

Table - 4.2.1 (1/6) Public Investment Programme of MWR, 1997/1998 - 1999/2000

No.	Project Name	Water-Retard Policy Water Supply Sewerage/ Sanitation	Priority	Source of Fund	Total Estimated Cost		Balance Required to Complete		Year Started	Year of Completion	Proposed Expenditure Schedule		Balance Remaining
					GOK	External Loan	GOK	External			1997/98	1998/99	
A. ON-GOING PROJECTS (280 PROJECTS)													
	A-1. GOK Funded Projects (232 Projects)												
060	Construction of Water Supply - Livelihood Programme	•	C		4,402		1,902		1990		517	645	740
043	Livelihood and Water Supply Development Programme - ENSDA	•	C		3,000		2,900		1992		500	1,000	1,300
059	Water Supply/Livelihood Development and Marketing - CDA	•	C		5,600		5,600		1994		25	300	5,000
061	Catchment Conservation and Rehabilitation - ENSDA	•	C		5,000		4,049		1994		25	2,400	1,624
116	Rehabilitation of Canals & Proposed Gravity System - BISP	•	C		735		735		1992		20	40	40
119	Rehabilitation of Canals & Proposed Gravity System - BISP	•	C		3,500		2,000		1988		209	800	1,000
204	Groundwater Development	•	C		100		100		1990		30	30	40
479	Construction of Water Supply - Rehab (SDD)	•	C		114,000		66,000		1995		16,000	24,000	26,000
519	Construction of Water Supply - Rehab (SDD)	•	C		3,150		2,350		1987		300	1,050	1,000
577	Yala Pava Canals - LBDA	•	C		1,000		210		1984		900	150	60
616	Construction of Water Supply - Kalyanika	•	C		15,000		14,400		1987		900	1,200	12,200
777	Construction of Water Supply - Saha/Wenaga	•	C		2,000		1,911		1991		250	810	851
778	Construction of Water Supply - Nema/Kahoren	•	C		2,000		1,911		1992		50	70	70
815	Construction of Water Supply - Kalyanika	•	C		3,000		1,000		1991		100	500	400
815	Construction of Water Supply - Kalyanika	•	H		115		50		1989		15	15	20
815	Construction of Water Supply - Kalyanika	•	H		413		250		1995		50	100	100
815	Construction of Water Supply - Kalyanika	•	H		2,000		500		1999		200	200	150
815	Construction of Water Supply - Kalyanika	•	H		860		400		1995		30	144	100
815	Construction of Water Supply - Kalyanika	•	H		900		274		1989		50	100	100
824	Construction of Water Supply - Wansu Laxo	•	H		5,400		2,500		1990		500	1,000	1,000
825	Construction of Water Supply - Wansu Laxo	•	H		5,000		1,606		1995		100	800	700
826	Construction of Water Supply - Malyo	•	H		482		482		1992		30	10	442
828	Construction of Water Supply - Koppin	•	H		210		200		1994		60	40	100
838	Female Minor Multipurpose Project - LBDA	•	H		1,500		500		1994		100	200	200
841	Agricultural and Irrigation Development - ENSDA	•	H		600		445		1995		135	150	160
047	DM/PMK Construction - ENSDA	•	H		2,500		2,348		1993		100	100	248
048	Horizontal and Irrigation Development - ENSDA	•	H		1,500		1,333		1991		133	600	600
049	Construction of Water Supply - Puyyil/Bomala	•	H		950		100		1998		80	20	20
057	Minor Urban Water Supply Programme	•	H		8,000		3,977		1974		105	405	607
062	Construction of Water Supply - Kurnimpu/Nalanga	•	H		2,500		500		1995		150	250	100
069	Construction of Water Supply - Wansu Laxo	•	H		850		200		1990		100	100	100
070	Construction of Water Supply - Wansu Laxo	•	H		35,000		34,816		1985		150	450	500
071	Construction of Water Supply - Ashi Yalla	•	H		500		250		1977		50	100	100
