0.121	-1.643	-2.327	2.95	4.08								
		Flow to		4																2.95	3.47								
3		17.6		1,461	4.74	280		0.016	0.005	17.6	0.001	0.022	225	3.0	280	0.62	0.025	-1.096	-1.936	1.66	3.34								
4	2	7.2	114.6	9,512	3.62	370	1,350	0.104	0.033	114.6	0.009	0.146	525	1.5	370	0.77	0.167	-2.894	-3.449	1.66	3.98								
		Flow to		9																2.53	5.39								
5		31.1		2,518	4.37	540		0.034	0.009	31.1	0.003	0.046	300	2.4	540	0.67	0.047	0.286	-0.410	1.44	1.51								
		Flow to		7																									
6		13.8		1,145	4.90	240		0.017	0.004	13.8	0.001	0.032	300	2.4	240	0.67	0.047	0.216	-0.360	2.56	2.00								
7	5	15.3	60.2	4,997	3.97	570	1,110	0.060	0.018	60.2	0.005	0.083	375	2.4	570	0.78	0.086	-0.485	-1.653	1.44	1.49								
		Flow to		9																2.53	3.95								
8		25.9		2,150	4.48	480		0.029	0.008	25.9	0.002	0.039	300	2.4	480	0.67	0.047	0.986	-0.262	2.33	1.00								
9	4	13.5	214.2	17,779	3.31	500	1,850	0.177	0.062	214.2	0.017	0.256	675	1.1	500	0.78	0.279	-3.599	-4.149	2.53	5.37								
		Flow to		13																2.71	6.10								
10		32.9		2,731	4.33	490		0.036	0.010	32.9	0.003	0.049	300	2.6	490	0.70	0.049	0.366	-0.908	2.71	2.00								
11		4.4	37.3	3,096	4.25	320	810	0.040	0.011	37.3	0.003	0.054	375	2.4	320	0.78	0.086	-0.983	-1.751	3.20	3.75								
		Flow to		13																2.71	4.03								
12		23.6		1,959	4.54	560		0.027	0.007	23.6	0.002	0.036	300	2.4	560	0.67	0.047	1.226	-2.384	2.57	1.00								
13	9	4.2	279.3	23,182	3.19	260	3,110	0.223	0.081	279.3	0.023	0.327	750	1.0	260	0.80	0.352	-4.224	-4.984	2.71	6.10								
		Flow to		22																2.43	6.08								
14		22.0		1,826	4.59	450		0.025	0.006	22.0	0.002	0.033	300	2.4	450	0.67	0.047	1.046	-0.034	2.39	1.00								
15		5.8	27.8	2,307	4.44	180	530	0.031	0.008	27.8	0.002	0.041	300	2.4	180	0.67	0.047	-0.034	-0.466	2.39	2.08								
																				2.41	2.53								

