

Table - 4.1.1 (1/3) Sewage Planning for Urban Centre

No.	Urban Name	Type & Age of Treatment	Population connected to sewer 1998 (a)	Population connected to sewer 2010 (b)	Incremental population connected to sewer (b-a)	Total Incremental population connected to sewer	Existing Treatment works capacity m ³ /day (c)	Dry weather flow 2010 m ³ /day (d)	Incremental treatment capacity m ³ /day (d-c)	Total Incremental treatment capacity m ³ /day	Treatment Works			Sewer Reticulation		
											Facility Plan	Build New Facility	Expand Existing Facility	Rehabilitation	New construction or Expand	Rehabilitation
1	Nairobi Dandora	WSP, 92	500,000	755,750	255,750	-	80,000	140,570	60,570	-	Expand Existing Facility & Rehabilitation	none	Provide Incremental treatment capacity for all of Nairobi	Rehabilitation needs De-sludge Maturation pond	Incremental population connected to sewer =511,500 (person) ; provide new treatment capacity before extending sewer network	Replacements Existing 25% small Dia. pipe. Cleaning=All main trunk
2	Nairobi Kariobangi	TF, 61	500,000	755,750	255,750	511,500	32,000	140,570	108,570	169,140	Abandon Existing Facility & Build New Facility	provide required capacity at Dandora	none	none		
3	Nakuru-town	TF + WSP, 97	61,750	190,060	128,310	-	6,600	35,351	28,751	-	Expand Existing Facility & Build New	Provide a new facility to to meet required treatment capacity	Increase treatment capacity to cover part of future requirement	none	Incremental population connection to sewer =256,619 (person) ; extend sewer network up to full design capacity of treatment works before expanding treatment facilities	Rehabilitation needs = none
4	Nakuru-Njoro		61,750	190,060	128,310	256,619	9,600	35,351	25,751	54,502	Expand Existing Facility	none	Increase treatment capacity to cover part of future requirement	none		
5	Mombasa Chengamwe	EA, 98	34,800	184,000	149,200	-	17,100	34,224	17,124	-	Expand Existing Facility	on-going construction of new extended aeration treatment works	Increase treatment capacity to cover part of future requirement	none	Incremental population connected to sewer =298,400(person); extend sewer network up to full treatment capacity at Chengamwe	Replacements Existing 25% small Dia. pipe. Cleaning=All main trunk
6	Mombasa Kizingo	PS, 61	34,800	184,000	149,200	298,400	32,500	34,224	1,724	18,848	Abandon Existing Facility & Build New Facility	Provide primary treatment facility on North Mainland	none	none		
7	Kisumu Conventional	TF, 84	65,000	140,257	75,257	-	6,800	26,088	19,288	19,288	Expand Existing Facility	none	Increase treatment capacity to cover part of future requirement	none	Incremental population connection to sewer =150,514 (person); extend sewer network in Nyalenda drainage basin up to treatment capacity, improve water supply conditions.	Replacements Existing 25% small Dia. pipe. Cleaning=All main trunk
8	Kisumu	WSP, 75	65,000	140,257	75,257	150,514	10,855	26,088	15,233	34,521	Rehabilitate existing and Build New	Provide a new treatment facility in accordance with Kisumu JICA Study recommendations	Increase treatment capacity to cover part of future requirement	Rehabilitation needs= De-sludge depth=0.75(m)		
9	Eldoret Coventional	TF, 59	35,200	112,657	77,457	-	1,578	20,954	19,379	-	none	none	none	on-going rehabilitation project	Incremental population connection to sewer =154,914 (person), extend sewer reticulation after treatment plants are rehabilitated and more capacity is available.	Replacements Existing 25% small Dia. pipe. Cleaning=All main trunk
10	Eldoret Ponds	WSP, 78	35,200	112,657	77,457	154,914	4,800	20,954	16,154	35,533	none	on-going project for design and construction of new WSP	none	on-going rehabilitation project		
11	Machakos	WSP, 72	8,000	203,911	195,911	-	2,000	37,927	35,927	35,927	Abandon Existing Facility & Build New Facility	Provide a new treatment facilities in accordance with existing wastewater master plan	none	none	Incremental population connection to sewer =195,911 (person); extend sewer network after more treatment capacity is available	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk Pumping sation
12	Meru	WSP, 74	800	168,718	167,918	-	2,500	31,382	28,882	28,882	Abandon Existing Facility & Build New Facility	provide a new treatment works at a new site	none	none	Incremental population connection to sewer =167,918 (person), extend sewer network after more treatment capacity is available	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
13	Nyeri Conventional	TF + ponds, 88	36,000	82,840	46,840	-	6,100	15,410	9,310	-	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	Rehabilitation needs= Embankment protection in maturation ponds, Outlet chamber	Incremental population connected to sewer =128,579 (person), extend sewer reticulation before providing more treatment capacity	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
14	Nyeri Kiganjo	WSP, 88	1,100	82,840	81,740	128,579	2,000	15,410	13,410	22,720	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	Rehabilitation needs= Pond inlet, Embankment protection in maturation ponds		
15	Kitale	TF, 57	18,750	57,332	38,582	-	1,830	10,664	8,834	-	Rehabilitation	none	none	Rehabilitation needs= All pumps, Distribution System, digester	Incremental population connection to sewer =77,164 (person), extend sewer reticulation up to treatment capacity if water supply system is improved.	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk Pumping sation
16	Kitale	WSP, 83	18,750	57,332	38,582	77,164	2,930	10,664	7,734	16,568	Rehabilitate existing and Build New	Provide new treatment works to cover incremental capacity required	Increase treatment capacity to cover part of future requirement	Rehabilitation needs = De-sludge depth 0.75(m)		
17	Kakamega Shirere	WSP, 74	25,850	50,629	24,779	-	5,000	9,417	4,417	-	Expand Existing Facility & Rehabilitation	Provide new treatment works to cover incremental capacity required	Increase treatment capacity to cover part of future requirement	Rehabilitation needs= Screen at inlet, Embankment protection	Incremental population connected to sewer =49,558 (person), improve sewer reticulation after treatment works are rehabilitated.	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk

Table - 4.1.1 (2/3) Sewage Planning for Urban Centre

No.	Urban Name	Type & Age of Treatment	Population connected to sewer 1998 (a)	Population connected to sewer 2010 (b)	Incremental population connected to sewer (b-a)	Total Incremental population connected to sewer	Existing Treatment works capacity m ³ /day (c)	Dry weather flow 2010 m ³ /day (d)	Incremental treatment capacity m ³ /day (d-c)	Total Incremental treatment capacity m ³ /day	Treatment Works			Sewer Reticulation		
											Facility Plan	Build New Facility	Expand Existing Facility	Rehabilitation	New construction or Expand	Rehabilitation
18	Kakamega Kiambi	WSP, 83	25,850	50,629	24,779	49,558	500	9,417	8,917	13,334	Abandon	none	none	none		
19	Thika	WSP, 72	87,230	95,175	7,945	-	6,100	17,703	11,603	11,603	Rehabilitate existing and Build New	Provide new treatment works to cover incremental capacity required in accordance with wastewater master plan	none	Rehabilitation needs = De-sludge depth 0.75 (m), Embankment protection	Incremental population connection to sewer =7,945 (person), extend sewers after treatment plant expansion in accordance with master plan	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
20	Naivasha	AL, 83	30,000	84,452	54,452	-	2,035	15,708	13,673	13,673	Rehabilitate existing and Build New	Provide new treatment works to cover incremental capacity required	Increase treatment capacity to cover part of future requirement	Rehabilitation needs = De-sludge depth 0.75 (m), All mechanical	Incremental population connection to sewer =54,452 (person), extend sewers if water supply conditions improve.	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
21	Kericho	TF, 62	41,600	76,261	34,661	-	1,500	14,185	12,685	12,685	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =34,661 (person), extend sewer reticulation after more treatment capacity is added.	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
22	Malindi		0	53,661	53,661	-	0	9,981	9,981	9,981	Build New Facility	Provide new treatment works to cover incremental capacity required in accordance with wastewater master plan	none	none	Incremental population connection to sewer =53,661 (person)	none
23	Webuye	WSP, 73	12,000	48,259	36,259	-	0	8,976	8,976	8,976	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	Rehabilitation needs = De-sludge depth 0.75 (m), Inlet chamber	Incremental population connection to sewer =36,259 (person), extend sewer reticulation before increasing treatment capacity	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
24	Kisii	WSP, 98	13,000	48,246	35,246	-	4,500	8,974	4,474	4,474	Expand Existing Facility	none	Proceed with Phase 2 expansion in accordance with design report.	none	Incremental population connection to sewer =35,246 (person), extend sewer reticulation prior to treatment plant expansion	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
25	Garissa		0	46,051	46,051	-	0	8,565	8,565	8,565	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =46,051 (person)	none
26	Bungoma	WSP	12,600	45,634	33,034	-	45	8,488	8,443	8,443	Build New Facility	Complete on-going project to provide new treatment works	none	none	Incremental population connection to sewer =33,034 (person), improve water supply conditions before extending sewer reticulation	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
27	Busia (South Teso)	WSP, 88	9,600	41,454	31,854	-	600	7,710	7,110	7,110	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	none	Incremental population connection to sewer =31,854 (person) improve water supply conditions before extending sewer reticulation	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
28	Nanyuki	WSP, 84	24,750	44,089	19,339	-	2,270	8,200	5,930	5,930	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	Rehabilitation needs = De-sludge depth 0.75(m), Staff house	Incremental population connection to sewer =19,339 (person), increase treatment capacity before extending sewer reticulation	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
29	Embu	WSP, 73	9,000	23,100	14,100	-	682	4,297	3,615	3,615	Rehabilitate existing and Build New	Provide new treatment works to cover incremental capacity required	none	Rehabilitation needs = De-sludge depth 0.75(m), Screen	Incremental population connection to sewer =14,100 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
30	Isiolo	WSP, 84	1,700	20,902	19,202	-	2,000	3,888	1,888	1,888	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	Rehabilitation needs = De-sludge depth 0.75(m), Embankment protection	Incremental population connection to sewer =19,202 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
31	Ongata Longai		0	20,337	20,337	-	0	3,783	3,783	3,783	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =20,337 (person)	none
32	Maragua		0	20,021	20,021	-	0	3,724	3,724	3,724	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =20,021 (person)	none
33	Narok		0	19,347	19,347	-	0	3,598	3,598	3,598	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =19,347 (person)	none
34	Homabay	AI, 84	15,000	18,000	3,000	-	750	3,348	2,598	2,598	Rehabilitate existing and Build New	Provide new treatment works to cover incremental capacity required	none	Rehabilitation needs = De-sludge depth 0.75 (m) at aerated lagoon, sedimentation tank, maturation pond, Embankment protection at maturation pond, Inlet	Incremental population connection to sewer =3,000 (person), improve water supply conditions before extending sewer network	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk

Table - 4.1.1 (3/3) Sewage Planning for Urban Centre

No.	Urban Name	Type & Age of Treatment	Population connected to sewer 1998 (a)	Population connected to sewer 2010 (b)	Incremental population connected to sewer (b-a)	Total Incremental population connected to sewer	Existing Treatment works capacity m ³ /day (c)	Dry weather flow 2010 m ³ /day (d)	Incremental treatment capacity m ³ /day (d-c)	Total Incremental treatment capacity m ³ /day	Treatment Works			Sewer Reticulation		
											Facility Plan	Build New Facility	Expand Existing Facility	Rehabilitation	New construction or Expand	Rehabilitation
35	Ruiru		0	17,500	17,500	-	0	3,255	3,255	3,255	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =17,500 (person)	none
36	Wajir		0	16,500	16,500	-	0	3,069	3,069	3,069	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =16,500 (person)	none
37	Muranga	WSP, 73	10,500	15,700	5,200	-	1,564	2,920	1,356	1,356	Expand Existing Facility & Rehabilitation	none	Increase treatment capacity to cover future requirement	none	Incremental population connection to sewer =5,200 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
38	Nyahururu	AI, 86	18,000	18,056	56	-	2,500	3,358	858	858	Rehabilitation	none	none	Rehabilitation needs = De-sludge depth 0.75(m) at aerated lagoon, maturation pond, Embankment protection of maturation pond. Floating aerators	Incremental population connection to sewer =56 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
39	Kitifi		0	14,300	14,300	-	0	2,660	2,660	2,660	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =14,300 (person)	none
40	Mandera		0	12,900	12,900	-	0	2,399	2,399	2,399	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =12,900 (person)	none
41	Mavoko (Athi River)	WSP, 94	1,310	12,110	10,800	-	12,960	2,252	-10,708	-10,708	Rehabilitation	none	none	Rehabilitation needs = De-sludge depth 0.75(m)	Incremental population connection to sewer =10,800 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
42	Kapsabet	WSP, 95	4,000	11,200	7,200	-	1,000	2,083	1,083	1,083	none	none	none	none	Incremental population connection to sewer =7,200 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
43	Ngong	WSP, 63	750	10,300	9,550	-	230	1,916	1,686	1,686	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =9,550 (person). provide new treatment facility before extending sewer network	none
44	Voi	WSP, 80	700	8,800	8,100	-	0	1,637	1,637	1,637	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =8,100 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
45	Kabernet		0	8,100	8,100	-	0	1,507	1,507	1,507	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =8,100 (person)	none
46	Kiambu	OD, 79	2,250	6,407	4,157	-	960	1,192	232	232	none	none	none	none	Incremental population connection to sewer =4,157 (person). extend sewer reticulation up to treatment plant design capacity	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
47	Karatina	WSP	5,109	13,630	8,521	-	317	2,535	2,218	2,218	Expand Existing Facility	none	Increase treatment capacity to cover future requirement	none	Incremental population connection to sewer =8,521 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk
48	Limuru	OD, 84	2,100	3,043	943	-	550	566	16	16	Build New Facility	Provide new treatment works to cover incremental capacity required	none	none	Incremental population connection to sewer =943 (person)	Replacement= Existing 25% small dia. pipe. Cleaning=All main trunk

Table 4.2.1 Relation between Diameter and Pipe Length, per Capita

Diameter (mm)	% of Pipe Length to the Total	Meters per Capita
150	40%	1.14
200	40%	
300	10%	
450	5%	
600	5%	

Table 4.2.2 Relation between Diameter and Depth of Excavation, Manhole

Diameter (mm)	Depth of Excavation (m)	Depth of Manhole (m)
150	1.0-2.0	2
200	1.0-2.0	2
300	2.0-3.0	3
450	2.0-3.0	3
600	3.0-4.0	4

Table 4.2.3 Rehabilitation and Replacement, Pipe Cleaning of Existing Sewer

Diameter (mm)	Rehabilitation
150	Replacement of 25% existing pipe
200	Replacement of 25% existing pipe
300	Cleaning of all existing pipe
450	Cleaning of all existing pipe
600	Cleaning of all existing pipe

Table - 4.2.4 Proportion of Typical Pipes in Diameter

Mombasa Island		Mombasa West Mainland	
Population Served	21,534	Population Served	48,022
φ 150	2,477	540	6%
φ 175	12,593	3,460	37%
φ 200	3,857	1,330	14%
φ 225	815	810	9%
φ 375	237	2,090	22%
φ 450	421	850	9%
φ 600	480	330	4%
Total Meters	20,880	Total Meters	9,410

Nakuru		% for Typical Development	
Population Served	123,500	φ 150	40%
φ 100	220	0.3%	
φ 150	50,681	40%	
φ 200	15,200	10%	
φ 250	435	5%	
φ 300	8,460	5%	
φ 400	510		
φ 450	6,490		
φ 600	4,160		
Total Meters	86,156		

Table - 4.2.5 Unit Cost for Construction of Sewer Reticulation

Diameter	Excavation					Pipe (Ksh/m) (c)	Total cost (Ksh/m) (f) = a+d+c	Unit cost of sewer construction (US\$/m) f x 1.02/61.1	Remark	
	Depth (m)	Unit cost (Ksh/m) (a)	Depth (m) (b)	Spacing (m) (b)	Unit cost (Ksh/no) (c)					Excavate/m (Ksh/m) (d) = c/b
150	2	220	2	60	30,179	502	2,725	45	Thika M/P appendix 11	
200	2	220	2	60	30,179	502	3,225	53	Thika M/P appendix 11	
300	2	396	3	60	43,198	719	4,008	66	Thika M/P appendix 11	
450	2	495	3	80	43,198	539	5,210	86	Thika M/P appendix 11	
600	3	792	3	100	43,198	431	8,165	136	Thika M/P appendix 11	

1.02 (Thika)

Table - 4.2.6 Unit Construction Cost of New Treatment Facilities

Item	Rate (US\$)	Unit	Remark
Excavation	3.1	m ³	Thika M/P appendix 1 182 (ksh/m ³) x 1.02/61.1 (US\$/ksh)
Embankment Protection	6.6	m ²	Murunga p82 (8.18) 225 (ksh/m ²) x 1.8/61.1 (US\$/ksh)
Fence	2.9	m	Murunga p16 (13.05) 100 (ksh/m ³) x 1.8/61.1 (US\$/ksh)
Site Lighting	460	no.	Thika appendix 12 825,000 (ksh)/30 (no) x 1.02/61.1 (ksh/US\$)
Kenya Power & Lighting Supply Line	15,500	1 set	Thika appendix 12 92,500 (ksh)/30 (no) x 1.02/61.1 (ksh/US\$)
Staff House	34,391	1 set	Thika appendix 12 2,060,000 (ksh)/30 (no) x 1.02/61.1 (ksh/US\$)

Table - 4.2.7 Unit Construction for Rehabilitation of Sewers and Treatment Facilities

Item	Rate (US\$)	Unit	Remark
Replacement of Existing Pipe φ 150	67	m	Thika M/P appendix 11, 13 45 (US\$/m) x 1.5, 25% of existing pipe
Replacement of Existing Pipe φ 200	79	m	Thika M/P appendix 11, 13 53 (US\$/m) x 1.5, 25% of existing pipe
Embankment Protection	6.62	m ²	Murunga p82 (8.18) 225 (ksh/m ²) x 1.8/61.1 (US\$/ksh)
Pipe Cleaning	1.47	m	Labor (ksh/man/month) x 10 (man)/20 (day/month) / 25 (m) = 4600 x 10/20/25/61.1
Desludge (Bulk Excavation)	3.02	m ³	Thika appendix 12 92,500 (ksh)/30 (no) x 1.02/61.1 (ksh/US\$)

Table - 4.2.8 Land Unit Cost

Urban Centre	Code	unit cost (US\$/ha)
Nairobi	U-1	8,183
Nakuru	U-159	2,864
Mombasa	U-52	6,546
Kisumu	U-120	2,864
Eldoret	U-166	2,864
Machakos	U-71	1,440
Meru	U-86	2,045
Nyeri	U-36	2,864
Kitale	U-164	1,309
Kakamega	U-210	2,045
Thika	U-9	2,864
Naivasha	U-158	2,454
Kericho	U-148	2,209
Malindi	U-40	1,440
Webuye	U-205	1,472
Kisii	U-117	3,273
Garissa	U-140	572
Bungoma	U-199	1,472
Busia (South Teso)	U-206	572
Nanyuki	U-153	2,045
Embu	U-60	2,864
Isiolo	U-63	2,045
Ongata Longai	U-146	2,864
Maragua	U-20	2,864
Narok	U-163	2,864
Homabay	U-129	2,864
Ruiru	U-8	2,864
Wajir	U-116	572
Muranga	U-21	2,864
Nyahururu	U-28	2,864
Kilifi	U-38	1,440
Mandera	U-109	572
Mavoko (Athi River)	U-69	2,864
Kapsabet	U-185	2,864
Ngong	U-144	8,183
Voi	U-55	1,440
Kabarnet	U-179	2,864
Kiambu	U-40	8,183
Karatina	U-33	8,183
Limuru	U-6	8,183