072	Construction of Water Supply - Chala	•	H		2,000		1,500		1992		300	500	200
073	Construction of Water Supply - Wansu	•	H		4,500		4,750		1990		100	150	4,300
074	Construction of Water Supply - Maudera	•	H		1,100		500		1992		100	100	100
075	Construction of Water Supply - Nyanam	•	H		1,250		740		1999		200	350	190
076	Construction of Water Supply - Migen	•	H		2,500		2,426		1993		100	340	706
081	Construction of Water Supply - Kithika	•	H		6,000		3,900		1986		100	1,000	2,000
084	Construction of Water Supply - Kithika	•	H		8,500		500		1995		150	150	200
085	Construction of Water Supply - Niramiti/Maama - Mera	•	H		2,000		1,000		1993		200	300	500
048	Construction of Water Supply - Bunni	•	H		1,500		1,000		1993		100	300	600
089	Construction of Water Supply - Bunni	•	H		4,000		2,000		2001		200	500	300
090	Construction of Water Supply - Haddo	•	H		300		100		1991		20	35	45
091	Construction of Water Supply - Haddo	•	H		500		300		1993		50	100	150
093	Construction of Water Supply - Kewaga	•	H		5,000		300		1993		100	100	150
095	Tourism and Fisheries Development - CDA	•	H		500		4,980		1994		100	2,500	2,130
099	Task Plan Scheme - NIR	•	H		250		100		1993		10	20	70
100	Palma Rehabilitation and Extension - NIR	•	H		200		200		1995		100	100	100
103	Abm Research Station - NIR	•	H		800		100		1995		100	250	150
110	Rehabilitation of Hoja Pumping Station - NIR	•	H		3,000		500		1994		300	700	800
112	Construction of Office, Mills and Store - NIR	•	H		2,000		2,000		1994		200	800	800
114	Construction of Water Supply - Kivanyi Rural	•	H		4,000		1,800		1994		100	50	50
115	Construction of Water Supply - Kivanyi Rural	•	H		1,743		1,500		1991		100	400	400

Table - 4.2.1 (2/6) Public Investment Programme of MWR, 1997/1998 - 1999/2000

(Unit: 1,000 Kshs)

No.	Project Name	Water Supply	Sewerage/Sanitation	Priority	Source of Fund	Total Estimated Costs			Balance Required to Complete		Year Started	Year of Completion	Planned Expenditure Schedule	Balance Remaining
						GOK	External Credit	Internal Loan	GOK	External				
117	Construction of Water Supply - Sidihi Malaka	•		H		1,150			900		1981	2000	100	200
118	Construction of Water Supply - Oyats	•		H		2,150			2,150		1991	2001	100	100
119	Construction of Water Supply - Ibbasa	•		H		2,000			2,000		1992	2001	100	100
120	Construction of Water Supply - Mwal Mwalaka	•		H		2,000			2,000		1988	1999	150	150
121	Construction of Water Supply - Eteon Kiding	•		H		5,600			5,600		1992	2001	50	50
134	Community Well Project - TIP	•		H		500			500		1988	1994	40	40
135	Construction of Water Supply - Sijor Longia	•		H		1,000			421		1992	2003	50	150
139	Construction of Water Supply - Fort Tuman	•		H		500			200		1979	2000	83	83
140	Construction of Water Supply - Mwal	•		H		500			103		1984	1998	50	150
143	Construction of Water Supply - Kuniini	•		H		900			400		1988	2000	50	50
145	Construction of Water Supply - Namboi	•		H		1,500			600		1984	1999	100	100
151	Construction of Water Supply - Namboi	•		H		900			200		1984	1999	100	100
157	Construction of Water Supply - Mwal	•		H		1,200			600		1988	2001	200	200
160	Construction of Water Supply - Sidihi Malaka	•		H		1,200			500		1990	1999	100	100