Table of Sewage Quantity

Table I.17 2/3

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer					Remarks									
		Increment	Total			Increment	m	Domestic Waste	Other	Infiltration		Total	Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface	Earth Covering				
										ha	ha								m ³ /sec	m ³ /sec			m	m	Begin Point	End Point
		ha	ha	persons				m ³ /sec	m ³ /sec	ha	m ³ /sec	mm	%	m	m/sec	m ³ /sec	m	m	m	m						
		Flow to (17)																								
(16)		7.2		598	5.38	310		0.010	0.002	7.2	0.001	0.013	0.225	3.0	310	0.62	0.025	0.954	-1.956	2.21	1.00					
(17)	(15)	7.3	42.3	3,511	4.18	320	1,050	0.044	0.012	42.3	0.003	0.059	0.375	2.4	320	0.78	0.086	-2.106	-2.874	2.41	4.08					
		Flow to (19)																								
(18)		6.8		564	5.43	270		0.009	0.002	6.8	0.001	0.012	0.225	3.0	270	0.62	0.025	1.004	-2.456	2.33	4.53					
(19)	(17)	6.4	55.5	4,607	4.02	280	1,330	0.056	0.016	55.5	0.004	0.076	0.375	2.4	280	0.78	0.086	-2.874	-3.546	2.33	4.77					
		Flow to (21)																								
(20)		4.9		407	5.69	230		0.007	0.001	4.9		0.008	0.225	3.0	230	0.62	0.025	0.764	-2.856	2.02	1.00					
(21)	(19)	4.7	65.1	5,403	3.93	260	1,590	0.064	0.019	65.1	0.005	0.088	0.450	2.2	260	0.80	0.128	-3.621	-4.193	2.28	5.39					
(22)	(13)	19.9	364.3	38,237	3.07	280	3,390	0.200	0.106	364.3	0.030	0.416	0.900	0.8	280	0.81	0.512	-4.634	-4.858	2.43	6.11					
(23)		45.7	418.0	34,017	3.02	600	3,990	0.310	0.119	418.0	0.033	0.462	0.900	0.8	600	0.81	0.512	-4.858	-5.338	2.45	6.06					
		Flow to (27)																								
(24)		35.0		105	6.90	390		0.002	0.024	35.0	0.003	0.029	0.300	2.4	390	0.67	0.047	-0.294	-1.230	2.15	6.01					
		Flow to (26)																								
(25)		24.4		73	7.27	400		0.002	0.017	24.4	0.002	0.021	0.225	3.0	400	0.62	0.025	-0.206	-1.406	2.02	1.00					
(26)	(24)	5.5	64.9	195	6.32	320	720	0.004	0.045	64.9	0.005	0.054	0.375	2.4	320	0.78	0.086	-1.556	-2.324	3.05	4.17					
(27)	(23)	1.8	476.7	34,217	3.02	120	4,110	0.312	0.165	476.7	0.038	0.515	0.1050	0.7	120	0.83	0.722	-5.488	-5.572	3.05	4.94					
		Flow to (33)																								
(28)		64.3		193	6.32	300		0.004	0.044	64.3	0.005	0.053	0.375	2.4	300	0.78	0.086	1.372	0.652	3.05	4.20					
(29)		19.2	83.5	251	6.09	220	520	0.005	0.058	83.5	0.007	0.070	0.375	2.4	220	0.78	0.086	0.652	0.124	3.66	2.58					
(30)		25.2	108.7	326	5.87	330	850	0.006	0.075	108.7	0.009	0.090	0.450	1.9	330	0.78	0.124	0.049	-0.578	3.66	3.10					
(31)		31.6	140.3	421	5.66	500	1,350	0.007	0.097	140.3	0.011	0.115	0.450	1.9	500	0.78	0.124	-0.578	-1.528	3.51	3.58					

Table of Sewage Quantity

Table I.18.^{3/3}

No. of Sewers		No. of Joint Sewers		Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer							Remarks		
										Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation			Elevation Ground Surface	Earth Covering
												m ³ /sec	ha						m ³ /sec	m ³ /sec			
		Increment	Total	ha	ha	persons		Increment	Total	m ³ /sec	m ³ /sec	ha	m ³ /sec	m	m	m	m	m	m	m			
(32)		4.8	145.1	435	5.63			220	1,570	0.007	0.100	145.1	0.012	0.119		-1.528	-1.946	3.35	4.37				
(33)	(27)	13.2	635.0	34,687	3.01			300	4,410	0.316	0.275	635.0	0.051	0.642		-5.572	-5.782	3.05	7.46				
		Flow into Treatment Plant																					
(27)	Sub-1		410.0	34,017	3.02					0.310	0.119		0.033	0.462									
	Sub-2		66.7	200	3.02					0.002	0.046		0.005	0.053									
	Total		476.7	34,217						0.312	0.165		0.038	0.515									
(33)	Sub-1		410.0	34,017	3.01					0.310	0.119		0.033	0.462									
	Sub-2		225.0	670	3.01					0.006	0.156		0.018	0.180									
	Total		635.0	34,687						0.316	0.275		0.051	0.642									