Table - 4.2.10 Cost Estimates

Urban Center Name	Direct Cost										Grand Total (US\$) (a)+(b)+(c)+(d)+(e)+(f)+(g)+(h)+(i)+(j)+(k)+(l)+(m)			
	Treatment Works					Sewer Retention						Total (US\$) (j)+(k)+(l)+(m)		
	Build New Facility (a)	Expand (b)	Rehabilitation (c)		Sub-Total (US\$) (d)=(b)+(c)+(e)	New Construction (e)	Replacement (f)	Pipe Cleaning (g)	Sub-Total (US\$) (h)=(f)+(g)+(i)					
			Expend (b)	Rehabilitation (c)										
Nairobi Dambo	0	3,110,657	17,000	3,111,267	17,000,000	8,464,173	167,920	26,301,959	34,419,616	8,912,942	5,941,961	0	7,427,465	81,701,033
Nairobi Nairobi	6,337,365	0	141,500	6,478,865	17,669,866	8,464,173	167,920	26,301,959	32,900,524	4,920,123	3,290,082	0	4,258,111	46,809,000
Nairobi Town	0	5,670,982	0	5,670,982	8,864,989	0	0	8,864,989	14,535,971	2,180,393	1,453,997	0	1,870,166	20,571,000
Nairobi-Njoro	0	5,039,489	0	5,039,489	3,110,520	0	0	3,110,520	8,150,009	1,222,501	815,000	0	1,018,751	11,206,000
Mombasa Phase1	4,015,364	0	0	4,015,364	25,008,183	0	0	25,008,183	29,623,567	4,443,533	2,962,356	0	3,702,945	40,732,000
Mombasa Phase2	0	22,176,759	0	22,176,759	3,326,513	0	0	3,326,513	22,717,679	2,772,694	0	0	2,772,694	30,493,000
Kisumu Phase1	0	2,480,000	1,098,000	3,578,000	6,629,000	4,022,000	0	10,651,000	14,274,000	2,133,000	1,422,400	0	1,779,250	19,571,000
Kisumu Phase2	3,919,000	0	0	3,919,000	14,460,000	4,602,000	0	19,081,000	23,001,000	3,450,150	2,300,100	0	2,875,125	31,626,000
Eldoret Conventional	0	0	0	0	5,351,543	593,877	11,800	5,957,220	5,959,240	893,866	595,924	0	744,905	8,193,000
Eldoret Pond	0	0	0	0	5,351,543	593,877	11,800	5,959,240	5,959,240	893,866	595,924	0	744,905	8,193,000
Machakos Phase1	2,449,252	0	0	2,449,252	1,012,941	0	0	1,012,941	3,462,193	579,329	346,219	0	482,774	5,310,000
Machakos Phase2	3,335,961	0	0	3,335,961	617,800	0	0	617,800	3,953,761	578,064	385,376	0	481,720	5,208,000
Meru	9,229,436	0	0	9,229,436	11,601,507	13,342	268	11,615,317	20,844,773	3,126,715	2,044,477	387,444	2,644,340	29,087,000
Nyeri Conventional	1,821,997	0	14,000	1,835,997	3,236,194	609,419	12,089	3,857,702	5,693,669	854,050	569,366	0	711,708	7,828,000
Nyeri Kiganjo	2,624,317	0	17,800	2,642,117	5,047,447	18,620	368	5,066,435	8,308,572	1,246,283	830,857	0	1,018,571	11,424,000
Kilale Conventional	0	0	740,000	740,000	2,665,654	317,405	6,296	2,989,355	3,729,355	559,403	375,935	0	464,169	5,172,000
Kilale Pond	3,275,864	0	51,100	3,326,964	2,665,654	317,405	6,296	2,989,355	6,316,319	947,447	631,631	0	803,538	8,038,000
Kakamega Shiree	2,737,816	0	6,500	2,744,316	1,711,983	437,596	8,680	2,158,259	4,902,557	715,386	490,257	0	269,782	6,942,000
Kakamega Kiambu	0	0	0	0	1,711,983	437,596	8,680	2,158,259	4,902,557	715,386	490,257	0	269,782	6,942,000
Thika	2,347,485	0	41,000	2,388,485	548,925	1,476,655	29,293	2,054,873	4,443,358	666,503	444,335	200,137	575,403	6,229,000
Nakuru	2,705,094	0	161,000	2,866,094	3,762,110	507,849	10,073	4,290,032	7,146,126	1,071,918	714,612	202,461	913,511	10,048,000
Malindi	2,028,197	0	0	2,028,197	3,707,463	704,318	13,969	3,112,931	5,673,191	851,008	562,339	169,121	726,485	7,986,000
Mwaiye	1,781,041	0	86,000	1,867,041	2,505,152	203,139	4,029	2,712,320	4,679,506	646,506	457,961	85,470	280,987	6,300,000
Kitale	928,400	0	0	928,400	2,435,149	220,048	4,364	2,659,581	3,587,981	538,197	358,798	0	448,497	4,933,000
Gisuru	1,567,038	0	0	1,567,038	3,181,669	0	0	3,181,669	4,749,607	712,441	474,960	29,560	596,556	6,503,000
Bungoma	1,726,008	0	0	1,726,008	2,262,318	213,296	4,229	2,499,843	4,225,863	633,877	422,865	74,922	479,633	5,892,000
Busia (Smooth Teas)	1,391,427	0	79,100	1,470,527	2,200,808	162,511	3,224	2,366,543	3,837,070	575,560	383,707	0	479,633	5,892,000
Nanyuki	650,521	0	141,700	792,221	1,336,135	418,976	8,312	1,763,423	2,555,644	383,346	255,564	0	319,455	3,514,000
Embu	722,099	0	144,500	866,599	974,171	152,354	3,021	1,129,546	2,046,145	306,921	204,614	62,233	261,991	2,881,000
Meru	369,480	0	35,400	404,880	1,326,664	28,777	569	1,356,010	1,760,899	264,133	176,089	0	220,111	2,421,000
Quinga Leng'ei	805,525	0	0	805,525	1,405,087	0	0	1,405,087	2,210,612	331,591	221,081	65,062	282,832	3,111,000
Mwingi	793,949	0	0	793,949	1,383,258	0	0	1,383,258	2,177,207	326,581	217,720	64,355	278,586	3,064,000
Mwingi	768,766	0	0	768,766	1,336,694	0	0	1,336,694	2,105,460	315,819	210,546	62,233	269,405	2,903,000
Itumbiye	570,667	0	52,600	623,267	207,268	253,924	5,036	466,228	1,089,495	163,624	108,949	44,553	140,642	1,507,000
Ruiru	700,999	0	0	700,999	1,209,079	0	0	1,209,079	1,910,078	286,511	191,007	56,575	244,417	2,688,000
Wajir	664,038	0	0	664,038	1,139,987	0	0	1,139,987	1,804,025	270,403	180,402	10,607	226,563	2,492,000
Muranga	148,752	0	0	148,752	359,266	177,747	3,525	540,538	680,290	103,393	68,929	0	86,161	947,000
Nyahumunu	583,303	0	113,700	697,003	1,133,700	304,709	6,044	1,448,409	1,847,109	264,247	42,831	0	53,539	2,444,000
Kilifi	531,599	0	0	531,599	982,900	0	0	982,900	1,571,293	233,693	157,129	23,115	198,723	2,107,000
Mandera	0	0	457,900	457,900	1,139,987	0	0	1,139,987	1,671,586	250,737	167,158	8,344	209,782	2,307,000
Albi River	0	0	0	0	746,173	22,184	419	768,796	1,226,696	184,004	122,669	0	150,336	1,686,000
Kapsabet	389,737	0	0	389,737	699,824	67,712	1,341	566,500	662,770	84,975	56,650	0	70,812	778,000
Njoro	380,113	0	0	380,113	559,631	12,695	291	542,109	1,092,507	139,376	106,250	82,843	141,097	1,552,000
Kisumu	354,112	0	0	354,112	559,631	11,849	233	571,513	951,826	142,773	95,182	14,224	120,400	1,324,000
Kisumu	0	0	0	0	559,631	0	0	559,631	913,943	137,061	91,374	26,116	116,829	1,285,000
Kisumu	0	0	0	0	287,221	38,088	753	326,062	326,062	48,909	32,600	0	40,757	448,000
Karuri	434,061	0	0	434,061	588,720	86,483	1,713	676,916	1,110,977	166,646	111,997	0	134,872	1,527,000
Embu	166,769	0	0	166,769	165,163	35,548	704	101,415	267,684	40,157	26,768	28,287	36,289	399,000
Grand Total	47,948,000	62,159,000	3,498,000	116,495,000	196,958,000	33,999,000	501,000	221,458,000	347,953,000	52,187,000	34,789,000	4,212,000	43,910,000	483,050,000

Table - 4.2.11 The Cost of Operation and Repair Cost of Equipment

Item	Economic Lifetime in Years	Annual Maintenance and Repair Costs as a % of Capital Cost
Ponds	40	0.5
Treatment works in masonry or reinforce concrete	30	1
Mass concrete structures e.g. intakes, culverts	40	1
Earth works generally	40	1
Pumps	10	5
Pipes	30	1
Building, Masonry	30	1
Road of access	30	1
Electrical equipment including cables	10	5

Source: Design Manual for Water Supply in Kenya

Table - 4.2.12 The Desirable Staffing for Operation and Maintenance of System and Manpower Cost

Category	Annual manpower cost (US\$)	No. of Population Served to Sewer (P)				
		25,000 < P	25,000 ≤ P < 50,000	50,000 ≤ P < 100,000	100,000 ≤ P < 300,000	300,000 ≤ P
Management /Process Control	Assistant General Manager	0	0	0	0	1
	Sewage Work Superintendent	0	0	1	1	1
	Sewage Work Technician	1	1	1	1	1
Treatment Work	Inspector	1	1	1	2	2
	Laboratory Assistant	0	0	1	1	2
	Foreman/Supervisor	1	1	1	1	1
	Mechanical Engineer	0	0	0	1	1
	Laboratory Technician	0	0	1	1	2
	Assistant Foreman	0	1	2	2	2
Collection System	Labor	1	2	4	6	10
	Driver	0	1	1	1	2
	Watchman	1	1	1	3	5
	Sewer Superintendent	1	1	1	1	1
	Sewer Foreman	0	0	0	2	2
	Assistant Sewer Foreman	0	0	1	2	4
	M/E Tradesman	0	1	2	4	6
	Labor	4	6	10	20	30
	Total No. of Staff	10	16	28	49	73
Total Cost (US\$) / Year		18,397	25,935	43,898	74,700	105,228

Table -4.2.13 Annual Maintenance and Repair Cost of Equipment of Each Area

Urban Name	Direct Cost (US\$)	Fonds	Treatment works in masonry or reinforce concrete	Mass concrete structures e.g. intakes culverts	Earth works generally	Pipes	Building Masonry	Road of access	Total
	(a)	(a)*0.5%	(a)*1%	(a)*1%	(a)*1%	(a)*1%	(a)*1%	(a)*1%	
Nairobi Dundura	59,419,616	297,098	594,196	594,196	594,196	594,196	594,196	594,196	3,862,274
Nairobi Kariobangi	32,800,824	164,004	328,008	328,008	328,008	328,008	328,008	328,008	2,132,052
Nakuru-town	14,535,971	72,679	145,359	145,359	145,359	145,359	145,359	145,359	944,833
Nakuru-Njoro	8,150,009	40,750	81,500	81,500	81,500	81,500	81,500	81,500	529,750
Mombasa Phase I	29,623,568	148,117	296,235	296,235	296,235	296,235	296,235	296,235	1,925,527
Mombasa Phase II	22,176,759	110,883	221,767	221,767	221,767	221,767	221,767	221,767	1,441,483
Kisumu Phase I	14,234,000	71,170	142,340	142,340	142,340	142,340	142,340	142,340	925,210
Kisumu Phase II	23,001,000	115,005	230,010	230,010	230,010	230,010	230,010	230,010	1,495,065
Eldoret Conventional	5,959,240	29,796	59,592	59,592	59,592	59,592	59,592	59,592	387,348
Eldoret Ponds	5,959,240	29,796	59,592	59,592	59,592	59,592	59,592	59,592	387,348
Machakos Phase I	3,862,193	19,310	38,621	38,621	38,621	38,621	38,621	38,621	251,036
Machakos Phase II	3,853,761	19,268	38,537	38,537	38,537	38,537	38,537	38,537	250,490
Meru	20,844,773	104,223	208,447	208,447	208,447	208,447	208,447	208,447	1,354,905
Nyeri Conventional	5,693,669	28,468	56,936	56,936	56,936	56,936	56,936	56,936	370,084
Nyeri Kiganjo	8,308,572	41,542	83,085	83,085	83,085	83,085	83,085	83,085	540,052
Kitale conventional	3,729,355	18,646	37,293	37,293	37,293	37,293	37,293	37,293	242,404
Kitale Pond	6,316,319	31,581	63,163	63,163	63,163	63,163	63,163	63,163	410,559
Kakamega Shirere	4,902,575	24,512	49,025	49,025	49,025	49,025	49,025	49,025	318,662
Kakamega Kiambi	2,158,259	10,791	21,582	21,582	21,582	21,582	21,582	21,582	140,283
Thika	4,443,358	22,216	44,433	44,433	44,433	44,433	44,433	44,433	288,814
Naivasha	7,146,126	35,730	71,461	71,461	71,461	71,461	71,461	71,461	464,496
Kericho	5,673,391	28,366	56,733	56,733	56,733	56,733	56,733	56,733	368,764
Malindi	5,735,660	28,678	57,356	57,356	57,356	57,356	57,356	57,356	372,814
Webuye	4,579,361	22,896	45,793	45,793	45,793	45,793	45,793	45,793	297,654
Kisii	3,587,981	17,939	35,879	35,879	35,879	35,879	35,879	35,879	233,213
Garissa	4,749,607	23,748	47,496	47,496	47,496	47,496	47,496	47,496	308,724
Bungoma	4,225,851	21,129	42,258	42,258	42,258	42,258	42,258	42,258	274,677
Busia (South Teso)	3,837,070	19,185	38,370	38,370	38,370	38,370	38,370	38,370	249,405
Nanyuki	2,555,644	12,778	25,556	25,556	25,556	25,556	25,556	25,556	166,114
Embu	2,046,145	10,230	20,461	20,461	20,461	20,461	20,461	20,461	132,996
Isiolo	1,760,890	8,804	17,608	17,608	17,608	17,608	17,608	17,608	114,452
Ongata Longai	2,210,612	11,053	22,106	22,106	22,106	22,106	22,106	22,106	143,689
Maragua	2,177,207	10,886	21,772	21,772	21,772	21,772	21,772	21,772	141,518
Narok	2,105,460	10,527	21,054	21,054	21,054	21,054	21,054	21,054	136,851
Homabay	1,089,495	5,447	10,894	10,894	10,894	10,894	10,894	10,894	70,811
Ruiru	1,910,078	9,550	19,100	19,100	19,100	19,100	19,100	19,100	124,150
Wagir	1,804,025	9,020	18,040	18,040	18,040	18,040	18,040	18,040	117,260
Muranga	689,290	3,446	6,892	6,892	6,892	6,892	6,892	6,892	44,798
Nyahururu	428,319	2,141	4,283	4,283	4,283	4,283	4,283	4,283	27,839
Kilifi	1,571,293	7,856	15,712	15,712	15,712	15,712	15,712	15,712	102,128
Mandera	1,671,586	8,357	16,715	16,715	16,715	16,715	16,715	16,715	108,647
Mavoko (Athi River)	1,226,696	6,133	12,266	12,266	12,266	12,266	12,266	12,266	79,729
Kapsabet	566,500	2,832	5,665	5,665	5,665	5,665	5,665	5,665	36,822
Ngong	1,062,507	5,312	10,625	10,625	10,625	10,625	10,625	10,625	69,062
Voi	951,826	4,759	9,518	9,518	9,518	9,518	9,518	9,518	61,867
Kabarnet	913,743	4,568	9,137	9,137	9,137	9,137	9,137	9,137	59,390
Kiambu	326,062	1,630	3,260	3,260	3,260	3,260	3,260	3,260	21,190
Karatina	1,110,977	5,554	11,109	11,109	11,109	11,109	11,109	11,109	72,208
Limuru	267,684	1,338	2,676	2,676	2,676	2,676	2,676	2,676	17,394
Total									22,616,843

Table - 4.2.14 Annual Manpower Cost for Each Urban Centre

Urban Centre Name	No. of Manpower				Manpower Cost (US\$/year)
	Management/ Process Control	Treatment Work	Collection System	Total	
Nairobi Dundura	7	23	43	73	105,228
Nairobi Kariobangi		23		23	30,430
Nakuru-Town	5	15	29	49	74,700
Nakuru-Njoro		15		15	22,145
Mombasa	7	23	43	73	105,228
Kisumu Conventional	5	15	29	49	74,700
Kisumu Pond		15		15	22,145
Eldoret Conventional	5	15	29	49	74,700
Eldoret Pond		15		15	22,145
Machakos	5	15	29	49	74,700
Meru	5	15	29	49	74,700
Nyeri Conventional	5	15	29	49	74,700
Nyeri Kiganjo		15		15	22,145
Kitale	5	15	29	49	74,700
Kitale		15		15	22,145
Kakamega Shirere	5	15	29	49	74,700
Kakamega Kiambi		15		15	22,145
Thika	5	15	29	49	74,700
Naivasha	4	10	14	28	43,898
Kericho	4	10	14	28	43,898
Malindi	4	10	14	28	43,898
Webuye	2	6	8	16	25,935
Kisii	2	6	8	16	25,935
Garissa	2	6	8	16	25,935
Bungoma	2	6	8	16	25,935
Busia (South Teso)	2	6	8	16	25,935
Nanyuki	2	6	8	16	25,935
Embu	2	3	5	10	18,397
Isiolo	2	3	5	10	18,397
Ongata Longai	2	3	5	10	18,397
Maragua	2	3	5	10	18,397
Narok	2	3	5	10	18,397
Homabay	2	3	5	10	18,397
Ruiru	2	3	5	10	18,397
Wagir	2	3	5	10	18,397
Muranga	2	3	5	10	18,397
Nyahururu	2	3	5	10	18,397
Kilifi	2	3	5	10	18,397
Mandera	2	3	5	10	18,397
Athi River	2	3	5	10	18,397
Kapsabet	2	3	5	10	18,397
Ngong	2	3	5	10	18,397
Voi	2	3	5	10	18,397
Kabarnet	2	3	5	10	18,397
Kiambu	2	3	5	10	18,397
Karatina	2	3	5	10	18,397
Limuru	2	3	5	10	18,397

Table - 4.5.1 A Ranking of Urban Centres

Priority	Urban Centre
1	Mombasa
2	Nairobi
3	Kisumu
4	Machakos, Meru, Nakuru
5	Narok, Malindi, Kitale
6	Kisii, Naivasha
7	Maragua, Ruiru, Wagir, Thika, Kericho, Nanyuki
8	Garissas, Ongat, Kilifi, Nyafururu, Webuye, Voi, Eldoret, Nyeri
9	Mandera, Kabarnet, Muranga, Bungoma, Busia, Isiolo
10	Kapsabet, Homa Bay, Karatina, Embu, Kakamega
11	Ngong, Athi River
12	Kiambu
13	Limuru

Table - 4.5.2 Implementation Schedule of Urban Water Supply Schemes

Urban centre name	Code	Implementation Schedule																
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Nairobi	U - 1			⇒	⇒	☆	☆	●	●	●								
Kiambu	U - 4			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Limuru	U - 6								⇒	⇒	●	●						
Ruiru	U - 8			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Thika	U - 9			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Maragua	U - 20			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Muranga	U - 21			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Nyahururu	U - 28			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Karatina	U - 33			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Nyeri	U - 36			⇒	⇒	☆	☆	●	●	●								
Kilifi	U - 38			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Malindi	U - 40			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Mombasa	U - 52			⇒	⇒	☆	☆	●	●	●								
Voi	U - 55			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Embu	U - 60	⇒	⇒	■	■	■												
Isiolo	U - 63			⇒	⇒	☆	☆	●	●	●								
Athi River	U - 69			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Machakos	U - 71			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Meru	U - 86	⇒	⇒	■	■	■												
Garissa	U - 104			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Mandera	U - 109			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Wajir	U - 116			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Kisii	U - 117			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Kisumu	U - 120			⇒	⇒	☆	☆	●	●	●								
Homa Bay	U - 129	⇒	⇒	■	■	■												
Ngong	U - 144			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Ongata Longai	U - 146			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Kericho	U - 148			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Nanyuki	U - 153			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Naivasha	U - 158			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Nakuru	U - 159			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Narok	U - 163	⇒	⇒	■	■	■												
Kitale	U - 164			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●
Eldoret	U - 166					☆	☆	●	●	●								
Kabarnet	U - 179			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Kapsabet + Baraton	U - 185			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Bungoma	U - 199			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Webuye	U - 205			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Busia	U - 206			⇒	☆	☆	☆	☆	☆	☆	⇒	⇒	●	●	●			
Kakamega	U - 210			⇒	☆	☆	☆	☆	☆	☆				⇒	⇒	●	●	●

Legend : ⇒ : Studies, surveys, detailed design, final arrangements, etc.
 ☆ : Rehabilitation to normalize operation and to restore production capacity, including establishment of metering systems
 ● : Expansion schemes to meet water demand up to 2010
 ■ : Rehabilitation and expansion schemes to be implemented in parallel

Table - 4.5.3 (1/4) Implementation Schedule "A"

Urban Name	code	Annual Maintenance & Operating Cost (US\$000)	Initial cost (4) (US\$)	Planning	cost (US\$)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
						(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)
Nairobi Dandora	U-1	3,662,000	81,701,000	Treatment works	45,514,000												
				Rehabilitation	24,000												
Nairobi Kariakoo	U-1	2,132,000	46,639,000	Treatment works	9,240,000												
				Sewer reticulation	37,559,000												
Nairobi Lower	U-159	945,000	20,571,000	Treatment works	8,025,000												
				Sewer reticulation	12,546,000												
Nairobi Upper	U-159	530,000	11,206,000	Treatment works	6,929,000												
				Sewer reticulation	4,277,000												
Nairobi Phase I	U-52	1,928,000	40,732,000	Treatment works	6,346,000												
				Sewer reticulation	34,386,000												
Nairobi Phase II	U-52	1,441,000	30,493,000	Treatment works	30,493,000												
				Sewer reticulation	3,410,000												
Nairobi Phase I	U-120	925,000	19,657,000	Treatment works	1,509,000												
				Sewer reticulation	14,652,000												
Nairobi Phase II	U-120	1,495,000	31,629,000	Treatment works	5,416,000												
				Sewer reticulation	26,210,000												
Nairobi Conventional	U-160	387,000	8,193,000	Treatment works	8,193,000												
				Sewer reticulation	8,193,000												
Nairobi Phase I	U-160	347,000	6,193,000	Treatment works	6,193,000												
				Sewer reticulation	1,343,000												
Nairobi Phase II	U-71	251,000	5,290,000	Treatment works	4,449,000												
				Sewer reticulation	840,000												
Nairobi	U-80	1,355,000	29,009,000	Treatment works	12,879,000												
				Sewer reticulation	16,204,000												
Nairobi Conventional	U-56	370,000	7,025,000	Treatment works	2,905,000												
				Sewer reticulation	19,000												
					5,504,000												

Table - 4.5.3 (2/4) Implementation Schedule "A"

Urban Sector	Code	Amount Maintenance & Operation Cost (US\$/Year)	Initial cost (a) (US\$)	Planning	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
North Kigali	U-36	541,000	11,424,000	Treatment works												
				Rehabilitation												
Kigali conventional	U-164	242,000	5,127,000	Sewer reticulation												
				Rehabilitation of treatment works												
Kigali Pond	U-164	411,000	8,830,000	Sewer reticulation												
				Rehabilitation of treatment works												
Kakanga Shwre	U-210	319,000	6,942,000	Treatment works												
				Rehabilitation												
Kakanga Shwre	U-210	319,000	6,942,000	Sewer reticulation												
				Rehabilitation of treatment works												
Kakanga Shwre	U-210	319,000	6,942,000	Sewer reticulation												
				Rehabilitation of treatment works												
Juba	U-9	289,000	6,329,000	Treatment works												
				Rehabilitation												
Nuvusha	U-158	404,000	10,048,000	Treatment works												
				Rehabilitation												
Nuvusha	U-158	404,000	10,048,000	Sewer reticulation												
				Rehabilitation of treatment works												
Kensha	U-148	309,000	7,046,000	Treatment works												
				Rehabilitation												
Muhoh	U-40	373,000	7,981,000	Treatment works												
				Rehabilitation												
Wemur	U-216	296,000	6,306,000	Treatment works												
				Rehabilitation												
Koni	U-117	233,000	4,933,000	Sewer reticulation												
				Rehabilitation of treatment works												
Gatsisa	U-14	309,000	6,503,000	Treatment works												
				Rehabilitation												

Table - 4.5.3 (3/4) Implementation Schedule "A"