162	Construction of Water Supply - Mwal	•		H		1,700			400		1990	2000	200	200
208	Construction of Water Supply - Mwal Kuchilla	•		H		4,250			1,700		1995	2001	150	200
216	Construction of Water Supply - Thaba NWCP	•		H		825			1,600		1992	2004	105	315
220	Rehabilitation of Malaria Headquarters	•		H		1,500			645		1990	1999	200	200
234	Construction of Water Supply - Hala	•		H		700			500		1998	1999	150	150
238	Construction of Water Supply - Jua	•		H		2,000			300		1995	2000	200	200
246	Construction of Water Supply - Mwal	•		H		2,500			500		1985	2001	220	220
252	Construction of Water Supply - Umat Dam	•		H		7,000			1,433		1990	2001	300	300
254	Construction of Water Supply - Mwal	•		H		5,000			6,350		1992	2004	300	300
256	Construction of Water Supply - Mwal	•		H		1,605			1,000		1995	2001	150	200
261	Construction of Water Supply - Mwal	•		H		2,450			1,565		1992	2005	50	50
263	Construction of Water Supply - Mwal	•		H		2,100			200		1986	1998	50	50
265	Construction of Water Supply - Mwal	•		H		1,000			300		1980	1998	75	75
310	Construction of Water Supply - NWCP	•		H		15,000			300		1980	1998	200	250
318	Construction of Water Supply - Mwal	•		H		4,150			14,700		1988	2010	150	200
321	Construction of Water Supply - Mwal	•		H		2,000			1,446		1994	2004	50	50
326	Construction of Water Supply - Mwal	•		H		1,500			1,500		1980	1999	150	150
328	Construction of Water Supply - Mwal	•		H		9,000			800		1995	2001	100	200
329	Construction of Water Supply - Mwal	•		H		760			5,000		1985	2006	100	200
349	Construction of Water Supply - NWCP	•		H		350			300		1995	1999	25	25
353	Construction of Water Supply - Thaba	•		H		3,240			298		1995	2004	445	897
358	Construction of Water Supply - Thaba	•		H		2,596			1,642		1990	2002	300	596
359	Construction of Water Supply - Mwal	•		H		1,064			1,596		1989	2004	100	200
403	Construction of Water Supply - Mwal	•		H		1,046			564		1990	2000	400	400
406	Construction of Water Supply - Mwal	•		H		900			820		1995	2000	125	125
408	Construction of Water Supply - Mwal	•		H		770			607		1995	2002	50	100
411	Construction of Water Supply - Mwal	•		H		900			270		1995	2000	200	200
412	Construction of Water Supply - Mwal	•		H		1,000			786		1990	2000	100	200
413	Construction of Water Supply - Mwal	•		H		10,000			800		1990	2001	100	100
414	Construction of Water Supply - Mwal	•		H		1,800			9,963		1995	2006	70	70
419	Construction of Water Supply - Mwal	•		H		17,948			1,734		1995	2003	300	300
420	Construction of Water Supply - Mwal	•		H		14,000			1,018		1985	2002	110	1,100
429	Construction of Water Supply - Mwal	•		H		500			13,865		1995	2006	130	130
436	Construction of Water Supply - Mwal	•		H		600			370		1999	1999	30	300
447	Construction of Water Supply - Mwal	•		H		500			552		1995	1999	130	150
470	Construction of Water Supply - Mwal	•		H		500			300		1991	1999	65	65
494	Construction of Water Supply - Mwal	•		H		1,200			270		1995	1999	100	100
546	Construction of Water Supply - Mwal	•		H		1,500			500		1991	2002	100	150
553	Construction of Water Supply - Mwal	•		H		1,500			600		1985	2002	100	150
566	Construction of Water Supply - Mwal	•		H		6,000			1,000		1991	2004	100	200
571	Construction of Water Supply - Mwal	•		H		814			5,200		1994	2002	132	132