Table of Sewage Quantity

Table I.19. 1/8

No. of Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer					Remarks						
	Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation		Ground Surface	Earth Covering		
									ha	ha							m	m			m ³ /sec	m ³ /sec
1	122.9	1,983	3.51	710	0.126	—	122.9	0.010	0.136	450	26	710	0.91	0.145	—	0.003	—	1.849	3.51	3.00		
2	107.9	230.8	22,503	3.20	470	1,180	0.216	—	230.8	0.019	0.235	600	20	470	0.97	0.275	—	1.999	—	2.939	3.35	4.67
3	17.2	248.0	24,180	3.17	290	1,470	0.230	—	248.0	0.020	0.250	600	20	290	0.97	0.275	—	2.339	—	3.519	3.35	5.61
4	13.1	261.1	25,456	3.15	210	1,680	0.241	0.001	261.1	0.021	0.263	600	20	210	0.97	0.275	—	1.675	—	1.255	3.35	1.58
5	24.1	285.2	27,810	3.11	310	1,990	0.240	0.003	285.2	0.023	0.286	675	20	310	1.05	0.376	—	1.180	—	0.560	3.35	2.03
6	26.2	311.4	30,370	3.07	280	2,270	0.280	0.006	311.4	0.025	0.311	675	20	280	1.05	0.376	—	0.560	—	0.000	3.35	2.03
7	24.5	335.9	32,764	3.04	310	2,580	0.300	0.008	355.9	0.027	0.335	675	20	310	1.05	0.376	—	0.000	—	0.620	3.35	2.91
8	27.6	363.5	35,460	3.00	590	3,170	0.319	0.010	363.5	0.029	0.358	675	20	590	1.05	0.376	—	0.620	—	1.800	3.35	4.24
9	71.8	5,516	3.92	760	0.045	0.022	77.8	0.006	0.093	450	20	760	0.80	0.128	—	1.613	—	3.133	—	2.90	4.10	
10	23.3	1,652	4.65	370	0.023	0.007	23.3	0.002	0.032	300	40	370	0.87	0.061	—	2.006	—	0.526	—	3.35	1.00	
11	12.5	113.6	8,054	3.71	1,000	1,760	0.090	0.032	113.6	0.009	0.131	525	1.9	1,000	0.87	0.187	—	3.208	—	5.108	3.51	6.12
12	18.3	1,297	4.62	800	0.019	0.005	183	0.001	0.025	300	40	800	0.87	0.061	—	1.646	—	1.554	—	2.99	1.00	
13	54.1	3,836	4.13	610	0.048	0.015	54.1	0.004	0.067	375	35	610	0.94	0.104	—	2.032	—	4.164	—	2.44	4.04	
14	11.5	197.5	14,316	3.42	350	2,110	0.147	0.053	197.5	0.016	0.216	600	1.5	350	0.87	0.246	—	1.225	—	0.700	2.90	1.83
15	49.6	4,846	3.99	780	0.058	0.004	49.6	0.004	0.066	375	35	780	0.94	0.104	—	0.238	—	2.422	—	2.77	2.10	

No. of Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks			
	Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface Elevation	Earth Covering	
									ha	ha						m				m
(16)	9.7	620.3	35,572	2.82	420	3,590	0.471	0.069	620.3	0.050	0.590	900	1.5	420	1.10	0.701	-2.947	-3.577	320	5.73
	Flow to		(21)																320	5.78
(17)	35.4		3,459	4.19	380		0.044	0.003	35.4	0.003	0.050	300	2.5	380	0.68	0.048	0.706	-0.244	305	2.95
(18)	11.2	46.6	4,553	4.03	200	580	0.055	0.004	46.6	0.004	0.063	375	2.5	200	0.79	0.088	-0.319	-0.819	305	2.94
(19)	15.4	62.0	6,057	3.87	430	1,010	0.071	0.006	62.0	0.005	0.082	375	2.5	430	0.79	0.088	-0.819	-2.432	317	3.56
	Flow to		(21)																320	5.20
(20)	16.5		1,612	4.67	330		0.023	0.001	16.5	0.001	0.025	225	4.0	330	0.71	0.028	-1.656	-2.376	274	3.54
(21)	2.8	701.6	63,515	2.76	240	3,830	0.527	0.076	701.6	0.057	0.660	900	1.5	240	1.10	0.701	-3.577	-3.937	320	5.78
	Flow to		(25)																305	5.98
(22)	41.0		4,006	4.10	310		0.049	0.004	41.0	0.003	0.056	375	2.5	310	0.79	0.088	-0.352	-1.577	213	2.30
(23)	24.6	65.6	6,409	3.83	330	640	0.074	0.006	65.6	0.005	0.085	375	2.5	330	0.79	0.088	-1.577	-2.402	229	3.44
(24)	9.9	75.5	7,376	3.76	340	880	0.083	0.007	75.5	0.006	0.096	450	2.5	340	0.90	0.143	-2.477	-3.327	244	4.40
(25)	13.6	790.7	72,220	2.71	450	4,280	0.588	0.084	790.7	0.064	0.736	1050	1.0	450	1.00	0.864	-4.087	-4.987	305	5.86
(26)	3.4	794.1	72,552	2.71	180	4,460	0.593	0.084	794.1	0.064	0.741	1050	1.0	180	1.00	0.864	-4.387	-4.567	335	6.57
	Flow to		(31)																335	6.75
(27)	27.5		2,687	4.34	470		0.035	0.002	27.5	0.002	0.039	300	2.5	470	0.68	0.048	0.706	-0.469	305	2.00
(28)	28.2	55.7	5,442	3.93	530	900	0.064	0.005	55.7	0.005	0.074	375	2.5	530	0.79	0.088	-0.544	-2.732	274	2.85
	Flow to		(30)																274	5.04
(29)	14.3		1,397	4.77	460		0.020	0.001	14.3	0.001	0.022	225	4.0	460	0.71	0.028	1.644	-0.196	290	1.00
(30)	7.6	77.6	7,582	3.74	260	1,160	0.085	0.001	77.6	0.006	0.092	450	2.5	260	0.90	0.143	-2.807	-3.457	274	5.03
(31)	7.3	879.0	80,852	2.67	160	4,620	0.649	0.092	879.0	0.071	0.812	1050	1.0	160	1.00	0.864	-4.567	-4.707	335	6.75
	Flow into Pumping Station and to		(32)																320	6.74