Urban Name	code	Amount Maintenance & Operations Cost (US\$ Year)	Initial cost (2) (US\$)	Planning	cost (US\$)	1999 (US\$)	2000 (US\$)	2001 (US\$)	2002 (US\$)	2003 (US\$)	2004 (US\$)	2005 (US\$)	2006 (US\$)	2007 (US\$)	2008 (US\$)	2009 (US\$)	2010 (US\$)	
Bangalore	U-190	249,000	5,802,000	Treatment works	2,406,000													
				Sewer rehabilitation	3,486,000													
Bhavnagar (South) Urban	U-206	249,000	5,275,000	New or expand	1,913,000													
				Rehabilitation	108,000													
				Sewer rehabilitation	3,254,000													
Nagpur	U-153	166,000	3,314,000	New or expand	894,000													
				Rehabilitation	195,000													
Raipur	U-90	133,000	2,861,000	New or expand	1,067,000													
				Rehabilitation	204,000													
Raipur	U-63	114,000	2,421,000	New or expand	508,000													
				Rehabilitation	49,000													
Chennai	U-148	144,000	3,113,000	Sewer rehabilitation	1,864,000													
				Treatment works	1,134,000													
Mumbai	U-20	142,000	3,064,000	Sewer rehabilitation	1,947,000													
				Treatment works	1,117,000													
Surat	U-163	137,000	2,963,000	Treatment works	1,082,000													
				Sewer rehabilitation	1,881,000													
Bhubaneswar	U-129	71,000	1,547,000	New or expand	810,000													
				Rehabilitation	75,000													
Bhubaneswar	U-8	124,000	2,694,000	Treatment works	986,000													
				Sewer rehabilitation	1,702,000													
Wardha	U-116	117,000	2,402,000	Treatment works	917,000													
				Sewer rehabilitation	1,575,000													
Mumbai	U-21	45,000	947,000	Treatment works	204,000													
				Sewer rehabilitation	743,000													

Table - 4.5.3 (4/4) Implementation Schedule "A"

Urban Block	code	Annual Maintenance & Operation Cost (US\$'000)	Initial cost (a) (US\$)	Planning	cost (US\$)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		(US\$'000)	(US\$)		(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)
Mpshonnet	U-28	28,000	586,000	Rehabilitation of Treatment works	156,000												
				Sewer reticulation	432,000												
Solih	U-36	102,000	2,185,000	Treatment works	81,000												
				Sewer reticulation	1,374,000												
Mandara	U-109	110,000	2,307,000	Treatment works	754,000												
				Sewer reticulation	1,573,000												
Alh Akser	U-69	80,000	1,685,000	Rehabilitation of Treatment works	624,000												
				Sewer reticulation	1,057,000												
Kapadlet	U-185	37,000	776,000	Sewer reticulation	776,000												
Mewje	U-144	60,000	1,552,000	Treatment works	569,000												
				Sewer reticulation	983,000												
Wu	U-55	62,000	1,324,000	Treatment works	529,000												
				Sewer reticulation	795,000												
Kaburist	U-170	50,000	1,285,000	Treatment works	496,000												
				Sewer reticulation	789,000												
Kumbon	U-40	21,000	448,000	Sewer reticulation	448,000												
Karadina	U-33	72,000	1,527,000	Treatment works	597,000												
				Sewer reticulation	930,000												
Limara	U-6	17,000	399,000	Treatment works	248,000												
				Sewer reticulation	151,000												
Opening project			3,100														
Total			483,081,000														

Note: (b) : Design (c) : Implementation

Table - 4.5.4(1/4) Disbursement Schedule "A"

Urban Name	code	Annual Maintenance & Operation Cost (US\$/year)	Initial cost (e) (US\$)	Planning	cost (US\$)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
Nairobi Dambora	U-1	3,862,000	81,701,000	Treatment works	45,514,000							1,981,000	1,981,000	1,981,000	45,514,000				
				Rehabilitation	26,000														
				Sewer reticulation	36,163,000														
Nairobi Kimbongi	U-1	2,132,000	46,834,000	Treatment works	9,260,000	1,093,000	1,093,000	1,093,000	4,640,000	4,640,000									
				Sewer reticulation	37,559,000									9,390,000	9,390,000	9,390,000	9,390,000		
Nakuru-Inson	U-159	985,000	20,571,000	Treatment works	8,025,000	727,000	727,000			8,025,000									
				Sewer reticulation	12,546,000			6,273,000	6,273,000										
Nakuru-Njoro	U-159	530,000	11,206,000	Treatment works	6,929,000														
				Sewer reticulation	4,277,000								4,277,000						
Mombasa Phase I	U-52	1,926,000	40,732,000	Treatment works	6,346,000	1,481,000	1,481,000												
				Sewer reticulation	36,386,000			5,731,000	5,731,000	5,731,000	5,731,000	5,731,000							
Mombasa Phase II	U-52	1,451,000	30,493,000	Sewer reticulation	30,493,000														
				Treatment works	3,410,000	712,000	712,000												
Kisumu Phase I	U-120	925,000	19,571,000	Treatment works	1,509,000														
				Sewer reticulation	14,652,000			7,326,000	7,326,000										
Nairobi Phase II	U-120	1,955,000	31,626,000	Treatment works	5,416,000														
				Sewer reticulation	26,210,000			1,150,000	1,150,000	1,150,000	5,416,000	5,416,000							
Eldoret Conventional	U-166	397,000	8,193,000	Sewer reticulation	8,193,000														
				Treatment works	1,923,000														
Eldoret Pumps	U-166	397,000	8,193,000	Sewer reticulation	8,193,000														
				Treatment works	3,918,000														
Mugshaken Phase I	U-71	251,000	5,310,000	Treatment works	1,393,000	193,000	193,000	3,918,000											
				Sewer reticulation	1,923,000			696,000	696,000										
Mau Mau Phase II	U-71	250,000	5,298,000	Treatment works	4,449,000														
				Sewer reticulation	869,000			193,000	193,000										
Meru	U-86	1,355,000	29,097,000	Treatment works	12,879,000	1,042,000	1,042,000	12,879,000											
				Sewer reticulation	16,208,000			16,208,000											
NYSI Conventional	U-36	370,000	7,826,000	Treatment works	2,505,000														
				Sewer reticulation	5,304,000														

Table - 4.5.4(3/4) Disbursement Schedule "A"

Urban Name	code	Annual Maintenance & Operation Cost (US\$/year)	Initial cost (a) (US\$)	Planning	cost (US\$)	Year												
						1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
						(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)
Gurisa	U-14	309,000	4,563,000	Treatment works	2,166,000													
				Sewer reticulation	4,397,000													
Bangumu	U-199	240,000	5,882,000	Treatment works	2,406,000													
				Sewer reticulation	3,476,000													
Dava (South Town)	U-206	240,000	5,275,000	Treatment works	1,913,000													
				Sewer reticulation	3,362,000													
Nanyuki	U-153	166,000	3,514,000	Treatment works	894,000													
				Sewer reticulation	2,620,000													
Embu	U-60	153,000	2,881,000	Treatment works	1,087,000													
				Sewer reticulation	1,794,000													
Isiati	U-63	114,000	2,421,000	Treatment works	508,000													
				Sewer reticulation	49,000													
Ongata Lengua	U-106	144,000	3,111,000	Treatment works	1,134,000													
				Sewer reticulation	1,977,000													
Maragua	U-20	142,000	3,064,000	Treatment works	1,117,000													
				Sewer reticulation	1,947,000													
Narok	U-163	137,000	2,963,000	Treatment works	1,082,000													
				Sewer reticulation	1,881,000													
Homabay	U-129	71,000	1,547,000	Treatment works	810,000													
				Sewer reticulation	662,000													
Kiuri	U-8	124,000	2,686,000	Treatment works	986,000													
				Sewer reticulation	1,702,000													

Table - 4.5.4(4/4) Disbursement Schedule "A"

Urban Name	Code	Annual Maintenance & Operation Cost (US\$/year)	Initial cost (t) (US\$)	Planning	cost (US\$)	1999 (US\$)	2000 (US\$)	2001 (US\$)	2002 (US\$)	2003 (US\$)	2004 (US\$)	2005 (US\$)	2006 (US\$)	2007 (US\$)	2008 (US\$)	2009 (US\$)	2010 (US\$)	
Wager	U-116	117,000	2,492,000	Treatment works Sewer reticulation	917,000 1,575,000			60,000	60,000	60,000	917,000	1,575,000						
Muranga	U-21	45,000	947,000	Treatment works Sewer reticulation	204,000 743,000							23,000	23,000	23,000	743,000	204,000		
Nyahururu	U-26	26,000	596,000	Rehabilitation of Treatment works Sewer reticulation	155,000 432,000					14,000	14,000	14,000	156,000	432,000				
Nditi	U-33	102,000	2,145,000	Treatment works Sewer reticulation	811,000 1,374,000					52,000	52,000	52,000	811,000					
Manaketa	U-169	109,000	2,307,000	Treatment works Sewer reticulation	754,000 1,573,000							56,000	56,000	56,000	754,000			
Athi River	U-69	80,000	1,686,000	Rehabilitation of Treatment works Sewer reticulation	629,000 1,057,000								41,000	41,000	41,000	629,000		
Kipseret	U-185	37,000	778,000	Sewer reticulation	778,000								19,000	19,000	19,000	189,000		
Nipang	U-140	69,000	1,532,000	Treatment works Sewer reticulation	569,000 983,000								35,000	35,000	35,000	569,000		
Voi	U-55	62,000	1,320,000	Treatment works Sewer reticulation	529,000 765,000								32,000	32,000	32,000	765,000		
Kaharua	U-179	59,000	1,285,000	Treatment works Sewer reticulation	498,000 787,000							30,000	30,000	30,000	498,000			
Kiamba	U-40	21,000	446,000	Sewer reticulation	446,000								11,000	11,000	11,000	223,000		
Karatina	U-53	72,000	1,527,000	Treatment works Sewer reticulation	597,000 910,000								37,000	37,000	37,000	597,000		
Lumwa	U-6	17,000	399,000	Treatment works Sewer reticulation	248,000 151,000								9,000	9,000	9,000	248,000		
Ongoing project			31,000			15,500	15,500											
Total			483,091,000			5,648,500	6,788,500	36,251,000	48,379,000	45,100,000	38,229,000	52,716,000	51,238,000	52,377,000	72,405,000	60,660,500	47,588,500	

Table - 4.5.5(1/4) Implementation Schedule "B"

Urban Name	Work	Annual Maintenance & Operating Cost (US\$/year)	Initial cost (a) (US\$)	Planning	Cost (US\$)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
						(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)
Nairobi Dandora	U-1	3,862,000	81,701,000	Treatment works	45,514,000												
				Rehabilitation	24,000												
Nairobi Kariakoo	U-1	2,132,000	46,839,000	Sewer reticulation	36,163,000												
				Treatment works	9,240,000												
Nakuru town	U-159	945,000	29,571,000	Sewer reticulation	37,559,000												
				Treatment works	8,025,000												
Nakuru Nyayo	U-159	530,000	11,296,000	Sewer reticulation	12,566,000												
				Treatment works	6,929,000												
Mombasa Phase I	U-52	1,926,000	40,732,000	Sewer reticulation	4,277,000												
				Treatment works	6,346,000												
Mombasa Phase II	U-52	1,441,000	30,493,000	Sewer reticulation	24,386,000												
				Treatment works	6,346,000												
Kisumu Phase I	U-120	925,000	19,571,000	Sewer reticulation	30,493,000												
				Treatment works	3,410,000												
Kisumu Phase II	U-120	1,455,000	31,626,000	Rehabilitation	1,509,000												
				Sewer reticulation	14,652,000												
Eldoret Conventional	U-106	267,000	8,193,000	Treatment works	5,416,000												
				Sewer reticulation	26,210,000												
Eldoret Ponds	U-106	309,000	8,193,000	Sewer reticulation	8,193,000												
				Treatment works	8,193,000												
Machakos Phase I	U-71	251,000	5,310,000	Treatment works	3,914,000												
				Sewer reticulation	1,390,000												
Machakos Phase II	U-71	250,000	5,298,000	Treatment works	4,449,000												
				Sewer reticulation	849,000												
Nyeri	U-58	1,345,000	29,087,000	Treatment works	12,879,000												
				Sewer reticulation	16,208,000												
Nyeri Conventional	U-36	370,000	7,828,000	Rehabilitation	2,505,000												
				Sewer reticulation	19,000												
					5,304,000												

Table - 4.5.5(2/4) Implementation Schedule "B"

Urban Name	Code	Annual Maintenance & Operation Cost (US\$ per year)	Initial cost (a) (US\$)	Financing	cost (US\$)	Year														
						1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010			
Ngori Suburb	U-56	600,000	13,424,000	Treatment works	3,609,000															
				Rehabilitation	24,000															
				Sewer rectification	7,791,000															
Nzale Environmental	U-163	242,400	5,127,000	Rehabilitation of treatment works	1,017,000															
				Sewer rectification	4,110,000															
Nzale Pond	U-164	411,000	8,858,000	New or expand Treatment works	4,584,000															
				Rehabilitation	71,000															
				Sewer rectification	4,183,000															
Kakamega Suburb	U-210	319,000	6,842,000	New or expand Treatment works	3,877,000															
				Rehabilitation	9,000															
				Sewer rectification	3,056,000															
Kakamega Kamiti	U-211	140,000	2,997,000	Sewer rectification	2,987,000															
Ithira	U-9	260,000	6,329,000	New or expand Treatment works	3,344,000															
				Rehabilitation	58,000															
				Sewer rectification	2,927,000															
Nariva	U-158	464,000	10,048,000	New or expand Treatment works	3,804,000															
				Rehabilitation	226,000															
				Sewer rectification	6,018,000															
Kericho	U-138	309,000	7,946,000	Treatment works	3,604,000															
				Sewer rectification	4,342,000															
Malindi	U-40	372,000	7,881,000	Treatment works	2,822,000															
				Sewer rectification	5,159,000															
Wahuru	U-205	298,000	6,390,000	New or expand Treatment works	2,485,000															
				Rehabilitation	120,000															
				Sewer rectification	3,785,000															
Kisumu	U-117	233,000	4,933,000	Treatment works	1,276,000															
				Sewer rectification	3,657,000															
Githurai	U-114	309,000	6,563,000	Treatment works	2,166,000															
				Sewer rectification	4,397,000															

Table - 4.5.5(3/4) Implementation Schedule "B"

Utility Name	Year	Annual Maintenance & Operations Cost (US\$/Year)	Initial cost (€)	Planning	Cost (US\$)	1999 (US\$)	2000 (US\$)	2001 (US\$)	2002 (US\$)	2003 (US\$)	2004 (US\$)	2005 (US\$)	2006 (US\$)	2007 (US\$)	2008 (US\$)	2009 (US\$)	2010 (US\$)	
Breganza	U-199	249,000	5,462,000	Treatment works	2,406,000													
				Sewer reticulation	3,486,000													
Brazo (North) (Pass)	U-216	249,000	5,275,000	New or expand	1,913,000													
				Rehabilitation	108,000													
Suzanka	U-153	166,000	3,514,000	Treatment works	894,000													
				Sewer reticulation	195,000													
Tamba	U-60	133,000	2,881,000	New or expand	1,087,000													
				Rehabilitation	204,000													
Tucuba	U-63	144,000	2,421,000	Treatment works	508,000													
				Sewer reticulation	45,000													
Ongaba Fongai	U-146	144,000	3,111,000	Treatment works	1,134,000													
				Sewer reticulation	1,977,000													
Mancose	U-215	142,000	3,064,000	Treatment works	1,117,000													
				Sewer reticulation	1,947,000													
Nuruk	U-163	137,000	2,963,000	Treatment works	1,082,000													
				Sewer reticulation	1,881,000													
Bomabay	U-129	71,000	1,547,000	Treatment works	810,000													
				Sewer reticulation	75,000													
Boru	U-8	124,000	2,688,000	Treatment works	986,000													
				Sewer reticulation	1,702,000													
Wagye	U-116	117,000	2,492,000	Treatment works	917,000													
				Sewer reticulation	1,575,000													
Mimnopa	U-21	45,000	947,000	Treatment works	204,000													
				Sewer reticulation	743,000													

Table - 4.5.5(4/4) Implementation Schedule "B"

Urban Name	code	Annual Maintenance & Operation Cost (US\$/year)	Initial Cost (e) (US\$)	Planning	cost (US\$)	Year												
						1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Nyaburum	U-28	28,000	590,000	Rehabilitation of Treatment Works	156,000													
				Sewer reticulation	432,000													
Kalihi	U-38	102,000	2,195,000	Treatment works	811,000													
				Sewer reticulation	1,374,000													
Mandera	U-189	109,000	2,307,000	Treatment works	724,000													
				Sewer reticulation	1,573,000													
Ahi River	U-69	80,000	1,606,000	Rehabilitation of Treatment works	625,000													
				Sewer reticulation	1,057,000													
Kapsabet	U-185	37,000	778,000	Sewer reticulation	778,000													
				Treatment works	569,000													
Ngong	U-144	69,000	1,552,000	Treatment works	524,000													
				Sewer reticulation	983,000													
Voi	U-55	62,000	1,324,000	Treatment works	524,000													
				Sewer reticulation	795,000													
Naivasha	U-179	59,000	1,265,000	Treatment works	406,000													
				Sewer reticulation	787,000													
Nakuru	U-40	21,000	448,000	Sewer reticulation	448,000													
				Treatment works	597,000													
Naraina	U-53	72,000	1,527,000	Treatment works	597,000													
				Sewer reticulation	930,000													
Lunenburg	U-6	17,000	399,000	Treatment works	248,000													
				Sewer reticulation	151,000													
On-going project			31,000															
Total			495,000,000															

Note: █ : Implementation

Table - 4.5.6 (1/4) Disbursement Schedule "B"

Urban Name	Code	Annual Maintenance & Operating Cost (US\$/Year)	Initial cost (+) (US\$)	Planning	cost (US\$)	1999 (US\$)	2000 (US\$)	2001 (US\$)	2002 (US\$)	2003 (US\$)	2004 (US\$)	2005 (US\$)	2006 (US\$)	2007 (US\$)	2008 (US\$)	2010 (US\$)	
Nainith Damdreh	U-1	3,862,000	81,701,000	Treatment works	45,514,000							1,981,000	1,981,000	1,981,000	1,981,000	18,082,000	
				Rehabilitation	24,000												
Nainith Karnabangit	U-1	2,152,000	46,830,000	Sewer reticulation	36,163,000	1,093,000	1,093,000	1,093,000	4,640,000	4,640,000	9,380,000	9,380,000	9,380,000	9,380,000			
				Treatment works	9,260,000												
Nokantolam	U-159	945,000	20,571,000	Treatment works	8,025,000	727,000	727,000			8,025,000							
				Sewer reticulation	12,506,000			6,273,000	6,273,000								
Nokantolam	U-159	580,000	11,206,000	Treatment works	6,929,000				408,000	408,000			6,929,000				
				Sewer reticulation	4,277,000								4,277,000				
Mombasa Phase I	U-52	1,926,000	40,732,000	Treatment works	6,346,000	1,481,000	1,481,000								6,346,000		
				Sewer reticulation	34,386,000			5,731,000	5,731,000	5,731,000	5,731,000	5,731,000	5,731,000	5,731,000	5,731,000	5,731,000	
Mombasa Phase II	U-52	1,441,000	30,493,000	Sewer reticulation	30,493,000									1,108,000	1,108,000	15,246,000	15,247,000
				Treatment works	3,410,000	712,000	712,000			3,410,000							
Nzouma Phase I	U-120	925,000	19,571,000	Rehabilitation	1,509,000			1,509,000									
				Sewer reticulation	14,652,000					7,326,000	7,326,000						
Nzouma Phase II	U-120	1,405,000	31,626,000	Treatment works	5,416,000				1,150,000	1,150,000	5,416,000						
				Sewer reticulation	26,210,000										13,105,000	13,105,000	
Bikoro Communal	U-166	302,000	8,193,000	Sewer reticulation	8,193,000												
				Treatment works	3,918,000	193,000	193,000	3,918,000									
Bikoro Ponds	U-166	307,000	8,193,000	Sewer reticulation	8,193,000												
				Treatment works	1,393,000												
Mafakara Phase I	U-71	251,000	5,310,000	Treatment works	4,449,000			193,000	193,000	4,449,000							
				Sewer reticulation	849,000									421,000	421,000		
Mafakara Phase II	U-71	251,000	5,310,000	Treatment works	12,879,000	1,043,000	1,043,000	12,879,000									
				Sewer reticulation	16,208,000			16,208,000									
Mera	U-86	1,355,000	29,067,000	Treatment works	2,505,000												
				Rehabilitation	19,000												
Nyoni Communal	U-86	370,000	7,928,000	Treatment works	5,304,000												
				Sewer reticulation	2,505,000												

Table - 4.5.6 (2/4) Disbursement Schedule "B"

Urban Name	Code	Annual Maintenance & Operations Cost (US\$/Year)	Initial cost (P) (US\$)	Planning	Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
						(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)
Mera Kigano	U-36	540,000	11,424,000	Treatment works	3,069,000												
				Rehabilitation	24,000												
Naha conventional	U-164	242,000	5,127,000	Rehabilitation of treatment works	1,017,000	124,000	1,017,000										
				Sewer reticulation	4,110,000									124,000			
Naha Pond	U-164	411,000	6,626,000	Rehabilitation	71,000		71,000										
				Sewer reticulation	4,185,000												
Sakamaga Shire	U-210	319,000	6,942,000	Rehabilitation	9,000												
				Sewer reticulation	3,056,000												
Sakamaga Kumbi	U-210	540,000	2,907,000	Sewer reticulation	2,907,000								72,000	72,000	72,000	72,000	1,484,000
				Rehabilitation	3,344,000												
Taka	U-9	200,000	6,329,000	Rehabilitation	58,000												
				Sewer reticulation	2,927,000												
Nawaha	U-158	464,000	10,046,000	Rehabilitation	226,000				226,000								
				Sewer reticulation	6,014,000												
Nericho	U-128	369,000	7,986,000	Rehabilitation	3,604,000		189,000	189,000	3,604,000								
				Sewer reticulation	4,382,000												
Molindi	U-40	373,000	7,981,000	Rehabilitation	2,822,000	191,000	191,000	2,822,000									
				Sewer reticulation	5,159,000												
Wajury	U-205	298,000	6,390,000	Rehabilitation	120,000												
				Sewer reticulation	3,785,000												
Kisi	U-117	233,000	4,933,000	Rehabilitation	1,276,000												
				Sewer reticulation	3,657,000												
Garissa	U-14	309,000	6,563,000	Rehabilitation	2,166,000												
				Sewer reticulation	4,397,000												

Table - 4.5.6 (3/4) Disbursement Schedule "B"