573	Construction of Water Supply - Mwal	•		H		2,000			346		1985	1999	100	350
579	Construction of Water Supply - Mwal	•		H		1,650			1,416		1984	2001	10	50
602	Construction of Water Supply - Mwal	•		H		1,650			140		1984	2001	140	140

Table - 4.2.1 (3/6) Public Investment Programme of MWR, 1997/1998 - 1999/2000

No.	Project Name	Water Supply	Sewerage/Sanitation	Priority	Source of Fund	Total Estimated Costs			Balance Required in Complete		Year Started	Year of Completion	Proposed Expenditure 1997/98	1998/99	1999/00	Balance Remaining
						GOK	External Grant	External Loan	Total	Internal						
581	Construction of Building Headwaters - LRDA			H		7,107			7,107	1,351	1985	109	500	500	2,900	
589	Flood Control and Disease - LRDA			H		6,900			6,900	4,000	1990	40	200	200	5,700	
591	Yala Swamp Phase II - LRDA			H		17,600			17,600	6,380	1982	2010	100	100	17,200	
592	Minor Irrigation - LRDA			H		19,500			19,500	17,500	1995	2005	20	40	9,287	
594	Hydro-meteorological Survey of L. Victoria			H		116			116	9,362	1987	2005	60	50		
596	Construction of Water Supply - Village			H		1,500			1,500	110	1987	1998	100	100	10,360	
620	Water and Sewerage Development - ENNDA			H		15,000			15,000	5,000	1999	2004	300	300	640	
626	Construction of Residential - CDA			H		5,000			5,000	12,000	1995	2004	300	300	1,000	
630	Construction of Water Supply - Mbita/Kisumu/Elisi			H		6,750			6,750	4,200	1994	2001	350	100	4,950	
632	Construction of Water Supply - Mbita/Kisumu/Kerua			H		20,000			20,000	5,500	1990	2010	250	100	14,550	
633	Construction of Water Supply - Mt. Elgon, Kapsowon			H		1,000			1,000	500	1990	1999	100	100		
640	Thru Feed Wind Project - BNSP			H		1,650			1,650	300	1990	1999	50	50		
649	Construction of Pambana KDFM			H		2,500			2,500	600	1995	1999	100	100		
664	Rehabilitation of Equipment - NIB			H		1,500			1,500	3,000	1995	2003	500	500	1,800	
675	Therco/Tlum Project - ENNDA			H		4,070			4,070	250	1995	2000	80	75	95	
724	Water Catchment Protection and Preservation			H		4,000			4,000	3,000	1995	2008	200	100	2,400	
725	Construction of Water Supply - Kamwath			H		1,500			1,500	400	1991	2000	100	100		
726	Construction of Water Supply - Othman			H		1,000			1,000	750	1978	2003	140	100	350	
727	Construction of Water Supply - Suwa			H		2,250			2,250	1,000	1995	2003	150	100	600	
739	Construction of Water Supply - Ilak			H		1,500			1,500	1,000	1995	2004	140	100	600	
740	Construction of Water Supply - Kuga			H		2,000			2,000	1,600	1978	2001	300	300	100	
741	Construction of Water Supply - Gausu			H		250			250	150	1993	2000	50	50		
742	Construction of Water Supply - Buiwa/Dhadwah/Flua			H		1,200			1,200	300	1990	2000	100	100		
744	Construction of Water Supply - Mbita			H		1,000			1,000	200	1998	1998	50	50		
745	Construction of Water Supply - Ruwa			H		1,500			1,500	500	1992	2001	100	100	200	
746	Construction of Water Supply - Mbita			H		500			500	200	1993	1998	50	50		
747	Construction of Water Supply - Ntira Protection			H		2,200			2,200	500	1993	2001	150	150	100	
748	Construction of Water Supply - West Kamwathyo			H		1,300			1,300	500	1992	2006	120	130	50	
749	Construction of Water Supply - Lemba			H		2,500			2,500	2,000	1992	2010	250	370	200	