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks			
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface	Earth Covering	
										ha	ha						ha				m ³ /sec
32	32	13.1	222.3	21,132	2.67	340	4,980	0.652	0.016	892.9	0.072	0.820	1,050	1.0	360	1.00	0.864	1.037	0.677	3.38	2.88
33		28.1		627	5.34	640		0.010	0.007	28.1	0.002	0.019	300	3.0	640	0.62	0.025	0.756	-2.444	3.05	2.08
34	32	24.1	945.1	82,326	2.66	240	5,220	0.658	0.109	945.1	0.076	0.843	1,050	1.0	240	1.00	0.864	-3.194	-3.434	3.05	5.15
35		Flow to		36																3.10	2.00
36	34	22.3		497	5.53	620		0.008	0.006	22.3	0.002	0.016	300	3.0	620	0.62	0.025	0.756	-2.444	3.05	5.15
37		35.6	1,003.0	43,617	2.66	420	5,640	0.668	0.124	1,003.0	0.081	0.873	1,200	0.9	420	1.03	1.170	-3.584	-3.962	3.05	5.31
38		Flow to		36																3.10	2.00
39	36	15.4		343	5.83	610		0.006	0.004	15.4	0.001	0.011	300	3.0	610	0.62	0.025	0.756	-2.444	3.05	5.15
40	36	11.2	1,029.6	24,210	2.65	240	5,880	0.672	0.131	11.2	0.083	0.886	1,200	0.9	240	1.03	1.170	-3.962	-4.178	3.05	5.68
41	39	10.7	1,040.3	24,449	2.65	410	6,290	0.674	0.133	10.7	0.084	0.891	1,200	0.9	410	1.03	1.170	-4.178	-4.348	3.05	4.90
42	40	10.9	1,051.2	24,692	2.65	650	6,940	0.676	0.136	10.9	0.085	0.897	1,200	0.9	650	1.03	1.170	-4.348	-5.133	3.05	6.27
43	41	33.4	1,084.6	25,437	2.65	520	7,460	0.682	0.145	33.4	0.088	0.915	1,200	0.9	520	1.03	1.170	-5.133	-5.601	2.74	6.55
44	42	14.5	1,099.1	25,760	2.65	260	7,720	0.684	0.149	14.5	0.089	0.922	1,200	0.9	260	1.03	1.170	-5.601	-5.835	2.59	6.87
45	43	9.9	1,109.0	25,979	2.65	240	7,960	0.686	0.151	9.9	0.090	0.927	1,200	0.9	240	1.03	1.170	-5.835	-6.051	2.44	6.95
		Flow into Treatment Plant																		3.40	8.13
4	Sub-1		13.1	1,280	3.15			0.012	0.001		0.001	0.014									
	Sub-3		248.0	24,176	3.15			0.229	—		0.020	0.249									
	Total		261.1	25,456				0.241	0.001		0.021	0.263									