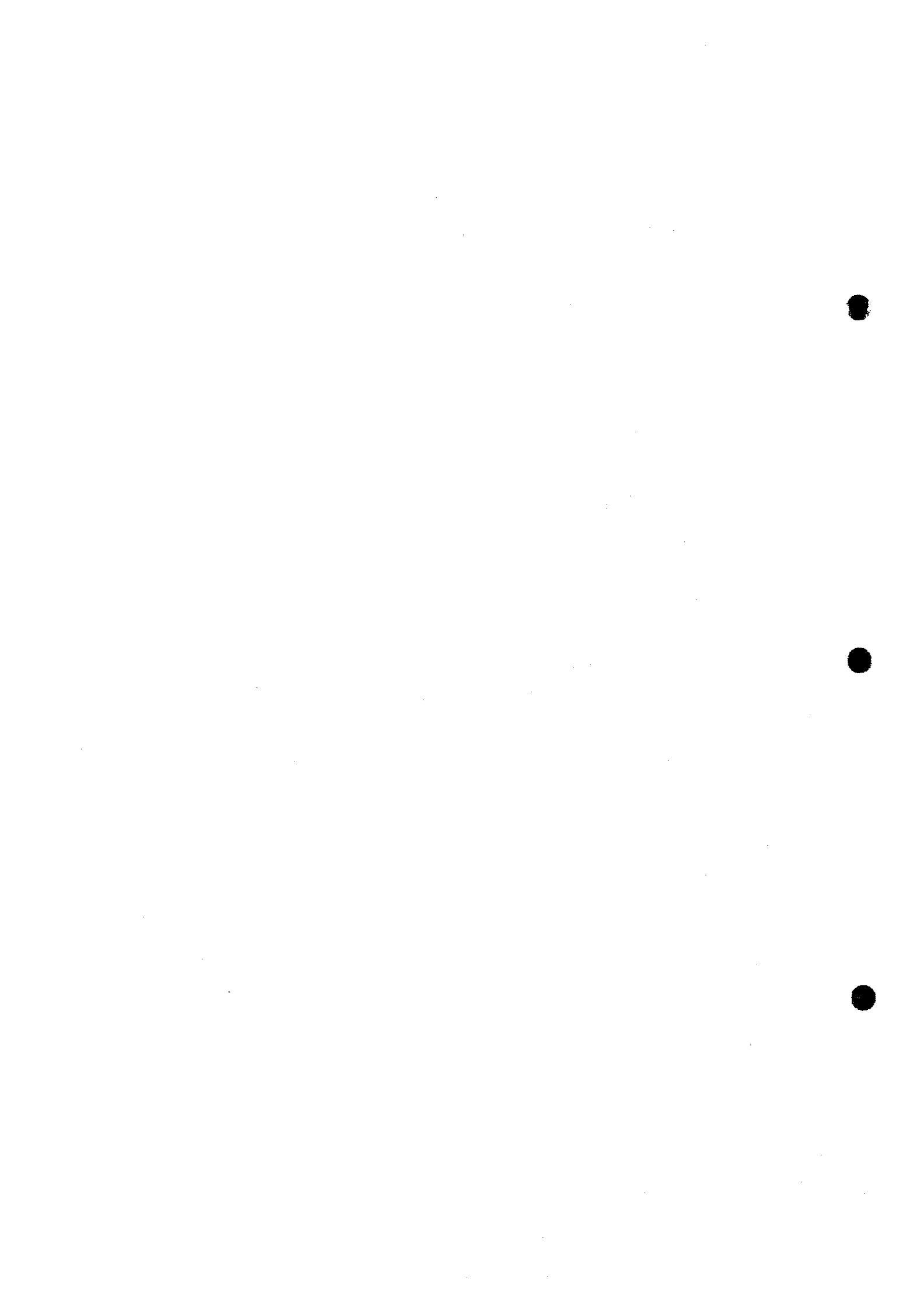
Urban Name	code	Asset Maintenance & Operation Cost (US\$ per yr)	Initial cost (p) (US\$)	Planning	cost (US\$)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
						(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)	(US\$)
Bogor	U-199	249,000	5,882,000	Treatment works	2,406,000												
				Sewer reticulation	3,476,000												
Bogor (South Java)	U-206	249,000	5,275,000	New or expand	1,913,000												
				Rehabilitation	106,000												
Mangrove	U-153	106,000	3,814,000	New or expand	894,000												
				Rehabilitation	195,000												
Batub	U-60	133,000	2,061,000	New or expand	1,047,000												
				Rehabilitation	204,000												
Banda	U-63	114,000	2,421,000	New or expand	508,000												
				Rehabilitation	49,000												
Bogor Lembang	U-146	144,000	3,111,000	Treatment works	1,134,000												
				Sewer reticulation	1,977,000												
Mangrove	U-20	142,000	3,064,000	Treatment works	1,117,000			70,000	70,000	70,000	1,117,000						
				Sewer reticulation	1,947,000									1,947,000			
Banda	U-163	132,000	2,963,000	Treatment works	1,092,000			70,000	1,092,000								
				Sewer reticulation	1,881,000									1,881,000			
Bogor	U-129	71,000	1,547,000	New or expand	810,000												
				Rehabilitation	75,000												
Bogor	U-8	124,000	2,085,000	Treatment works	986,000			64,000	64,000	64,000	986,000						
				Sewer reticulation	1,792,000									1,792,000			
Waser	U-116	117,000	2,482,000	Treatment works	917,000			60,000	60,000	60,000	917,000						
				Sewer reticulation	1,575,000									1,575,000			
Mangrove	U-21	45,000	627,000	Treatment works	204,000												
				Sewer reticulation	743,000												

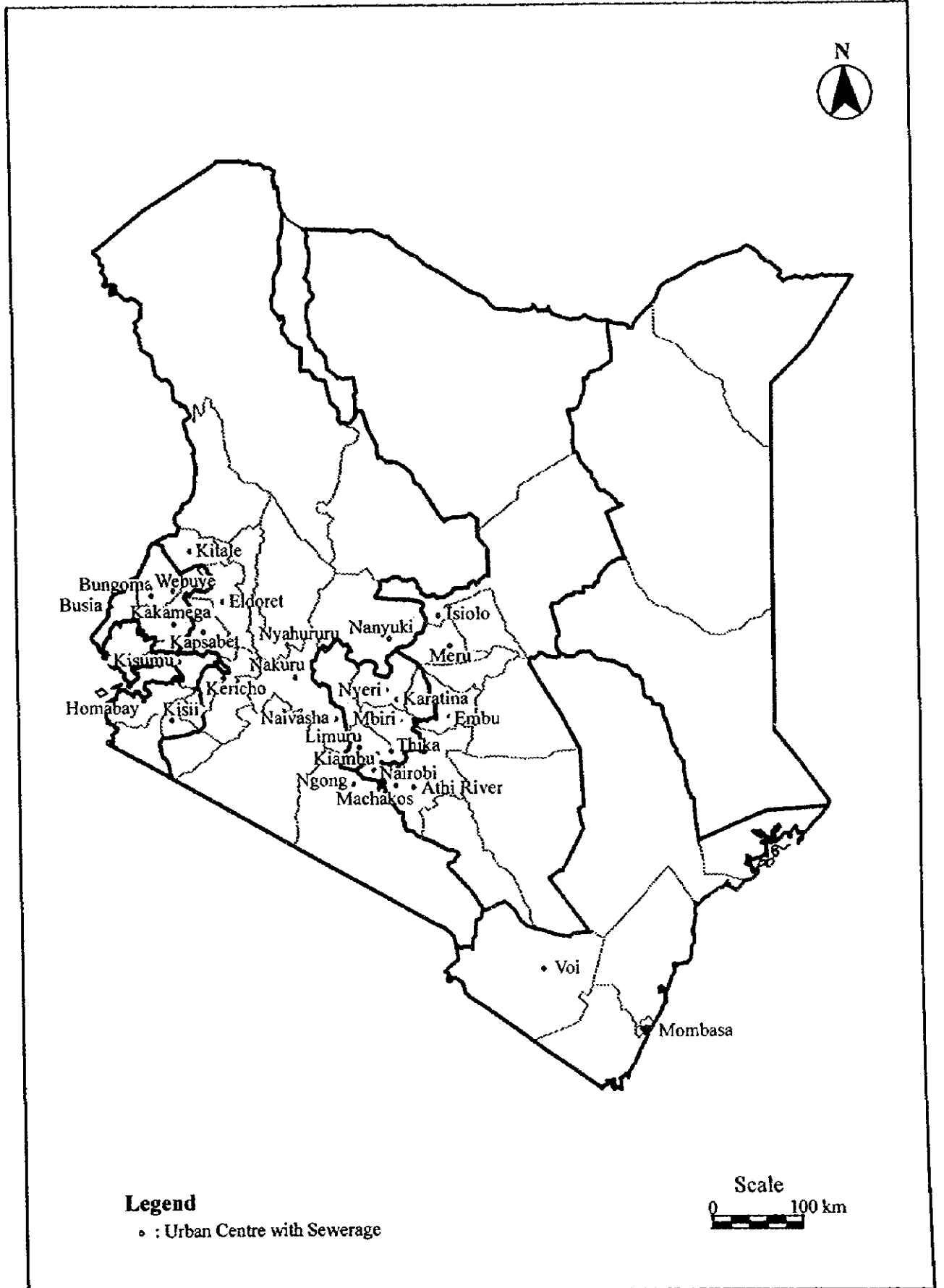
Table - 4.5.6 (4/4) Disbursement Schedule "B"

Urban Name	code	Annual Maintenance & Operation Cost (US\$/year)	Initial Cost (C) (US\$)	Planning	cost (US\$)	1999 (US\$)	2000 (US\$)	2001 (US\$)	2002 (US\$)	2003 (US\$)	2004 (US\$)	2005 (US\$)	2006 (US\$)	2007 (US\$)	2008 (US\$)	2009 (US\$)	2010 (US\$)
Nyabaramu	U-28	28,000	898,000	Rehabilitation of Treatment works Sewer excavation	156,000 452,000												
Kibifi	U-38	102,000	2,188,000	Treatment works Sewer reexcavation	811,000 1,374,000												
Mankera	U-109	109,000	2,307,000	Treatment works Sewer reexcavation	734,000 1,573,000												
Athi-River	U-69	82,000	1,006,000	Rehabilitation of Treatment works Sewer reexcavation	629,000 1,057,000												
Kippariki	U-185	37,000	778,000	Sewer reexcavation	778,000												
Ngungu	U-144	69,000	1,552,000	Treatment works Sewer reexcavation	569,000 983,000												
Vui	U-55	62,000	1,224,000	Treatment works Sewer reexcavation	529,000 795,000												
Suharwey	U-179	59,000	1,285,000	Treatment works Sewer reexcavation	498,000 787,000												
Kaunghis	U-40	21,000	448,000	Sewer reexcavation	448,000												
Karatina	U-33	72,000	1,527,000	Treatment works Sewer reexcavation	597,000 930,000												
Lamuru	U-6	17,000	399,000	Treatment works Sewer reexcavation	298,000 151,000												
Ongoing impact			31,000			15,500											
Total			483,000 (PPP)			5,648,500	6,252,500	36,042,000	47,261,000	43,545,000	32,073,000	44,343,000	36,306,000	30,005,000	65,678,000	42,798,000	25,894,000

- PART III : SEWERAGE DEVELOPMENT PLAN -

FIGURES





Legend

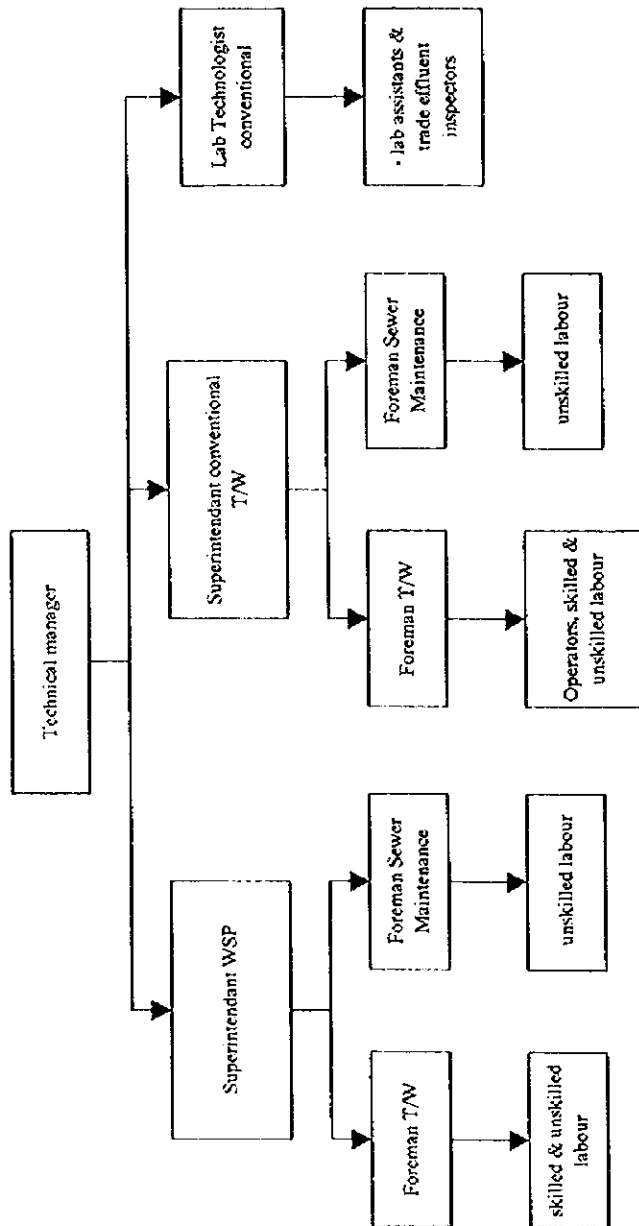
• : Urban Centre with Sewerage

Scale
0 100 km

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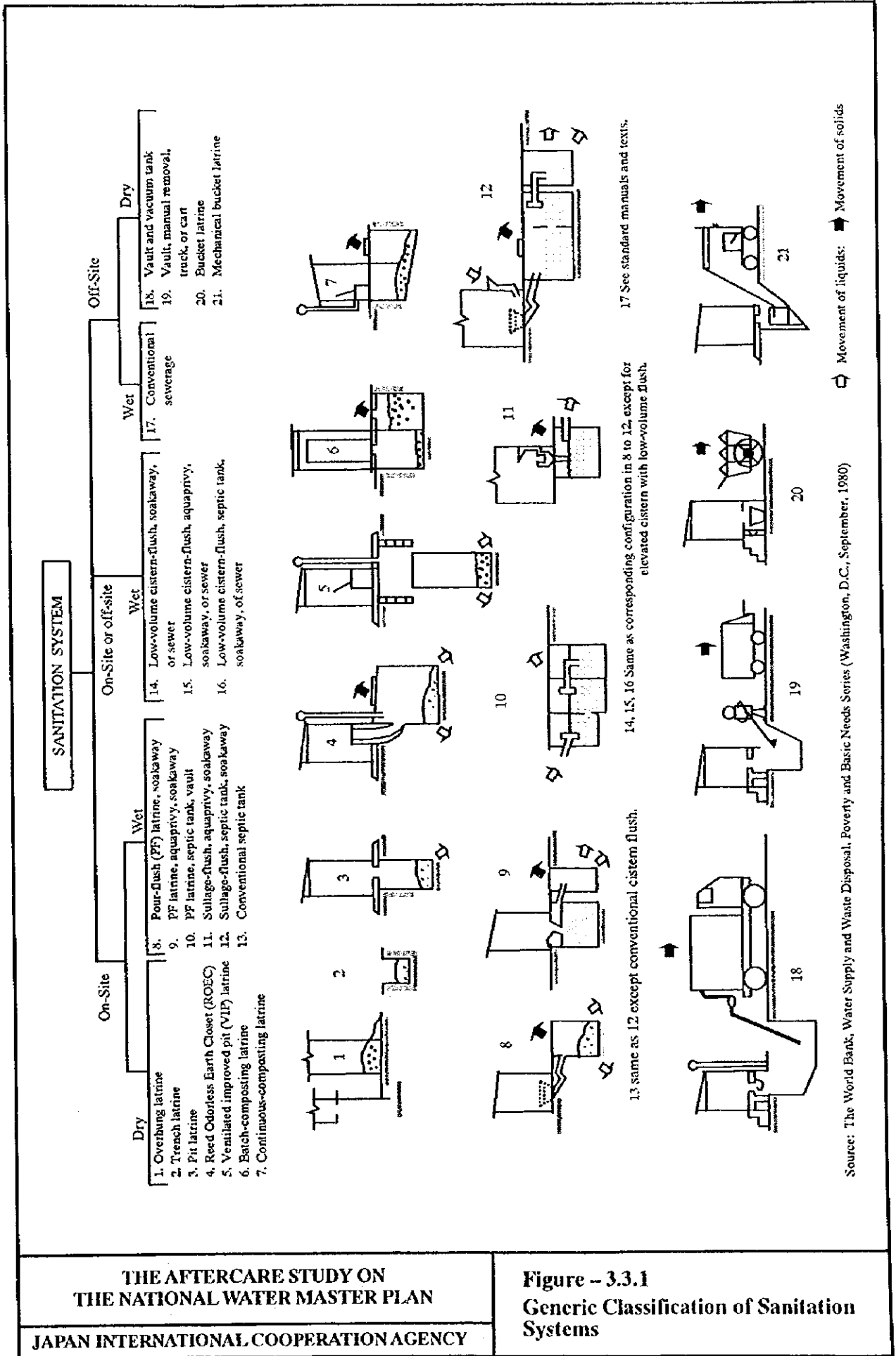
Figure - 2.1.1
Urban Centres with Sewerage



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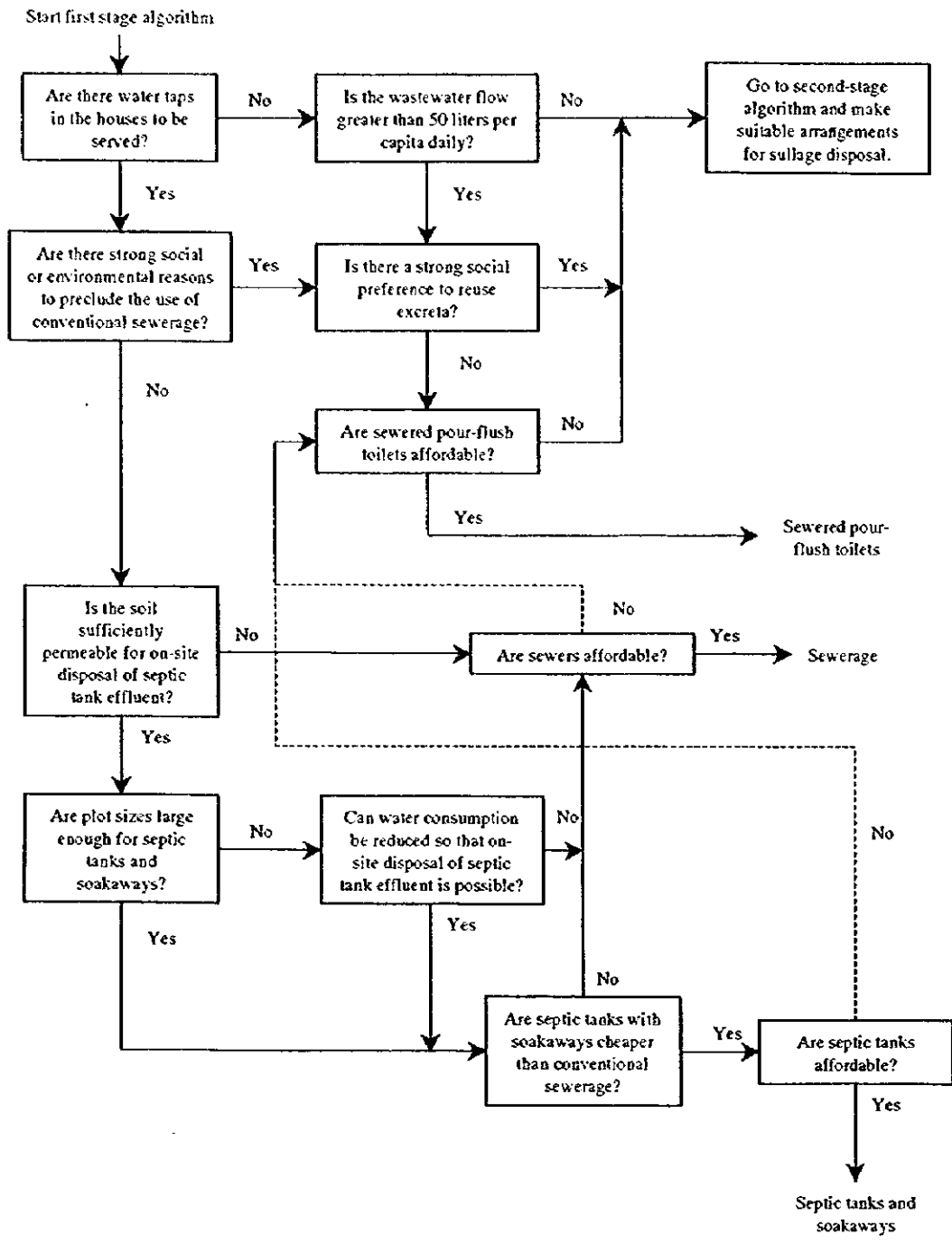
Figure - 2.3.1
 Typical O&M Organization Structure

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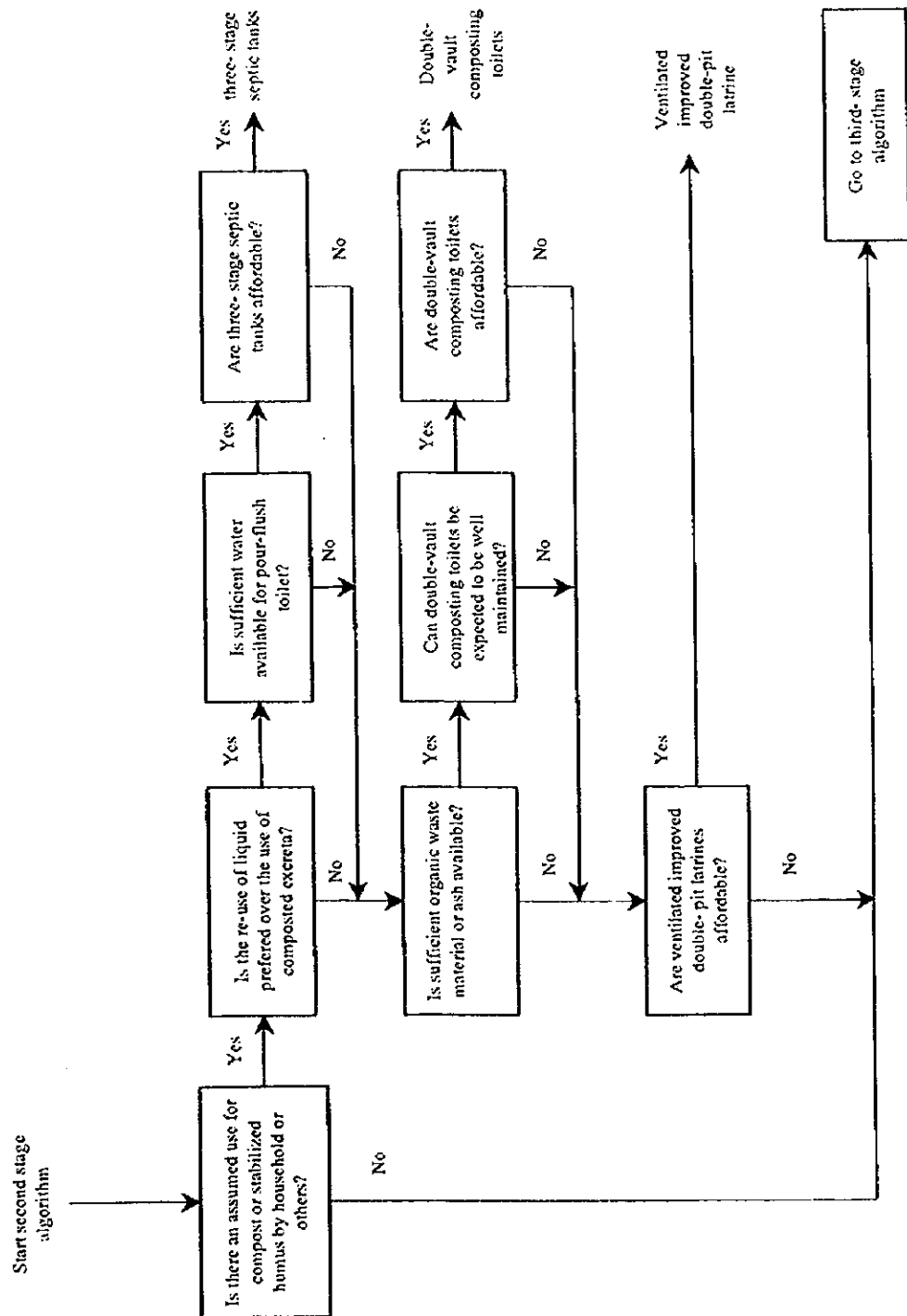