750	Construction of Water Supply - White			H		300			300	200	1992	1999	70	80	80	
751	Construction of Water Supply - Bunt Mills			H		600			600	400	1994	2001	150	100	150	
752	Construction of Water Supply - Nsubale Rural			H		1,200			1,200	500	1995	2001	150	150	100	
753	Construction of Water Supply - Kapsa			H		800			800	300	1994	1999	50	100		
754	Construction of Water Supply - Kapsa			H		800			800	300	1994	1999	50	100		
755	Construction of Water Supply - Babab			H		750			750	400	1991	1999	50	100		
756	Construction of Water Supply - Nungu Ekibe			H		1,200			1,200	200	1999	1999	50	100		
757	Construction of Water Supply - Kiroko/Kobogola			H		1,300			1,300	300	1992	1999	50	100		
758	Construction of Water Supply - Lintakwe			H		750			750	400	1989	2000	100	100	200	
761	Construction of Water Supply - Ndoria			H		800			800	500	1989	2001	150	100	100	
762	Construction of Water Supply - Ndoria			H		500			500	200	1990	1998	50	50		
763	Construction of Water Supply - Barambaga			H		200			200	100	1990	1998	50	50		
764	Construction of Water Supply - Nturo			H		500			500	350	1992	2001	100	100	50	
765	Construction of Water Supply - Nturo			H		400			400	200	1999	1999	50	100		
774	Construction of Water Supply - Jum			H		1,600			1,600	500	1990	2001	100	150	50	
775	Construction of Water Supply - Anjaro			H		1,250			1,250	750	1990	2001	100	100	400	
776	Construction of Water Supply - ODA			H		1,300			1,300	500	1990	2001	100	100	50	
013	Investigations, Plans and Design			M		1,000			1,000	500	1991	2002	150	50	70	
014	Basic Irrigation Research Station - BISP			M		2,500			2,500	400	1991	2001	130	70	100	
018	Construction of Water Supply - Thirika			M		5,000			5,000	4,500	1988	2010	150	50	50	
020	Kaji River Multi-Purpose Dam Development Project			M		2,000			2,000	400	1992	2000	50	200		
021	Fish Development in Lake Victoria - LRDA			M		1,500			1,500	500	1991	2000	100	250		
027	Fish Processing Plant and Cold Storage - LRDA			M		5,000			5,000	4,000	1992	1999	100	150		
028	Minor Irrigation - LRDA			M		750			750	500	1993	2001	200	1,000	800	
040	Minor Irrigation - ENNDA			M		845			845	300	1990	1999	50	100		
042	Catchment Conservation at Rehabilitation - ENNDA			M		2,000			2,000	1,000	1995	2002	150	150	400	
044	Construction of Water Supply - Chagoch/Chagoko			M		750			750	500	1999	2000	50	100		
055	Construction of Water Supply - Babu Rural			M		2,000			2,000	1,000	1995	2002	150	150		
058	Homebased and Irrigation Development - CTA			M		2,000			2,000	1,000	1995	2002	150	150	400	

Table - 4.2.1 (4/6) Public Investment Programme of MWR, 1997/1998 - 1999/2000

(Unit: 1,000 Kshs)

No.	Project Name	Water Supply	Water-Retard Projects/ Sewerage/ Sanitation	Priority	Source of Fund	Total Estimated Costs			Balance Required to Complete		Year of Completion	Proposed Expenditure Schedule		Balance Requiring
						GOK	Interest Loan	Total	GOK	External		1997/98	1998/99	
85	Minor Irrigation - BNNDA			M		500		500	200		1999	50	450	
86	Construction of Buildings - Non residential - BNNDA			M		2,380		2,380	2,380		2002	300	880	
86	Construction of Buildings - Non residential - BNNDA			M		750		750	700		2001	100	300	
87	Dean Construction - CDA			M		1,500		1,500	1,000		2002	150	350	