PORT KELANG

Zone - 2,3

Table I.22. 4/8

Table of Sewage Quantity

No. of Sewers	No. of Joint Sewers	Area		Population	Peeking Factor	Length		Design Flow				Designed Sewer						Remarks							
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration	Area Flow	Total	Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation	Begin Point	End Point	Elevation	Ground Surface	Earth Covering	
5	Sub-1		37.2	3,434	3.11			0.034	0.003		0.003	0.040													
	Sub-3		248.0	24,176	3.11			0.226			0.020	0.246													
	Total		285.2	27,610				0.260	0.003		0.023	0.286													
6	Sub-1		63.4	6,194	3.07			0.057	0.006		0.005	0.068													
	Sub-3		248.0	24,176	3.07			0.223			0.020	0.243													
	Total		311.4	30,370				0.280	0.006		0.025	0.311													
7	Sub-1		87.9	8,388	3.04			0.079	0.008		0.007	0.094													
	Sub-3		248.0	24,176	3.04			0.221			0.020	0.241													
	Total		335.9	32,764				0.300	0.008		0.027	0.335													
8	Sub-1		115.5	11,284	3.00			0.101	0.010		0.009	0.120													
	Sub-3		248.0	24,176	3.00			0.218			0.020	0.238													
	Total		363.5	35,460				0.319	0.010		0.029	0.358													
14	Sub-1		11.5	1,124	3.42			0.012	0.001		0.001	0.014													
	Sub-2		186.0	13,194	3.42			0.135	0.052		0.015	0.202													
	Total		197.5	14,318				0.147	0.053		0.016	0.216													

PORT KELANG
Zone - 2, 3

Table of Sewage Quantity

Table I.23. 5/8

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Area Flow	Total	Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface	Earth Covering																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
										ha	sq									m	m			m ² /sec	ha	m ² /sec	m	m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
(16)	Sub-1		186.0	18,202	2.82						0.154	0.017		0.015	0.186																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									</

PORT KELANG

Zone - 2.3

Table I.24. 5/8

Table of Sewage Quantity

No. of Sewers		Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks				
								Domestic Waste	Other	Infiltration		Flow Total	Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation		Ground Surface Elevation	Earth Covering
										m ³ /sec	ha								m ³ /sec	m ³ /sec		
No. of Joint Sewers	Increment	ha	Total	persons		Increment	Total	m ³ /sec								m	m	m				
31	Sub-1		445.0	43,482	2.67			0.349	0.040		0.036	0.425										
	Sub-2		186.0	13,194	2.67			0.106	0.052		0.015	0.173										
	Sub-3		248.0	24,176	2.67			0.194	—		0.020	0.214										
	Total		879.0	80,852					0.649	0.092		0.071	0.812									
32	Sub-1		445.0	43,482	2.67			0.349	0.040		0.036	0.425										
	Sub-2		186.0	13,194	2.67			0.106	0.052		0.015	0.173										
	Sub-3		248.0	24,176	2.67			0.194	—		0.020	0.214										
	Z - 3		13.9	310	2.67			0.003	0.004		0.001	0.008										
	Total		892.9	81,162				0.652	0.096		0.072	0.820										
34	Sub-1		445.0	43,482	2.66			0.348	0.040		0.036	0.424										
	Sub-2		186.0	13,194	2.66			0.105	0.052		0.015	0.172										
	Sub-3		248.0	24,176	2.66			0.193	—		0.020	0.213										
	Z - 3		66.1	1,474	2.66			0.012	0.017		0.005	0.034										
	Total		945.1	82,326				0.658	0.109		0.076	0.843										
36	Sub-1		445.0	43,482	2.66			0.348	0.040		0.036	0.424										
	Sub-2		186.0	13,194	2.66			0.105	0.052		0.015	0.172										
	Sub-3		248.0	24,176	2.66			0.193	—		0.020	0.213										
	Z - 3		124.0	2,765	2.66			0.022	0.032		0.010	0.064										
	Total		1003.0	83,617				0.668	0.124		0.081	0.873										