Source: The World Bank, Water Supply and Waste Disposal, Poverty and Basic Needs Series (Washington, D.C., September, 1980)

**Figure - 3.3.1
Generic Classification of Sanitation Systems**



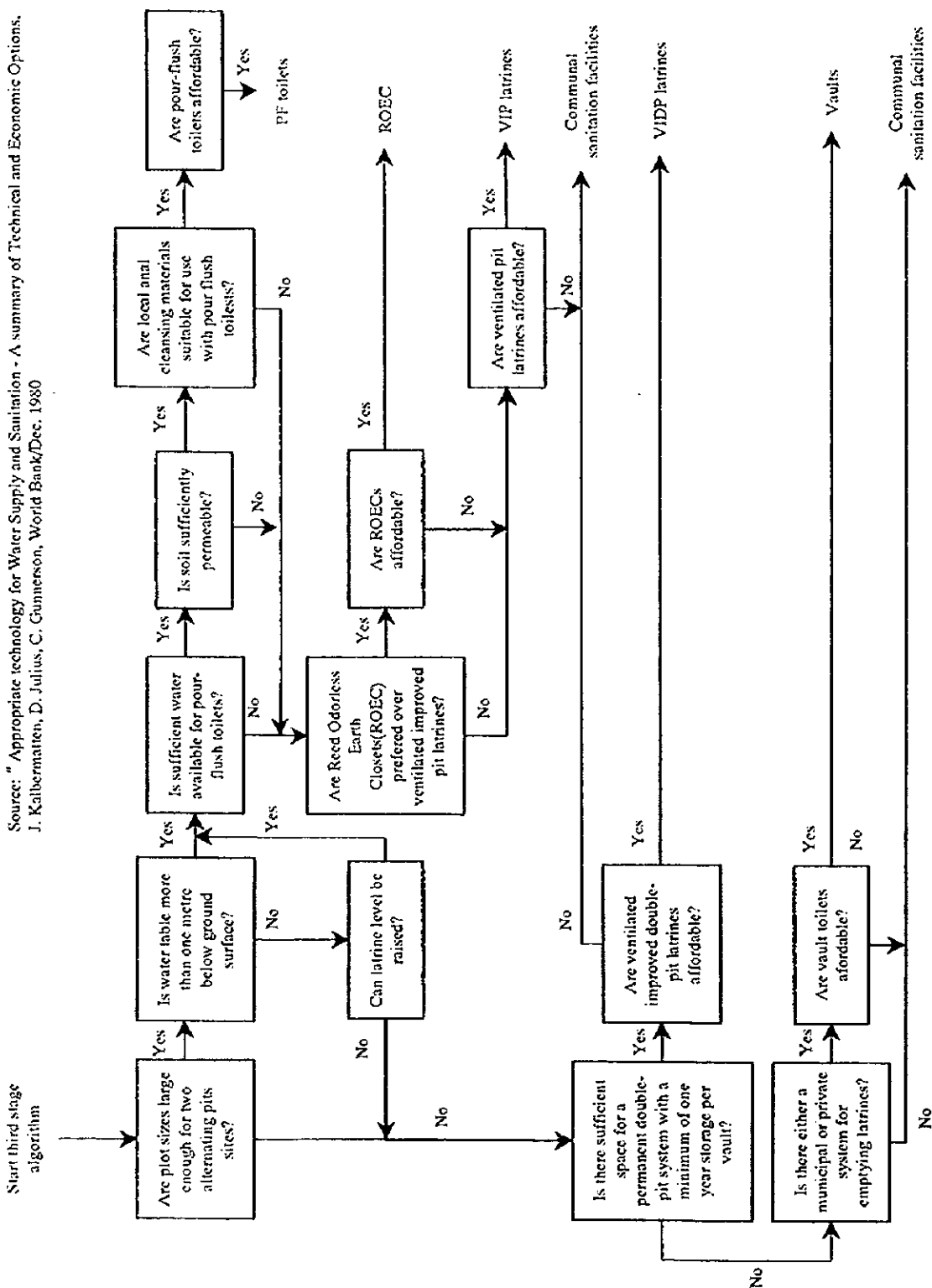
Source: "Appropriate technology for Water Supply and Sanitation - A summary of Technical and Economic Options, J. Kalbermatten, D. Julius, C. Gunnerson, World Bank/Dec. 1980



Source: " Appropriate technology for Water Supply and Sanitation - A summary of Technical and Economic Options, J. Kalbermaten, D. Julius, C. Gunnerson, World Bank/Dec. 1980

<p>THE AFTERCARE STUDY ON THE NATIONAL WATER MASTER PLAN</p> <p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>Figure - 3.3.2(2/3) Algorithm for Selection of Sanitation Technology</p>
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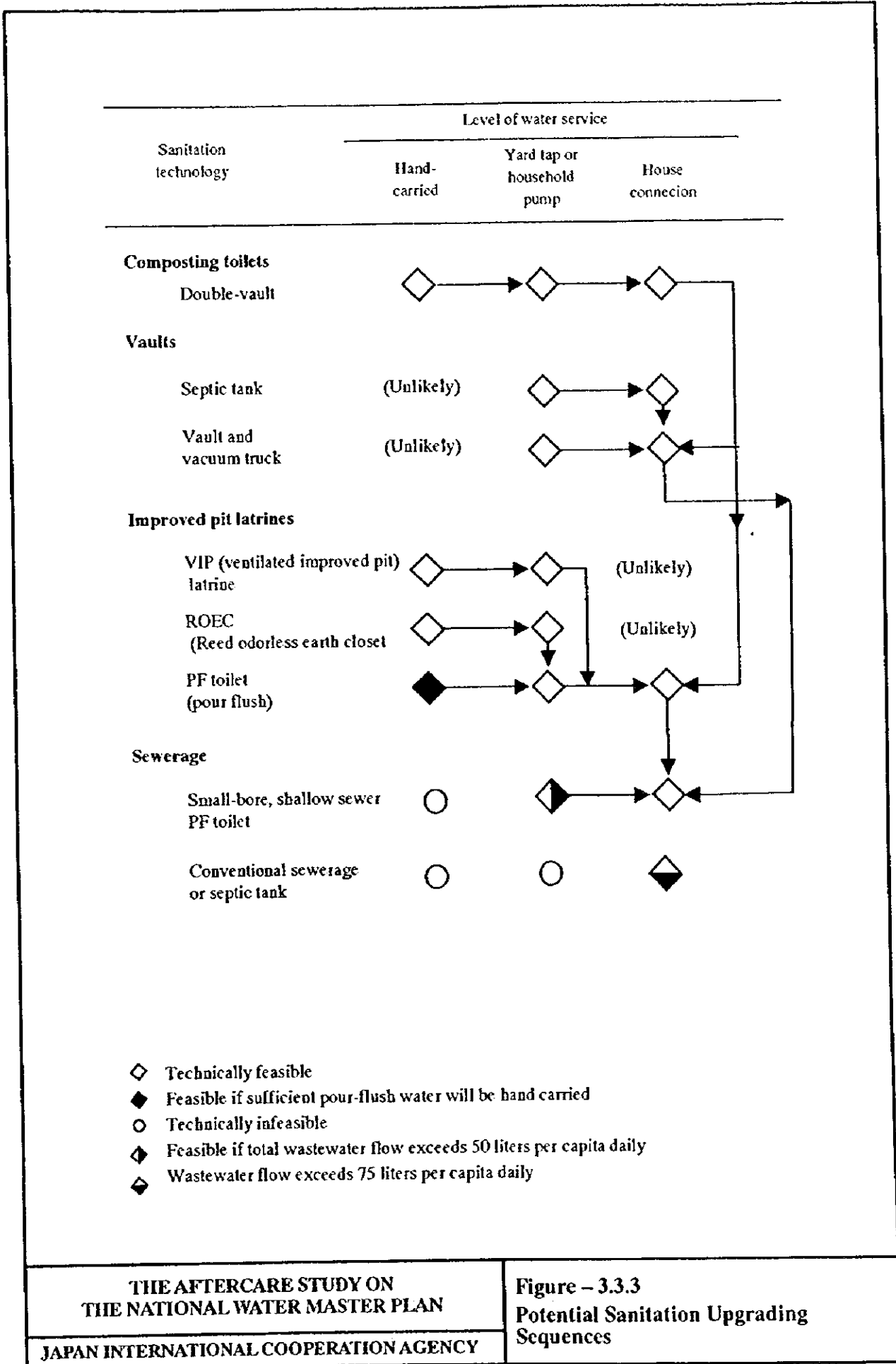
Source: "Appropriate technology for Water Supply and Sanitation - A summary of Technical and Economic Options, J. Kalbermatten, D. Julius, C. Gunnerson, World Bank/Dec. 1980



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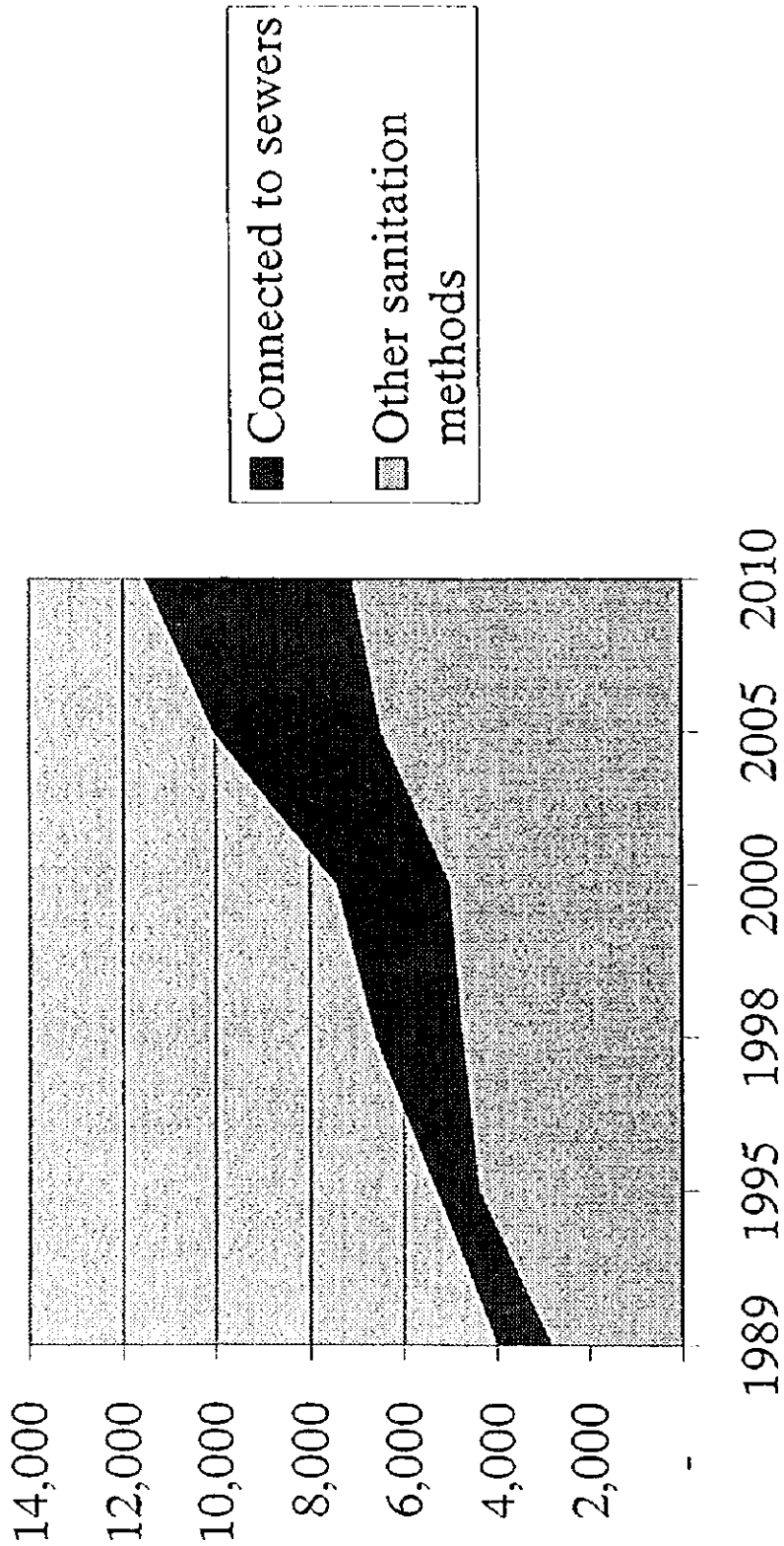
Figure - 3.3.2(3/3)
Algorithm for Selection of Sanitation
Technology



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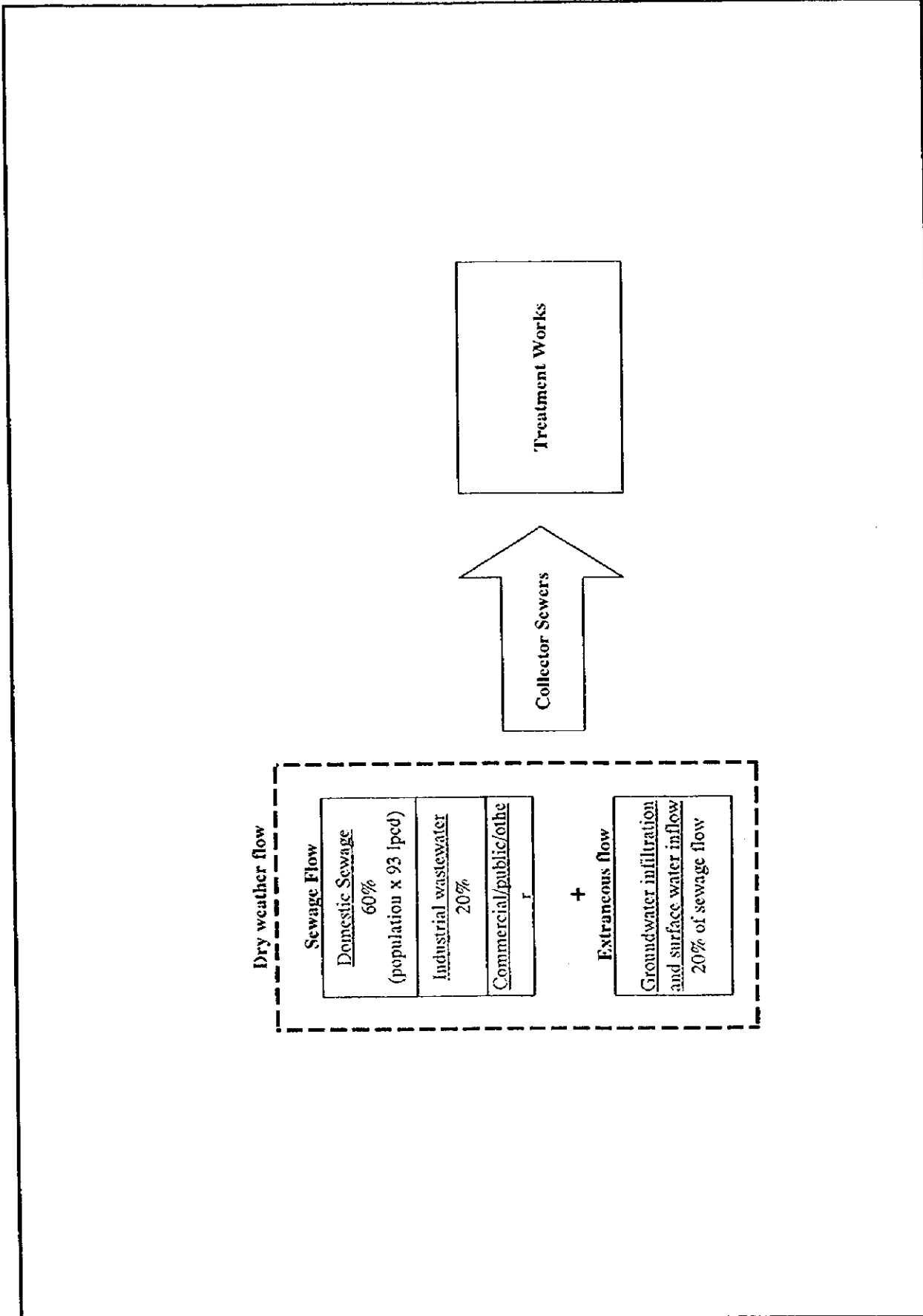
Figure - 3.3.3
Potential Sanitation Upgrading
Sequences



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Figure – 3.4.1
 Population Growth by Method of Disposal



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Figure - 3.5.1
Dry Weather Wastewater Flow

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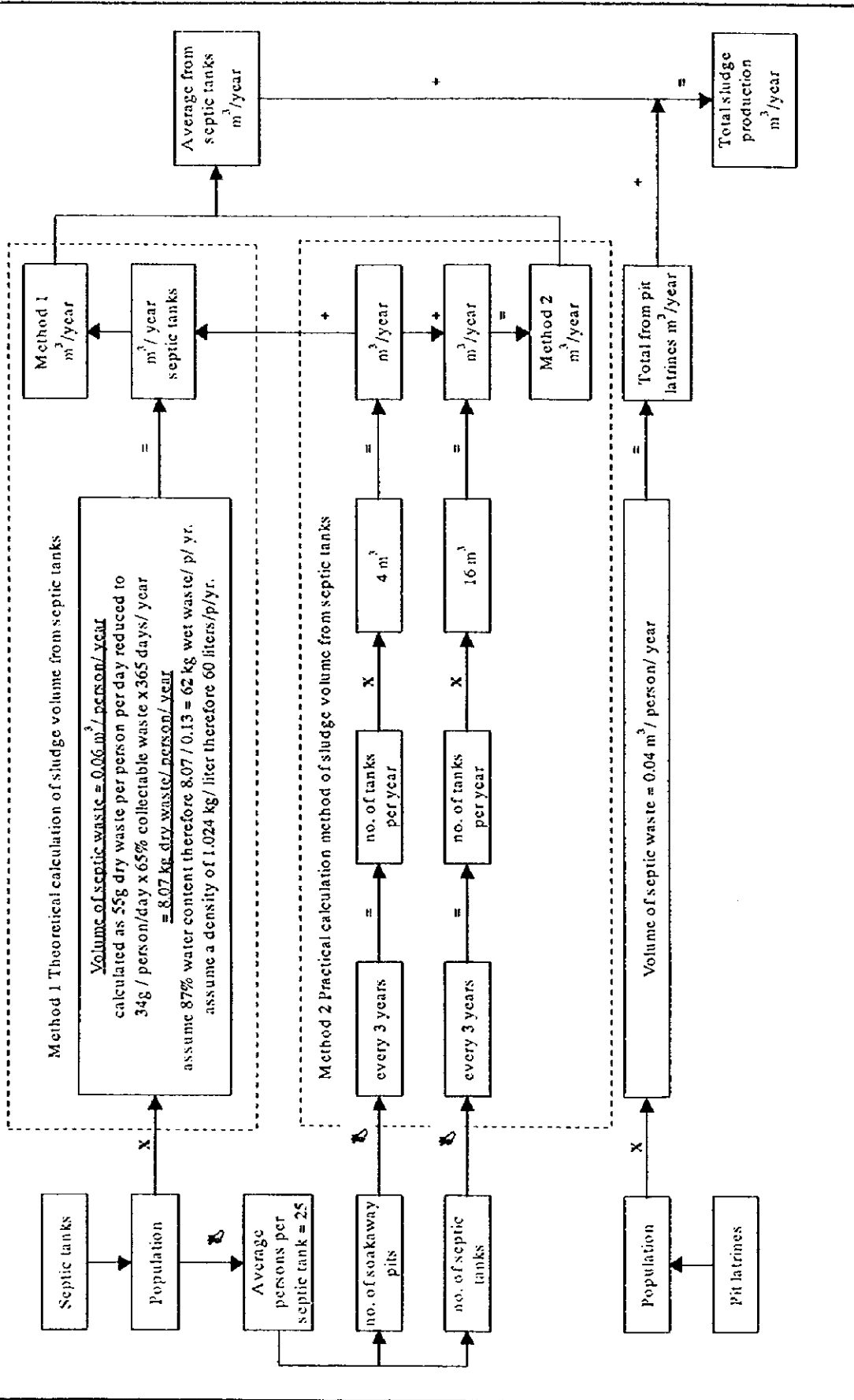
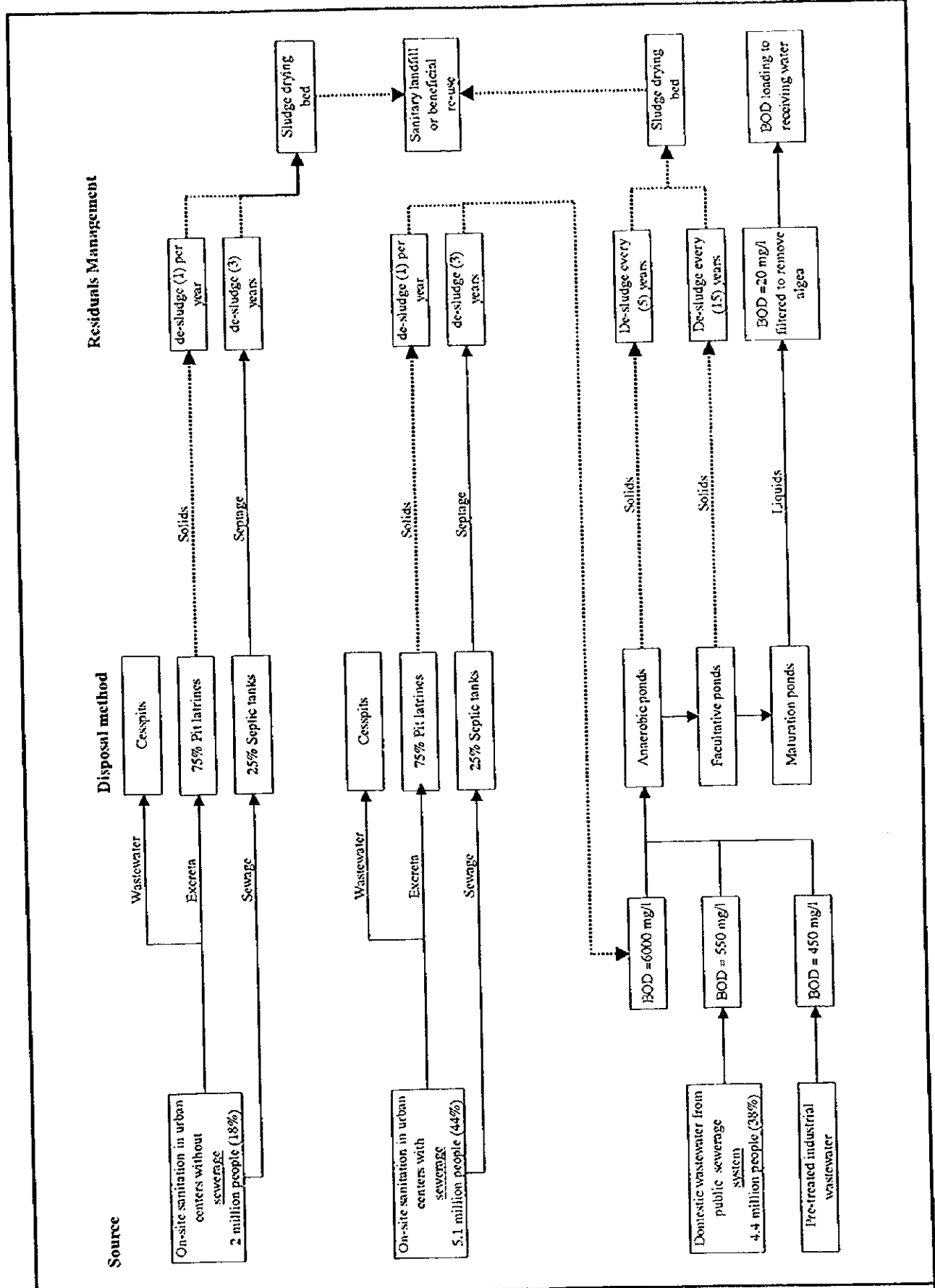


Figure 3.5.2
Sludge Volume Estimating Method

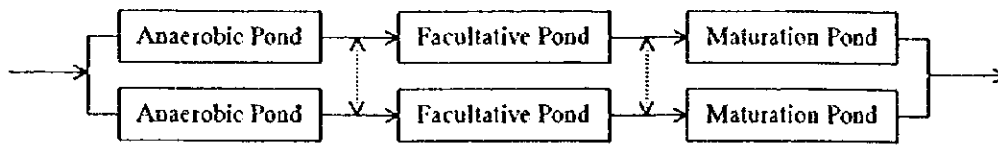
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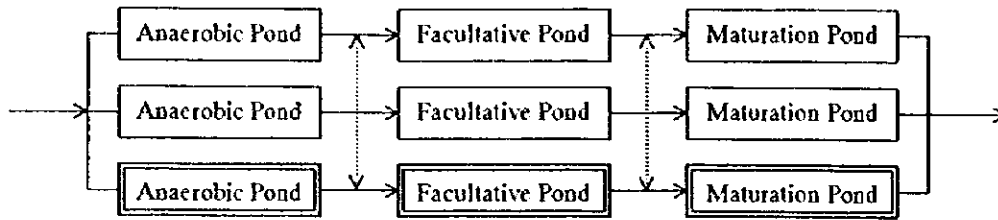


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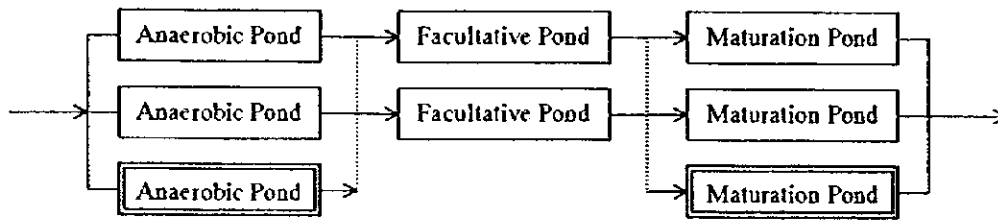
Figure - 3.6.1
Wastewater Treatment and Disposal
Flow Diagram



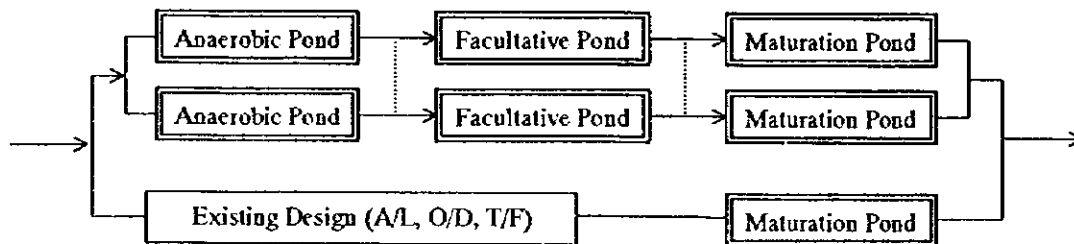
Typical Existing Stabilization Pond in Kenya



Expansion Type 1





Expansion Type 2



Expansion Type 3

Legend:

A/L: Aerobic Lagoon
 O/D: Oxidation ditch
 T/F: Trickling filter

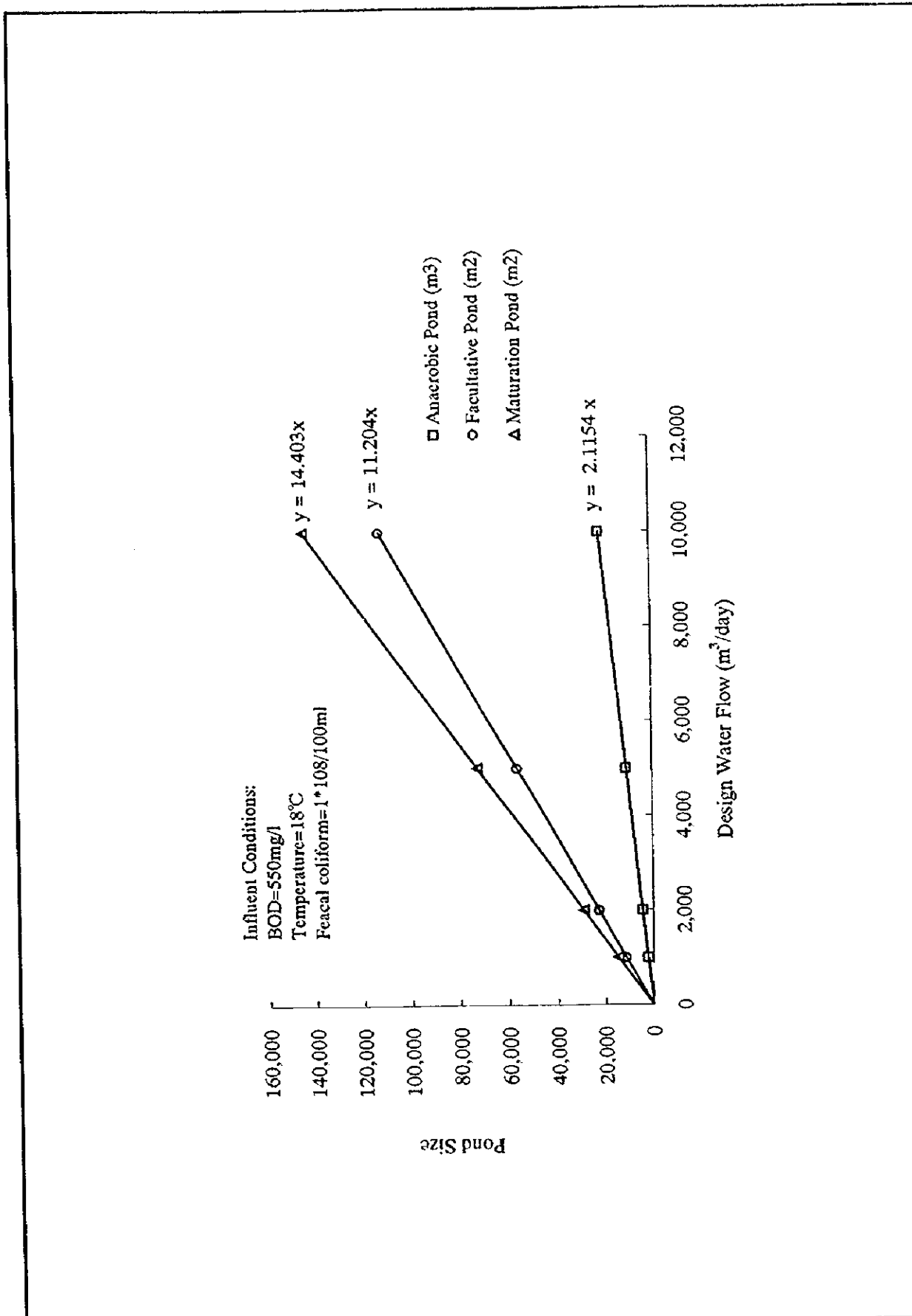
 : Existing
 : New

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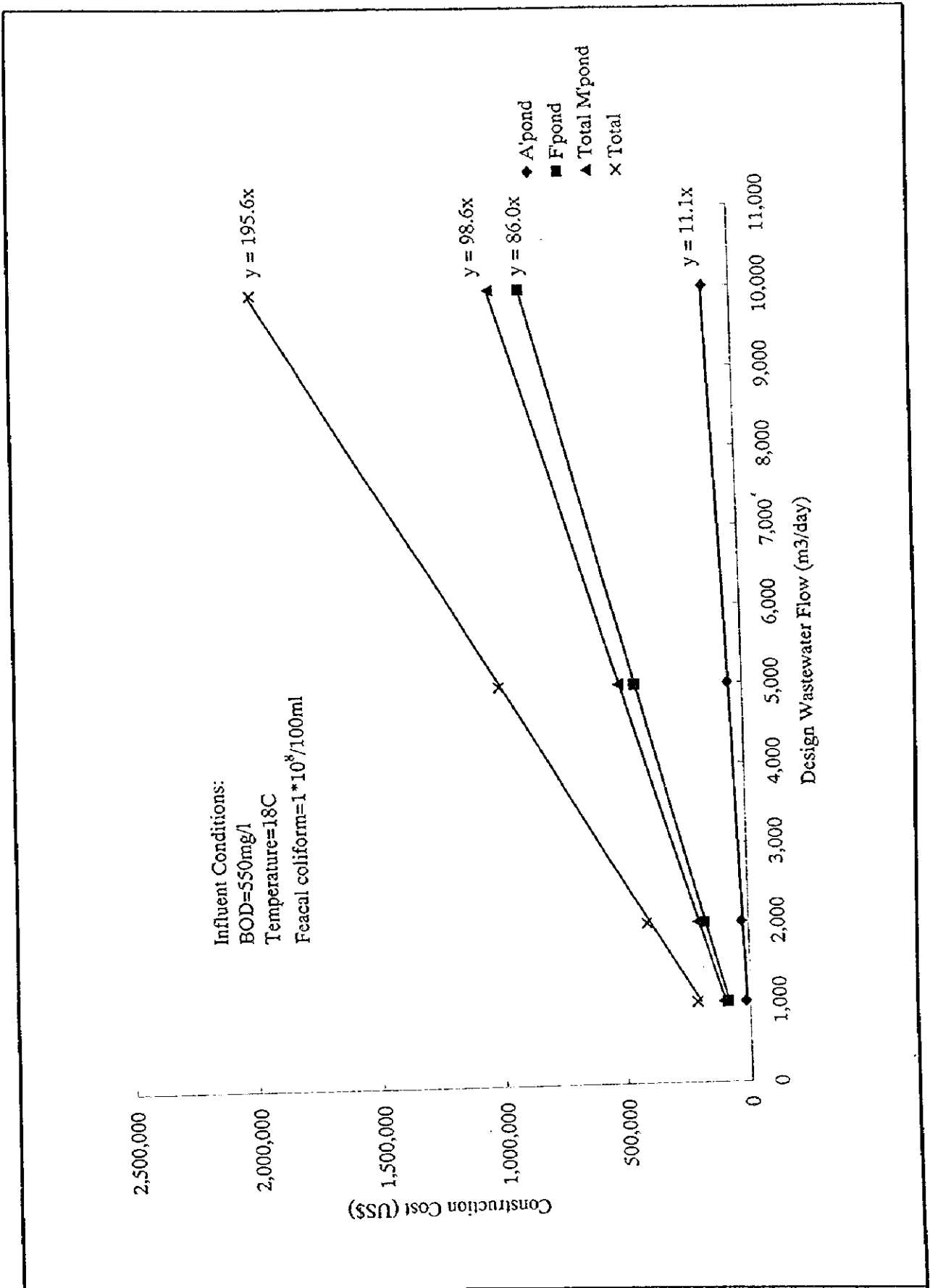
Figure - 4.2.1

Types of Expansion



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Figure - 4.2.2
 Typical Relation between Design
 Wastewater and Size of Treatment
 Facilities



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Figure - 4.2.4
 Typical Relation between Design
 Wastewater Flow and Total Construction
 Cost of Treatment Facilities

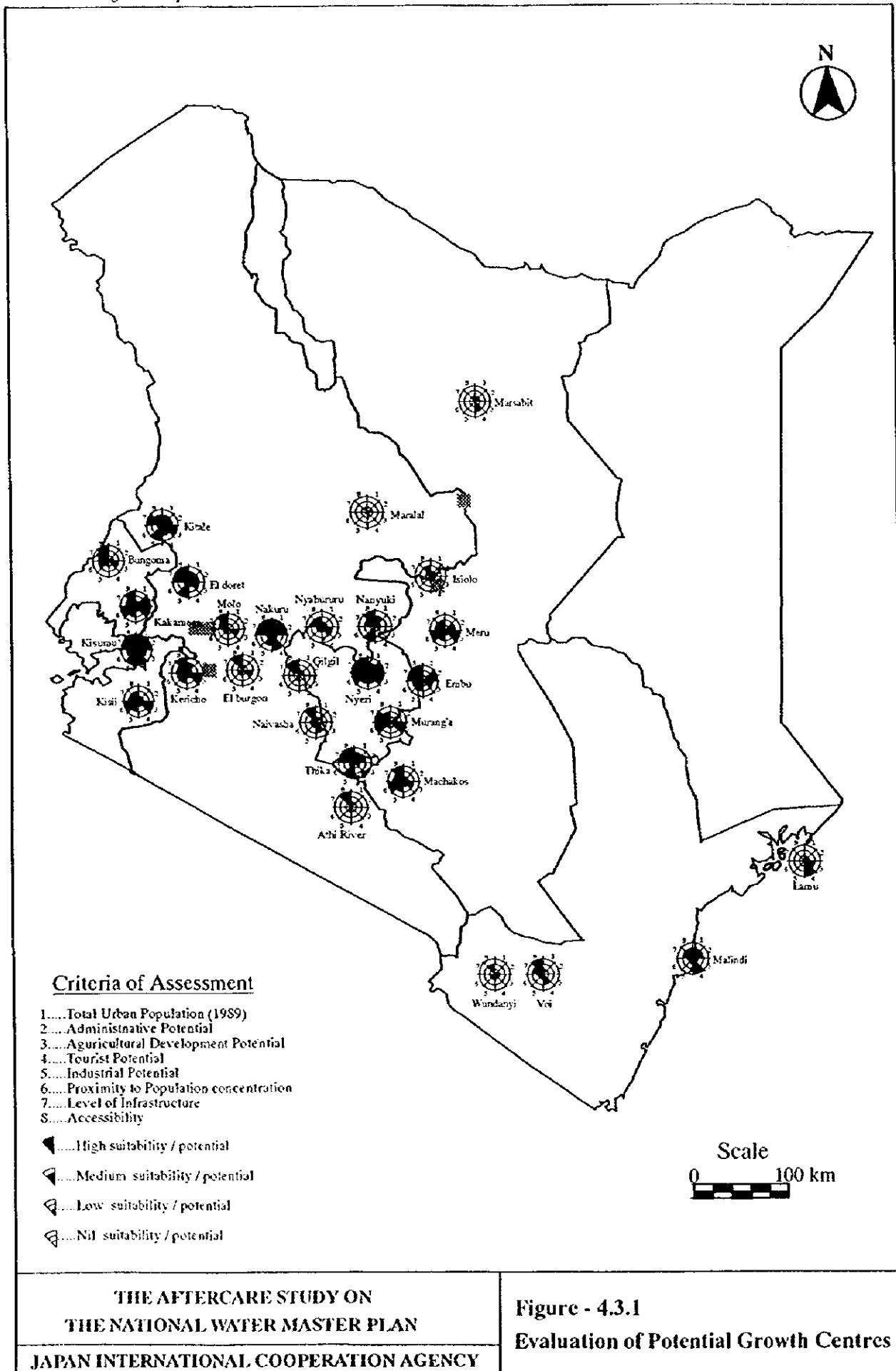
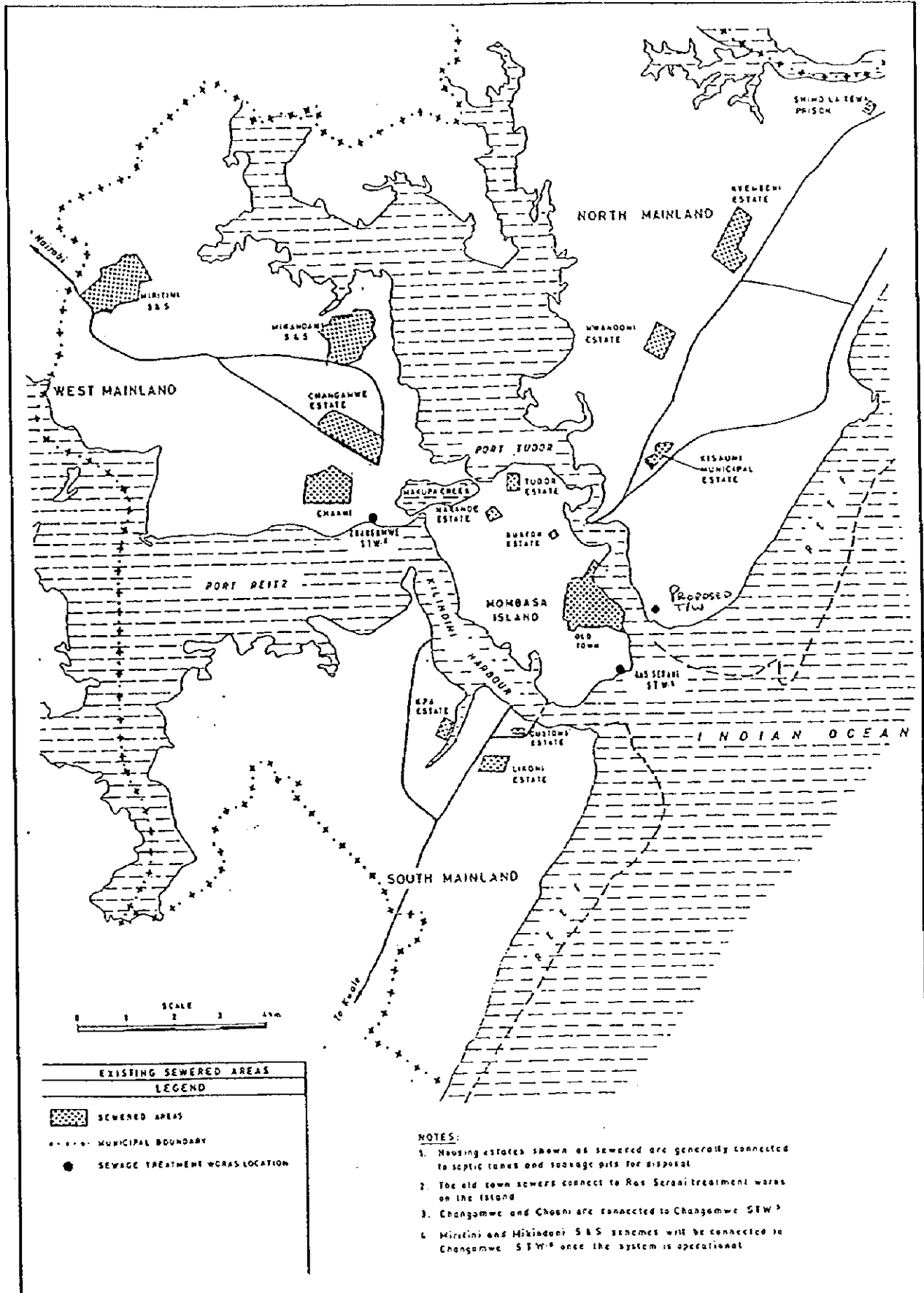