Table of Sewage Quantity

Table I.25. 7/e

Zone -2,3

No. of Sewers	No. of Joint Sewers	Area		Population	Peaking Factor	Length		Design Flow				Designed Sewer						Remarks					
		Increment	Total			Increment	Total	Domestic Waste	Other	Infiltration		Area Flow	Total	Diameter	Slope	Length	Full Velocity		Full Capacity	Invert Elevation		Ground Surface	Earth Covering
										ha	ha									m	m		
(38)	Sub-1		445.0	43,482	2.65					0.347	0.040		0.036	0.423									
	Sub-2		186.0	13,194	2.65					0.105	0.052		0.015	0.172									
	Sub-3		248.0	24,176	2.65					0.193	—		0.020	0.213									
	Z-3		150.6	3,358	2.65					0.027	0.039		0.012	0.078									
	Total		1029.6	84,210						0.672	0.131		0.083	0.886									
(39)	Sub-1		445.0	43,482	2.65					0.347	0.040		0.036	0.423									
	Sub-2		186.0	13,194	2.65					0.105	0.052		0.015	0.172									
	Sub-3		248.0	24,176	2.65					0.193	—		0.020	0.213									
	Z-3		161.3	3,597	2.65					0.029	0.041		0.013	0.083									
	Total		1040.3	84,449						0.674	0.133		0.084	0.891									
(40)	Sub-1		445.0	43,482	2.65					0.347	0.040		0.036	0.423									
	Sub-2		186.0	13,194	2.65					0.105	0.052		0.015	0.172									
	Sub-3		248.0	24,176	2.65					0.193	—		0.020	0.213									
	Z-3		172.2	3,840	2.65					0.031	0.044		0.014	0.089									
	Total		1051.2	84,692						0.676	0.136		0.085	0.897									
(41)	Sub-1		445.0	43,482	2.65					0.347	0.040		0.036	0.423									
	Sub-2		186.0	13,194	2.65					0.105	0.052		0.015	0.172									
	Sub-3		248.0	24,176	2.65					0.193	—		0.020	0.213									

Table of Sewage Quantity	Table I. 26.	8/8
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Table of Sewage Quantity

[illegible]

I-27

Table I.28^{2/2}

Table of Sewage Quantity

Zone - 2

I-28

Table of Sewage Quantity

Zone -

No. of Sewers		No. of Joint Sewers		Area		Population		Peaking Factor	Length		Design Flow				Designed Sewer						Remarks				
									Increment	Total	Domestic Waste	Other	Infiltration		Total	Diameter	Slope	Length	Full Velocity	Full Capacity		Invert Elevation		Ground Surface	Earth Covering
													ha	ha								m ³ /sec	m ³ /sec		
(1)		72.1		2,350	4.43	750		0.031		72.1	0.006	0.037	750	0.61	0.043	-0.144	-1.644	2.70	2.50						
(2)		44.7	116.8	3,808	4.13	650	1,400	0.047		116.8	0.009	0.056	650	0.76	0.121	-1.794	-2.964	3.80	5.00						
(3)		36.0	152.8	4,981	3.98	680	2,080	0.060		152.8	0.012	0.072	680	0.76	0.121	-2.964	-4.188	3.60	6.05						
		Flow into Pumping Station and to (4)																							
(4)	(3)	34.4	187.2	6,103	3.86	610	2,690	0.071		187.2	0.015	0.086	610	0.76	0.121	2.287	1.189	3.80	1.00						
(5)		11.6	198.8	6,481	3.83	540	3,230	0.075		198.8	0.016	0.091	540	0.76	0.121	1.189	0.217	3.41	1.78						
		Flow to (7)																							
(6)		132.7		4,326	4.06	330		0.053		132.7	0.011	0.064	330	0.78	0.086	0.998	-2.080	3.41	5.06						
(7)	(5)	23.6	355.1	11,576	3.52	470	3,700	0.122		355.1	0.029	0.151	470	0.80	0.172	-2.230	-2.982	3.41	5.80						
(8)		16.3	371.4	12,108	3.50	330	4,030	0.127		371.4	0.030	0.157	330	0.80	0.172	-2.982	-3.510	3.41	6.33						
(9)		7.6	379.0	12,355	3.49	320	4,350	0.130		379.0	0.031	0.161	320	0.80	0.172	-3.510	-4.022	3.41	6.84						
		Flow to (10)																							
(10)		51.7		1,685	4.64	520		0.024		51.7	0.004	0.028	520	0.67	0.047	0.756	-0.492	3.60	2.50						
(11)		31.8	83.5	2,722	4.33	390	910	0.035		83.5	0.007	0.042	390	0.67	0.047	-0.492	-1.428	4.03	3.75						
(12)		18.4	101.9	3,322	4.21	450	1,360	0.042		101.9	0.008	0.050	450	0.78	0.086	-1.503	-1.503	3.80	5.10						
		Flow to (14)																							
(13)		81.6		2,660	4.35	560		0.035		81.6	0.007	0.042	560	0.67	0.047	0.456	-0.888	3.80	3.00						
(14)	(12)	27.7	211.2	6,885	3.80	530	1,890	0.079		211.2	0.017	0.096	530	0.78	0.124	-3.013	-4.020	3.80	4.34						
		Flow into Pumping Station and to (15)																							
(15)		8.8	220.0	7,172	3.77	370	2,260	0.081		220.0	0.018	0.099	370	0.78	0.124	2.287	1.584	3.80	1.00						
(16)		22.0	242.0	7,889	3.72	520	2,780	0.088		242.0	0.020	0.108	520	0.78	0.124	1.584	0.596	3.80	1.70						
(17)		—	242.0	7,889	3.72	200	2,980	0.088		242.0	0.020	0.108	200	0.78	0.124	0.596	-0.008	3.80	2.69						
		Flow to (17)																							

Table of Sewage Quantity

Table 1.30.^{2/2}

[illegible]

Table of Sewage Quantity

[illegible]

PORT KELANG (Alternative)

Table of Sewage Quantity

Table I.32. 1/3

No. of Sewers		No. of Joint Sewers		Area		Population		Peaking Factor		Length		Design Flow				Designed Sewer						Remarks				
		Increment		Total		persons				Increment	Total	Domestic Waste	Other	Infiltration		Diameter	Slope	Length	Full Velocity	Full Capacity	Invert Elevation		Ground Surface	Earth Covering		
		ha	ha	ha	m ³ /sec									m ³ /sec	mm						%	m			m ³ /sec	m
1		77.8		5,514	3.92	71.0						0.065	0.022	77.0	0.006	0.093	450	2.0	76.0	0.00	0.120	-1.613	-2.133	2.90	4.10	
		Flow to		3																						
2		22.3		1,452	4.65	37.0						0.023	0.007	23.3	0.002	0.032	300	4.0	37.0	0.07	0.061	2.006	0.526	3.51	2.52	
3	1	12.5	112.6	8,054	3.71	100.0					1.760	0.000	0.032	113.6	0.009	0.131	525	1.9	100.0	0.07	0.107	-2.200	-5.100	2.90	7.61	
		Flow into Pumping Station and to		5																						
4		54.1		3,826	4.13	61.0						0.040	0.015	54.1	0.004	0.017	375	2.4	61.0	0.70	0.001	-2.032	-4.164	2.90	6.63	
		Flow into Pumping Station and to		5																						
5	3 4	10.2	101.8	13,107	3.41	80.0					2.560	0.151	0.047	101.8	0.015	0.116	525	1.9	80.0	0.07	0.107	-1.306	-0.214	2.90	2.61	
6		32.9	218.9	15,910	3.37	70.0					2.052	0.170	0.057	210.9	0.010	0.254	475	1.4	70.0	0.00	0.315	-0.364	-1.470	2.90	3.91	
7		4.4	223.3	16,283	3.36	32.0					2.170	0.183	0.150	223.3	0.010	0.259	475	1.4	32.0	0.00	0.315	-1.470	-1.918	2.71	3.07	
		Flow to		10																						
8		23.9		1,134	3.81	100						0.071	0.022	73.9	0.006	0.099	450	1.0	100	0.76	0.121	-0.563	-1.643	2.95	4.00	
9		15.9	88.8	7,453	3.75	30.0					0.00	0.004	0.026	89.8	0.007	0.117	450	1.0	30.0	0.76	0.121	-1.643	-2.327	2.95	4.00	
		Flow to		11																						
10		17.6		1,441	4.74	20.0						0.016	0.005	17.6	0.001	0.022	225	3.0	20.0	0.62	0.025	-1.081	-1.836	1.66	3.34	
11	9	7.2	114.6	9,512	3.12	37.0						0.104	0.033	114.6	0.009	0.146	525	1.5	37.0	0.77	0.167	-2.094	-3.469	2.53	5.39	
		Flow to		16																						
12		31.1		2,581	4.37	50.0						0.034	0.009	31.1	0.003	0.046	300	2.4	50.0	0.67	0.047	0.206	-0.410	1.04	1.51	
		Flow to		14																						
13		13.8		1,146	4.90	20.0						0.017	0.004	13.8	0.001	0.032	300	2.4	20.0	0.67	0.047	0.216	-0.360	1.04	1.46	
14	12	15.3	10.2	4,002	3.97	57.0						0.010	0.010	10.2	0.005	0.003	375	2.4	57.0	0.70	0.001	0.405	-1.053	2.52	2.95	