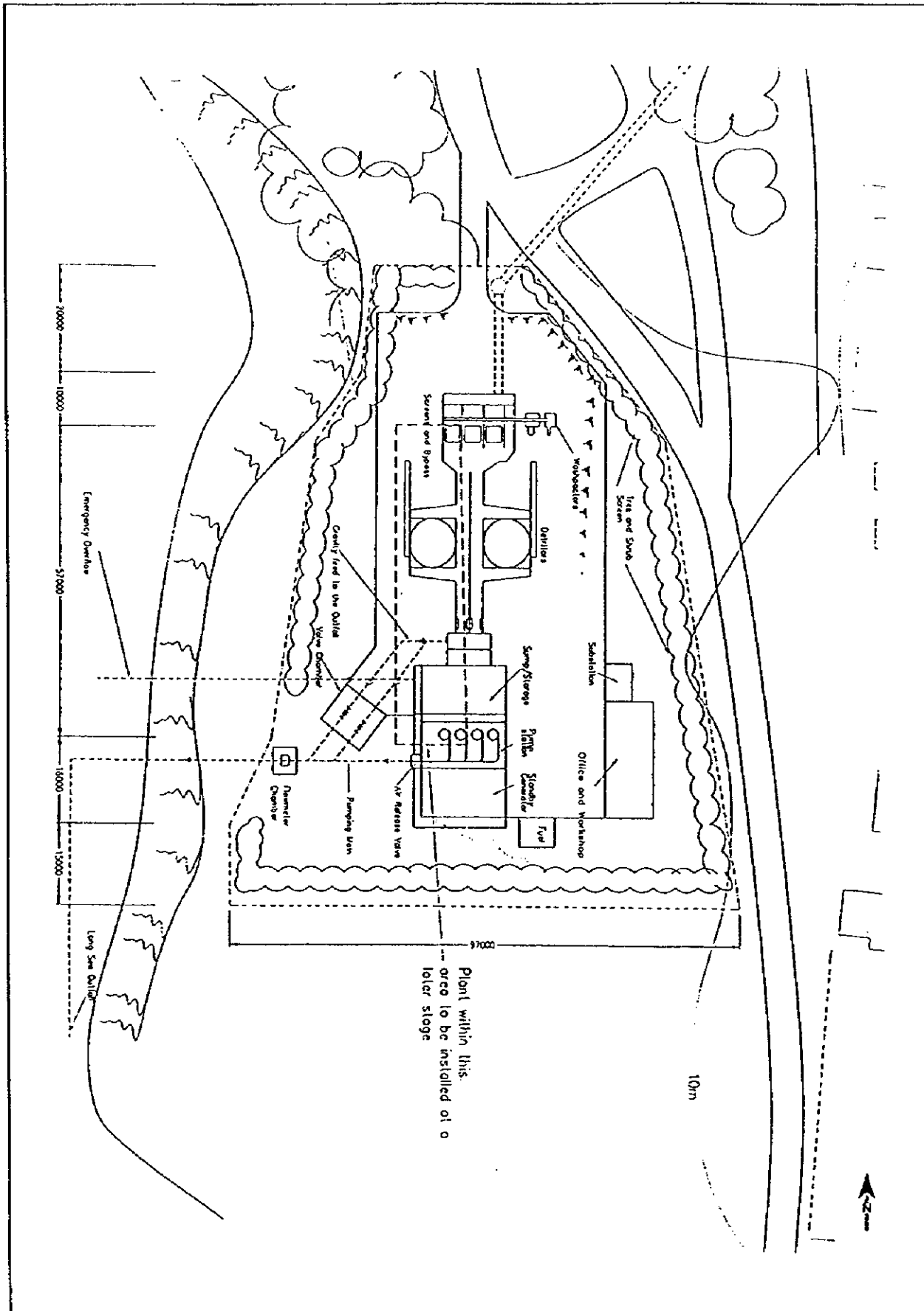
Figure - 4.3.1
Evaluation of Potential Growth Centres



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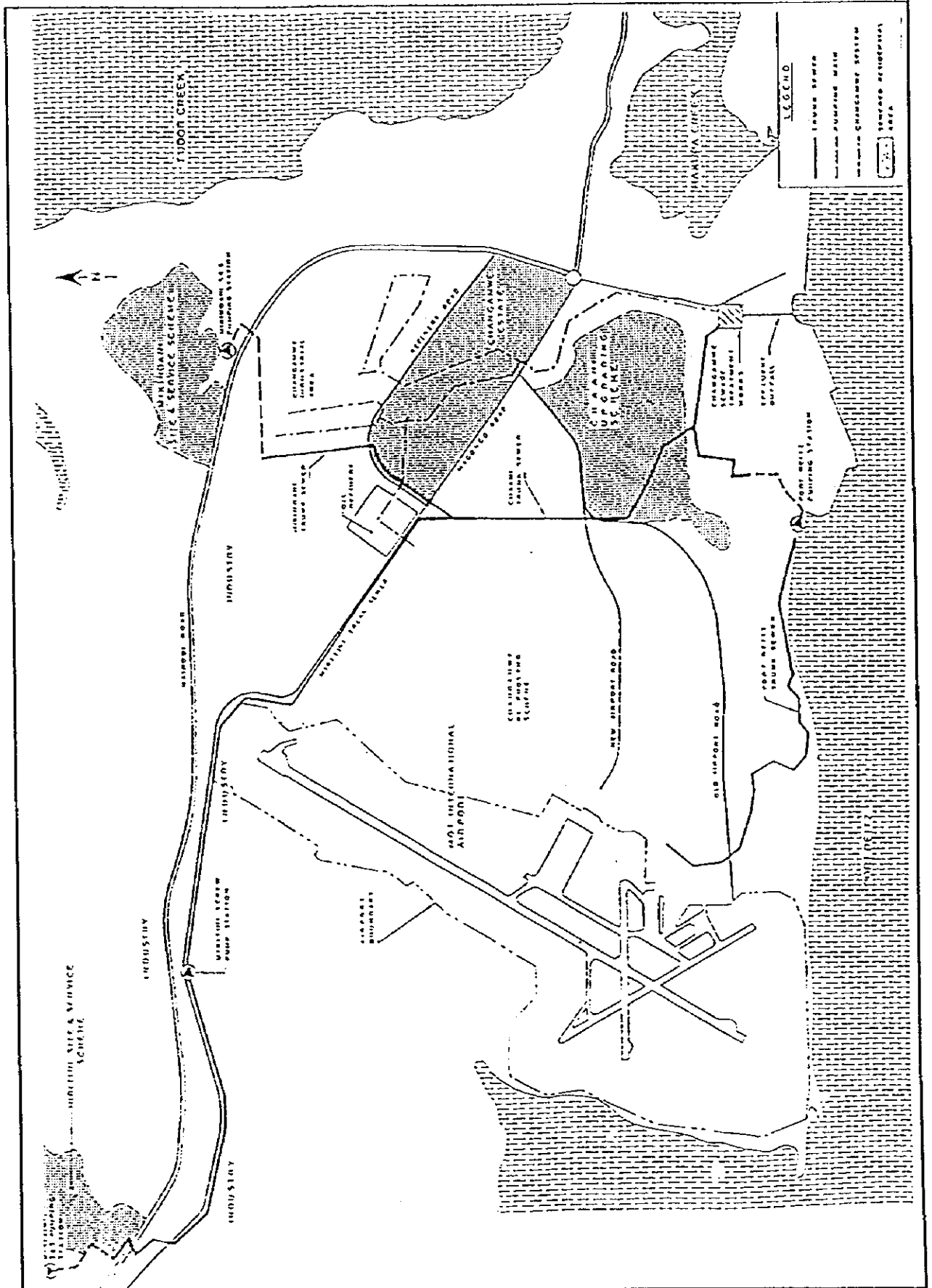
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure - 5.2.1
Mombasa - existing sewerage coverage



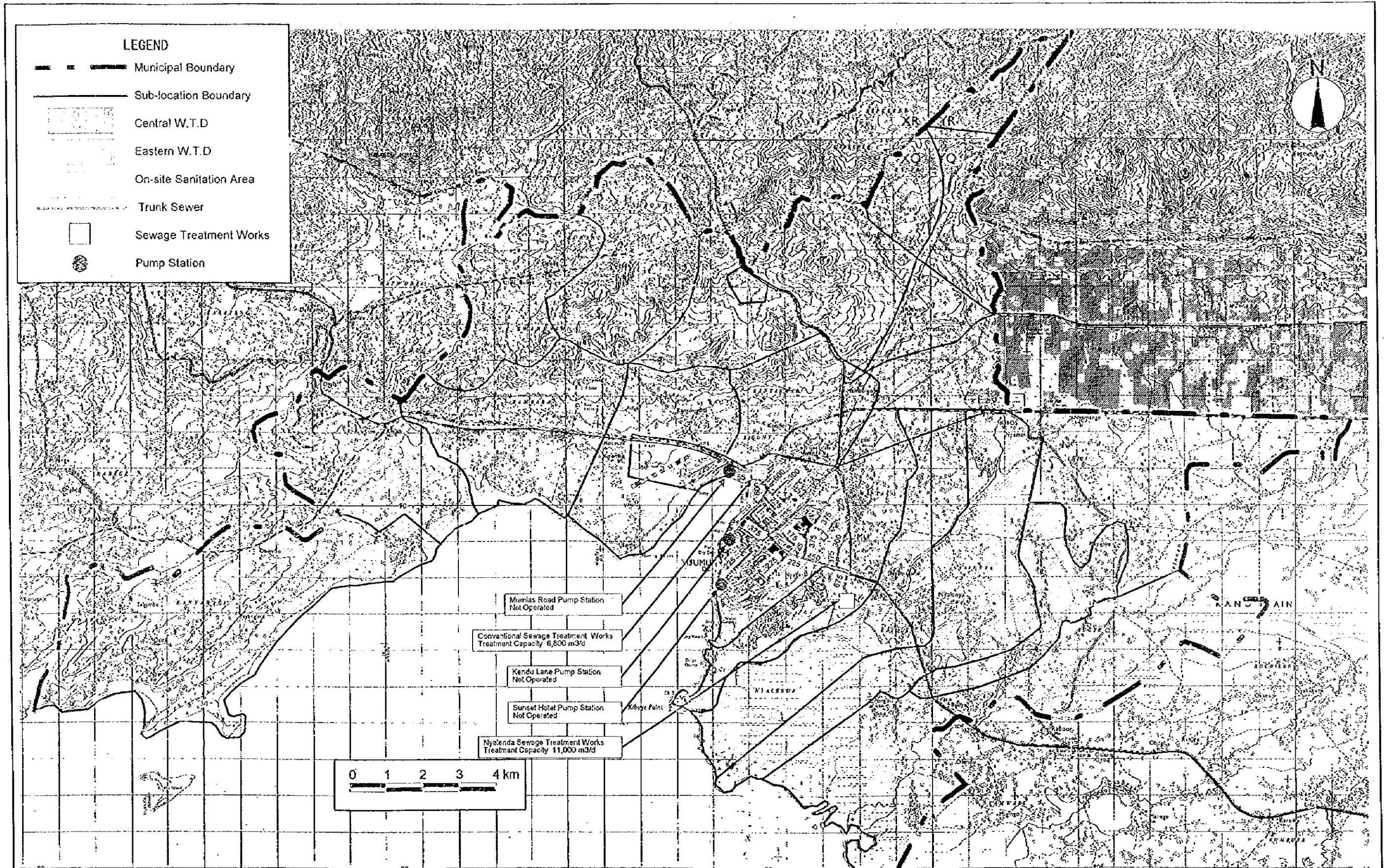
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Figure - 5.2.2
 Mombasa - proposed treatment works
 for Main Island & North Mainland



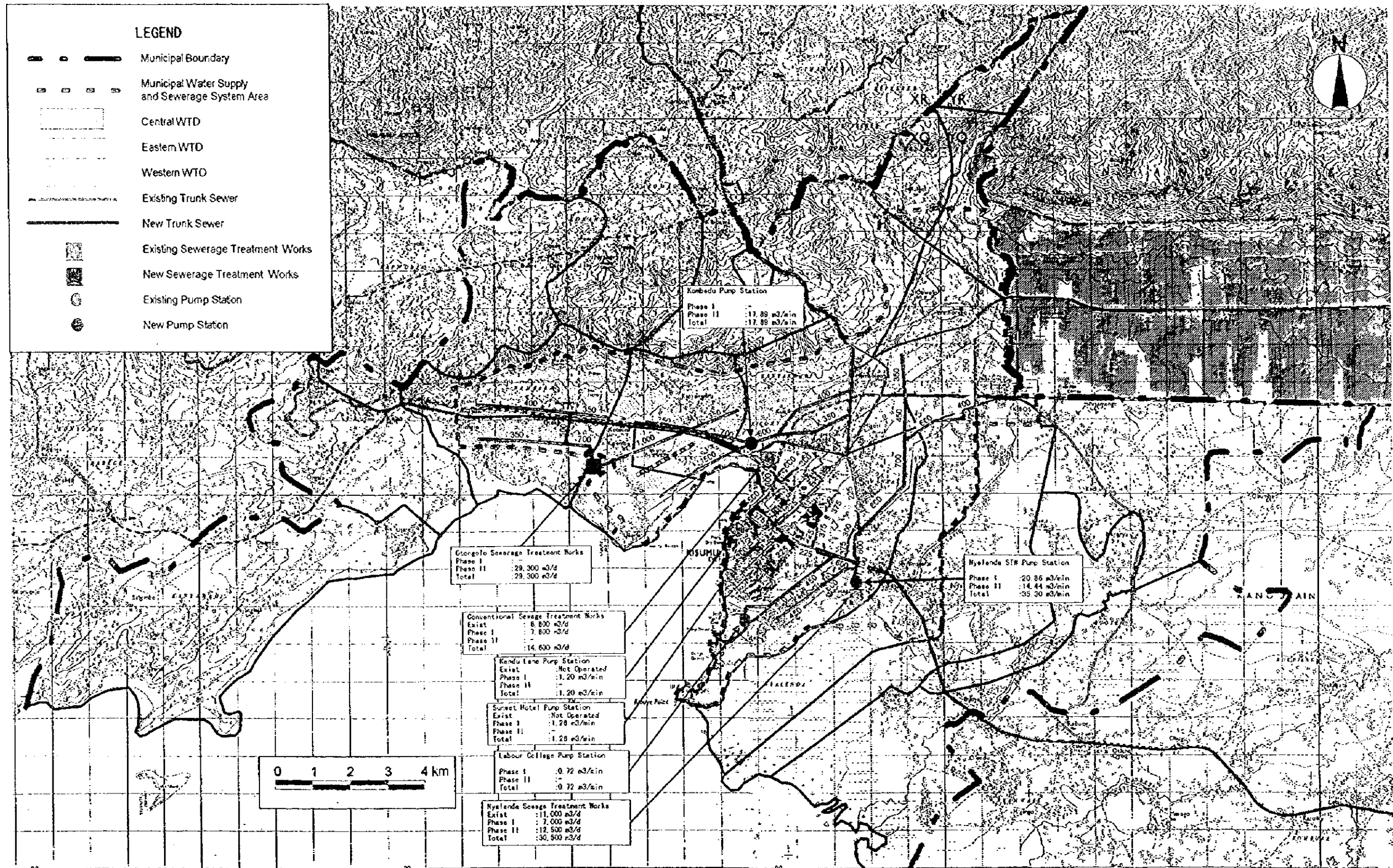
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Figure - 5.2.3
 Mombasa - proposed trunk sewers
 for West Mainland



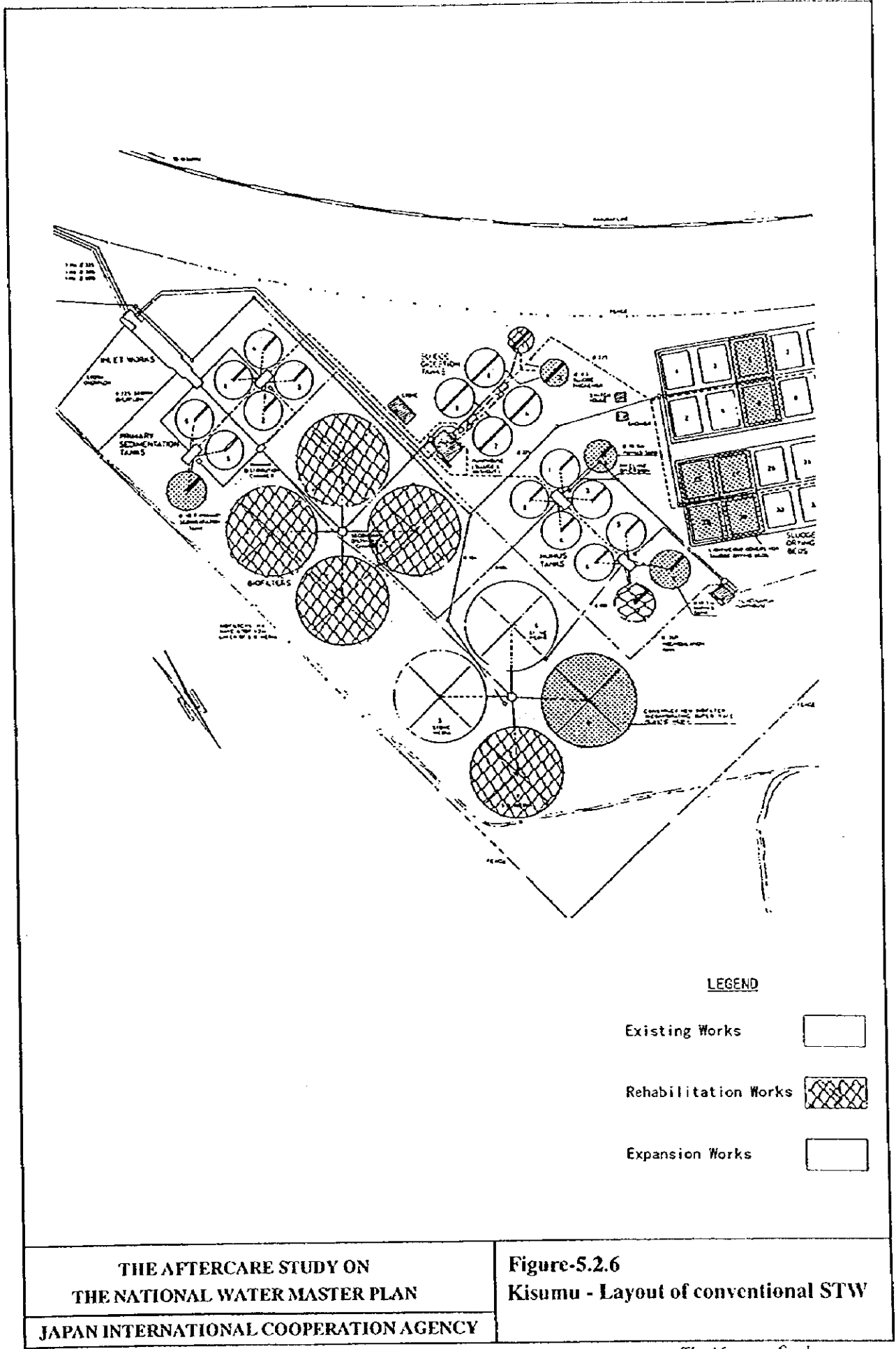
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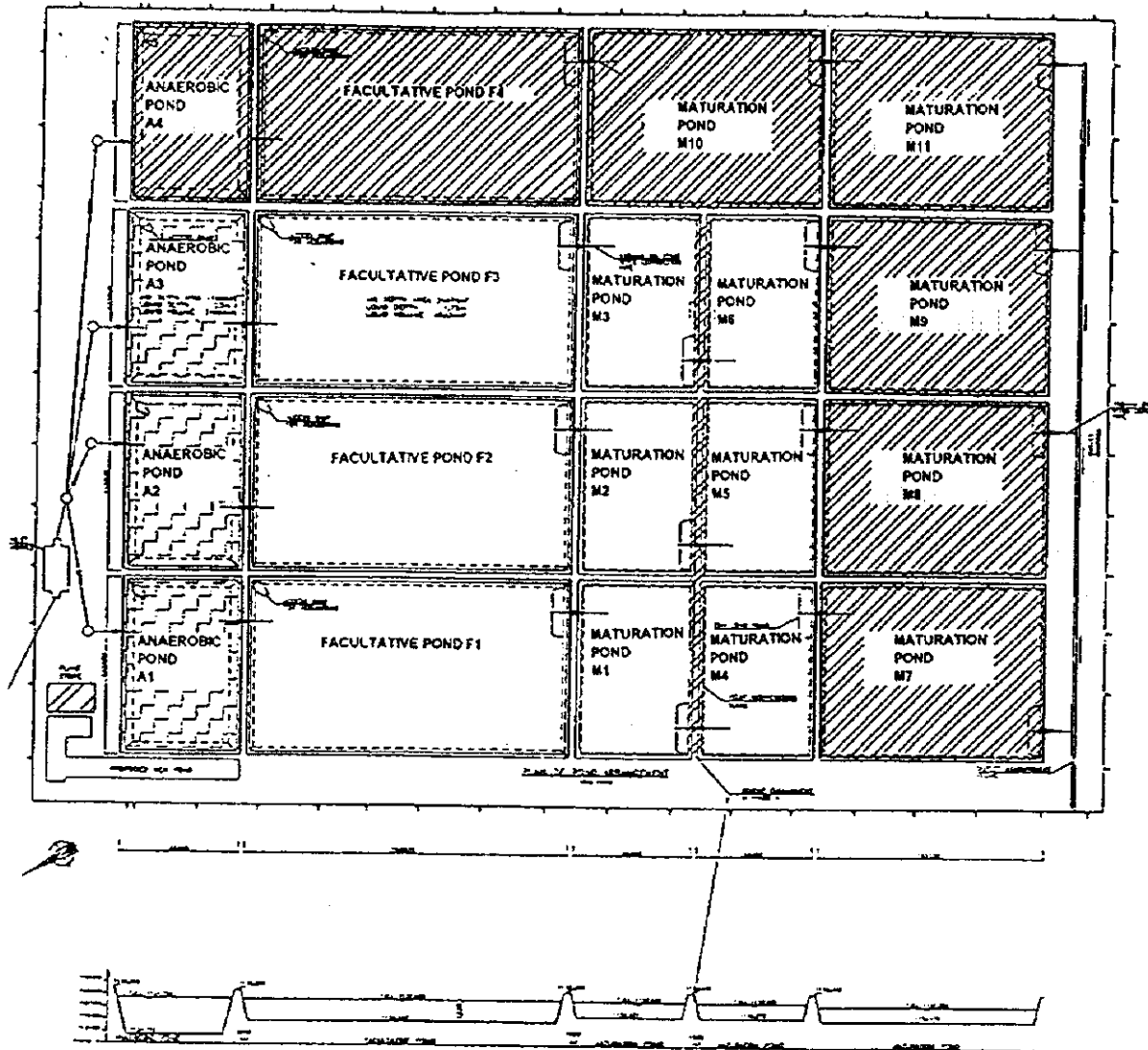
Figure - 5.2.4
 Kisumu - existing sewerage system



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**Figure - 5.2.5
Kisumu sewerage improvement plan
(2015)**



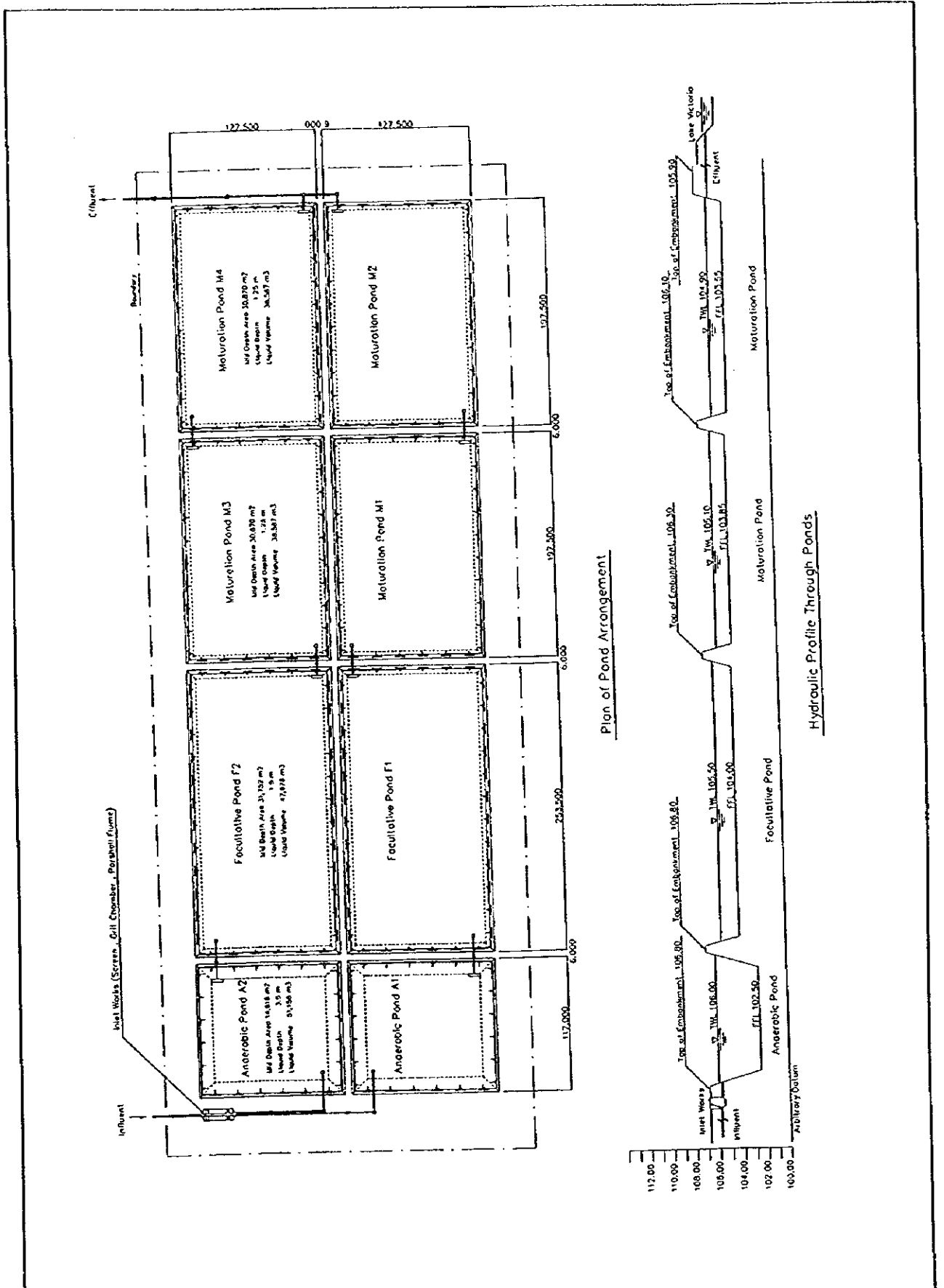


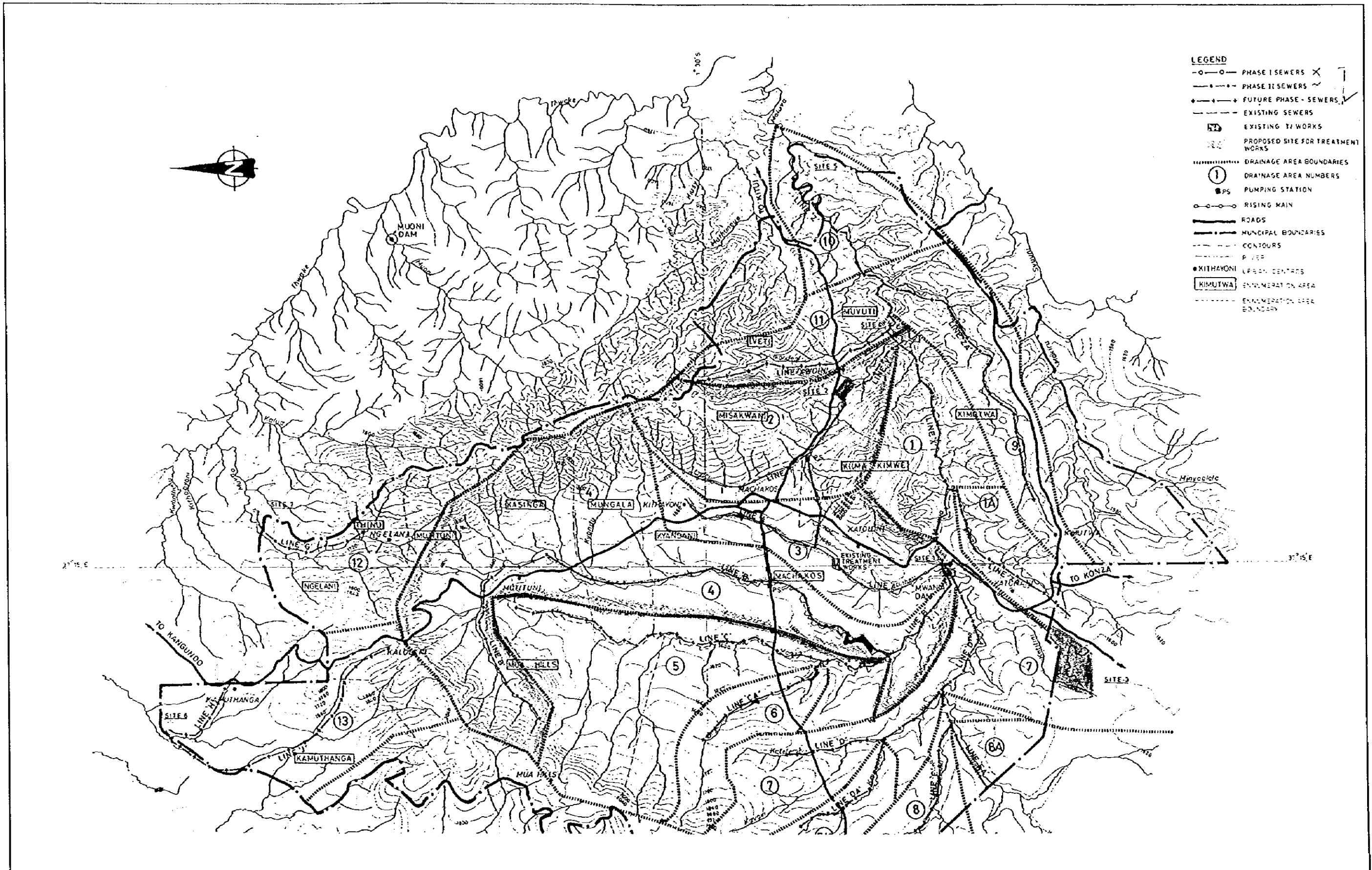
LEGEND

- Existing Works
- Phase I
- Phase II

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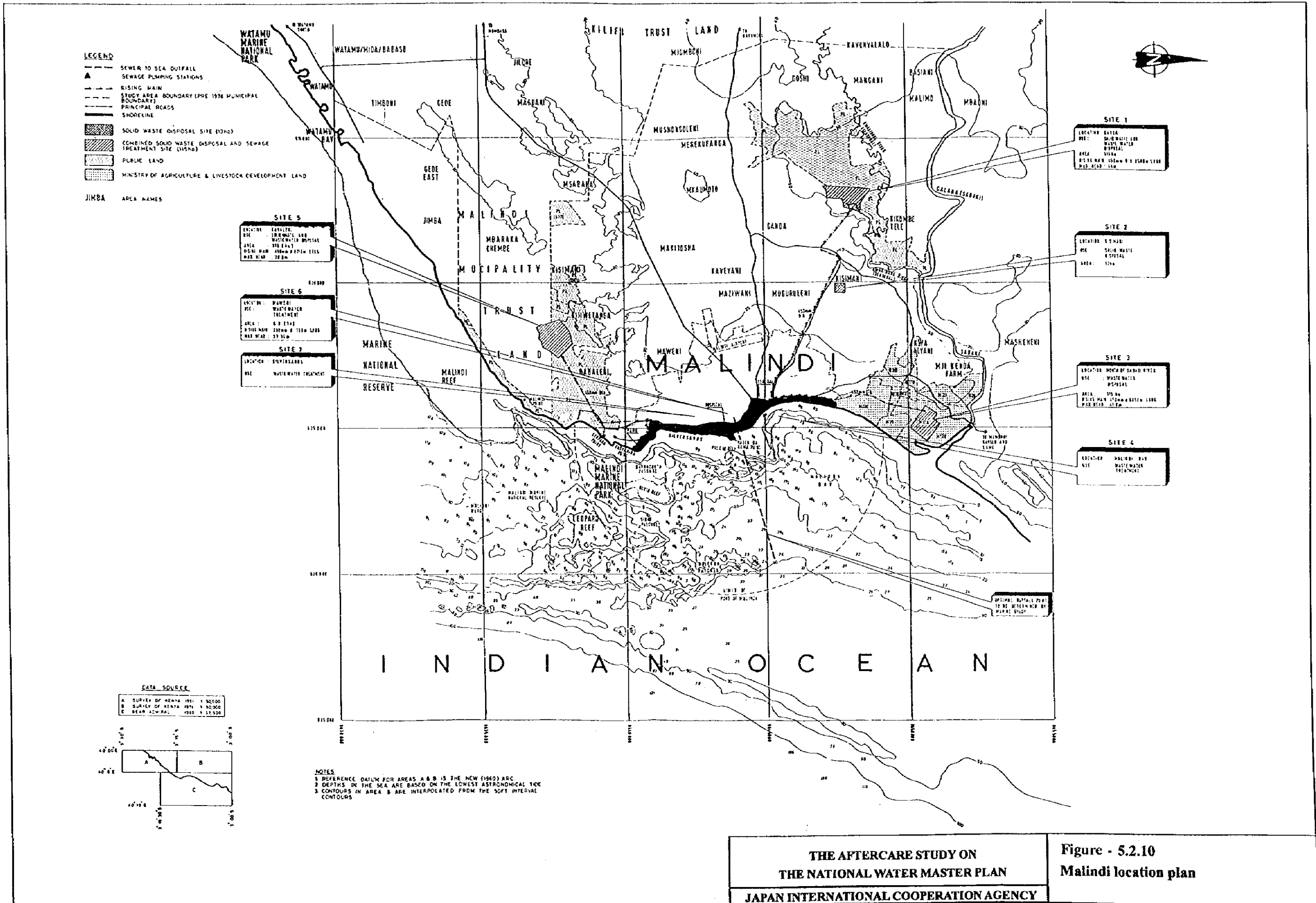
Figure - 5.2.7
 Kisumu - Layout of Nyalenda STW

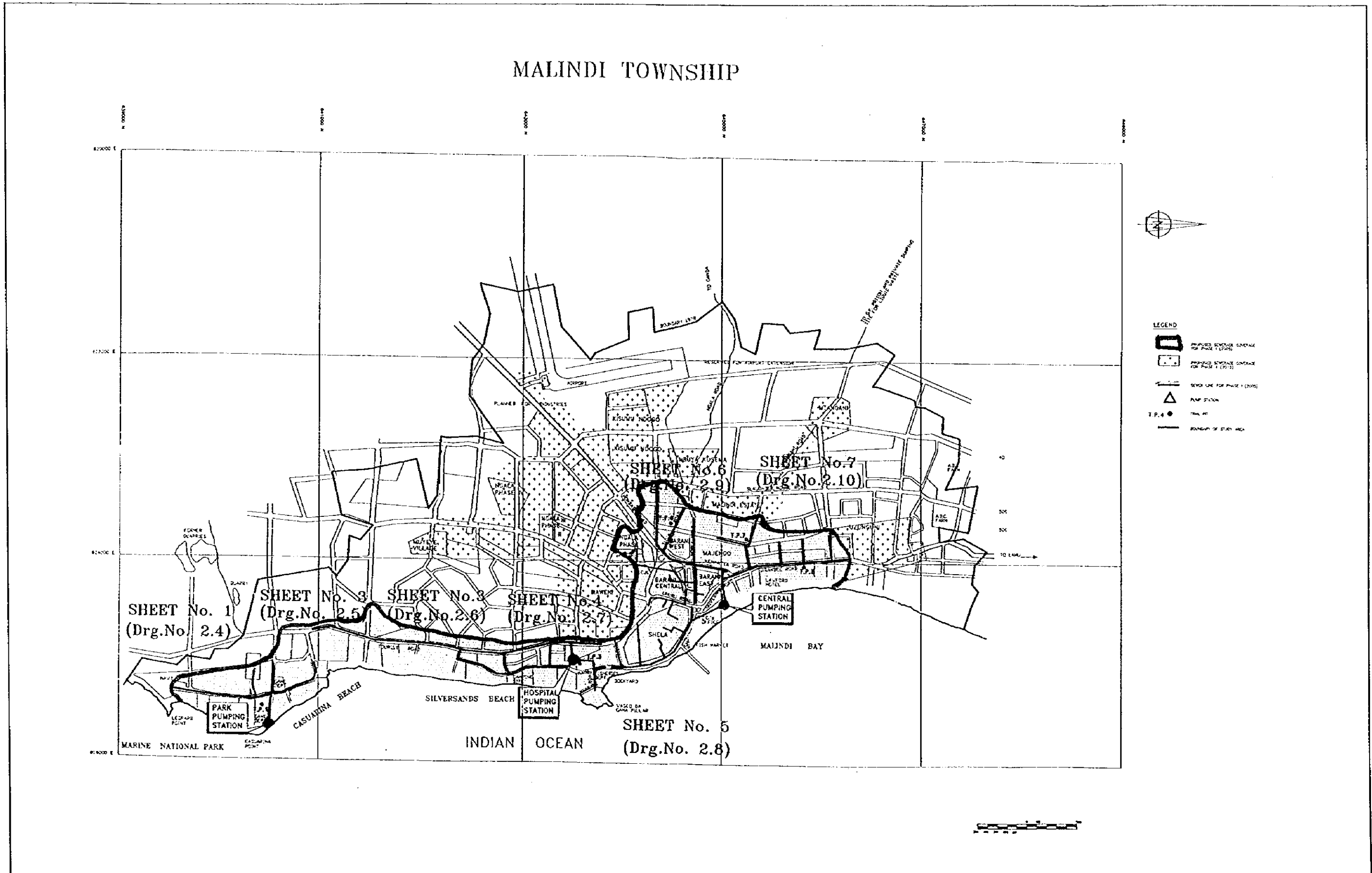




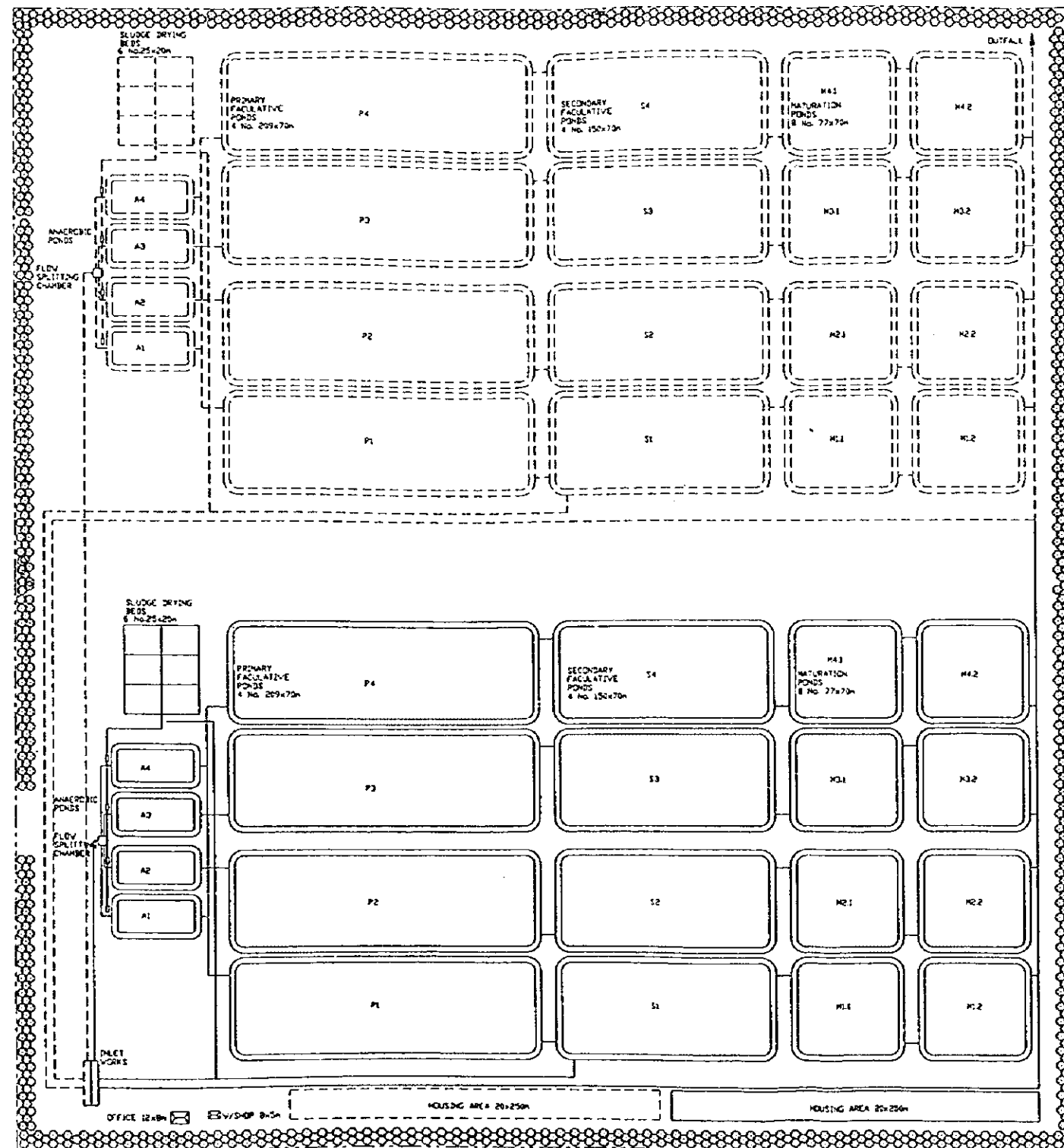
THE AFTERCARE STUDY ON
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Figure - 5.2.9
 Machakos sewerage master plan



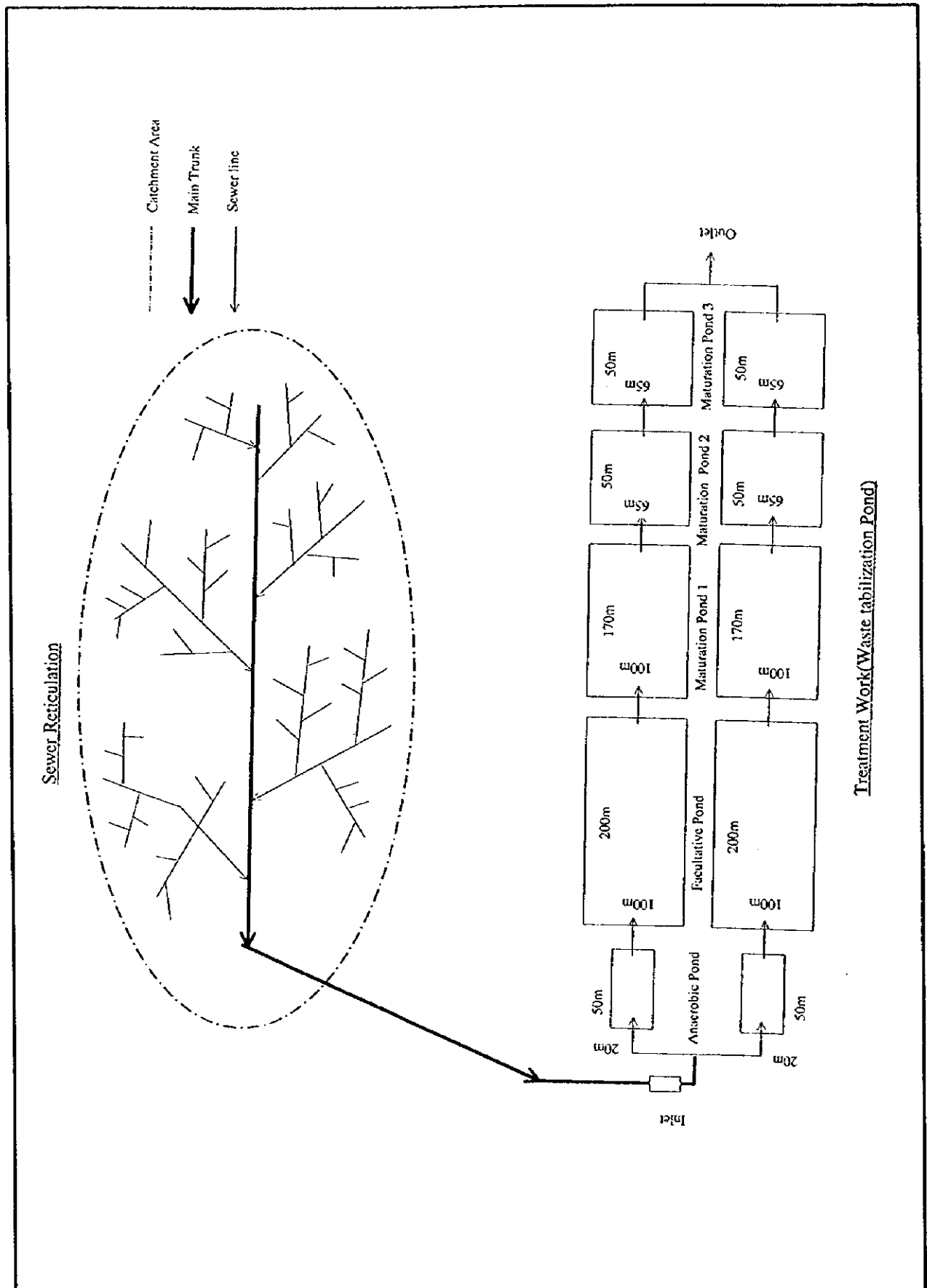


THE AFTERCARE STUDY ON THE NATIONAL WATER MASTER PLAN	Figure - 5.2.11 Malindi - proposed sewerage areas (phase 1)
JAPAN INTERNATIONAL COOPERATION AGENCY	



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Figure-5.2.12
 Malindi - treatment works layout



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Figure - 5.2.13
Sewer Reticulation and Treatment works
of Narok