Table of Sewage Quantity

Table I.33.

No. of Sewers		No. of Joint Sewers		Area		Population		Peeking Factor		Length		Design Flow				Designed Sewer				Remarks															
Increment		Total		ha		persons				Increment		Total		Domestic Waste		Other		Infiltration		Diameter		Slope		Length		Full Velocity		Full Capacity		Invert Elevation		Ground Surface		Earth Covering	
ha		ha								m		m		m ³ /sec		m ³ /sec		m ³ /sec		mm		‰		m		m/sec		m ³ /sec		m		m		m	
	Flow	to		16																															
15	25.9			2,150	4.48	430								0.029	0.008	25.9	0.002	0.029	300	2.4	430	0.67	0.047	0.086	-0.362	2.53	1.82	2.53	5.97						
16	13.5	214.2		17,776	3.31	500								0.177	0.062	214.0	0.017	0.256	875	1.1	500	0.70	0.279	-3.599	-4.149	2.71	6.10								
	Flow	to		18																															
17	23.6			1,959	4.54	560								0.027	0.007	23.6	0.002	0.036	300	2.4	560	0.67	0.047	1.226	-2.364	2.71	4.73	2.71	6.08						
18	42	415.2		31,970	2.00	260								0.390	0.128	415.2	0.038	0.556	900	1.0	260	0.90	0.572	-4.274	-4.634	2.43	4.06								
	Flow	to		27																															
19	22.0			1,826	4.59	450								0.025	0.006	22.0	0.002	0.032	300	2.4	450	0.67	0.047	1.041	-0.034	2.39	2.08	2.39	2.08						
20	5.8	27.8		2,397	4.44	180								0.031	0.008	27.8	0.002	0.041	300	2.4	180	0.67	0.047	-0.034	-4.466	2.41	2.53								
	Flow	to		22																															
21	72			598	5.38	310								0.010	0.002	72	0.001	0.012	225	3.0	310	0.62	0.025	0.954	-1.956	2.41	4.01	2.41	4.01						
22	7.3	42.3		3,511	4.18	320								0.044	0.012	42.3	0.003	0.059	375	2.4	320	0.70	0.086	-2.106	-2.874	2.33	4.77								
	Flow	to		24																															
23	6.8			514	5.43	270								0.008	0.002	6.8	0.001	0.012	225	3.0	270	0.62	0.025	1.004	-2.456	2.33	4.52	2.33	4.77						
24	6.4	55.5		4,607	4.02	280								0.051	0.016	55.5	0.004	0.076	375	2.4	280	0.70	0.086	-2.874	-3.546	2.28	5.38								
	Flow	to		26																															
25	4.9			497	5.69	230								0.007	0.001	4.9	0.000	0.008	225	3.0	230	0.62	0.025	0.714	-2.856	2.28	4.88	2.28	5.39						
26	4.7	65.1		5,403	3.93	210								0.014	0.019	65.1	0.005	0.020	450	2.2	260	0.80	0.120	-3.121	-4.193	2.43	4.11	2.43	4.11						
27	19.9	550.3		43,425	2.92	280								0.149	0.053	550.3	0.005	0.667	1,050	0.9	280	0.95	0.819	-4.784	-5.034	2.15	6.02	2.15	6.02						
28	45.7	596.0		47,218	2.88	600								0.502	0.166	596.0	0.000	0.716	1,050	0.9	600	0.95	0.819	-5.034	-5.574	2.05	7.46								
	Flow	to		32																															
29	35.0			105	6.98	390								0.002	0.024	35.0	0.003	0.029	300	2.4	390	0.67	0.047	-0.294	-1.230	2.05	3.04	2.05	3.04						