87	Dean Construction - CDA			M		1,000		1,000	800		2002	100	350	
107	Water Irrigation Scheme - Feasibility Study - NIB			M		200		200	150		1999	50	50	
109	Water Irrigation Scheme - Feasibility Study - NIB			M		300		300	300		2001	100	50	
135	Construction of Water Supply - Oldonyi Nyirio/Ruviri/Mwanusa			M		1,300		1,300	300		2000	50	150	
137	Construction of Water Supply - Kipiro/Njira			M		500		500	300		2000	100	150	
164	Construction of Water Supply - Tindiro			M		1,400		1,400	400		2000	50	150	
186	Construction of Water Supply - Narainiro			M		1,700		1,700	300		2000	50	150	
211	Construction of Water Supply - Mwakajulu			M		2,400		2,400	1,500		2006	150	1,100	
226	Construction of Water Supply - Small Schemes			M		5,000		5,000	4,000		2010	100	3,550	
227	Construction of Water Supply - Settlement Schemes			M		2,300		2,300	1,300		2008	150	650	
228	Grants for Water Supply			M		3,200		3,200	2,200		2006	170	1,690	
230	Grants to Non Governmental Organizations			M		100		100	100		1999	40	20	
232	Construction of Water Supply - Thambi			M		200		200	200		1997	100	100	
262	Construction of Water Supply - Organic Bonga			M		5,000		5,000	400		1998	200	200	
274	Expansion of Basin Survey			M		1,000		1,000	200		1999	50	70	
284	Construction of Water Supply - Wundani Group			M		750		750	150		1999	50	80	
285	Small Area Based Water Mainlining			M		200		200	80		2001	70	20	
288	Study Of Inland Lakes			M		50		50	20		1998	10	10	
290	Water Sector Policy/Master Plan Update			M		100		100	50		1998	5	35	
303	Employment Survey			M		50		50	25		1990	5	10	
308	Drilling and Borehole Recharge			M		500		500	350		1990	40	50	
309	Construction of Water Supply - Kipiro/Njira Project			M		2,000		2,000	1,500		2006	130	1,100	
339	Construction of Water Supply - Embu Urban - (NWQPC)			M		1,500		1,500	437		1989	200	127	
415	Construction of Water Supply - Palani West - (NWQPC)			M		2,350		2,350	1,000		2003	150	300	
428	Construction of Water Supply - Ahi River - (NWQPC)			M		500		500	141		1999	50	41	
432	Construction of Water Supply - Kijido/Kirigati - (NWQPC)			M		1,200		1,200	100		1991	20	20	
437	Construction of Dams - Mulari - (NWQPC)			M		4,500		4,500	2,000		2001	50	1,000	
438	Construction of Dams - Jels - (NWQPC)			M		2,700		2,700	2,000		2003	50	1,100	
470	Construction of Water Supply - Subulira			M		2,000		2,000	1,000		2001	50	1,000	
480	Water Catchment Protection			M		1,000		1,000	200		1999	50	50	
570	Priority Development - LIDA			M		400		400	200		2010	10	10	
572	Green Project - LIDA			M		1,400		1,400	1,000		2010	10	10	
574	Greenland Development - LIDA			M		1,000		1,000	500		2004	60	70	
576	Blue Kipiro Project - LIDA			M		1,000		1,000	500		2004	20	50	
580	Catchment Conservation and Rehabilitation - LIDA			M		1,000		1,000	500		2004	20	50	
581	Rural Development Scheme - LIDA			M		9,038		9,038	8,794		2006	50	50	
585	Construction of Buildings (Residential) - LIDA			M		500		500	212		1981	52	70	
585	Construction of Buildings (Residential) - LIDA			M		11,982		11,982	8,000		1991	100	400	
586	Construction of Water Supply - Nyando/Muhoro/Tindiro			M		170,000		170,000	175,994		2006	30	30	
587	LIDA Water Resources Database			M		780		780	500		1986	30	225	
615	Catchment Conservation and Rehabilitation - CDA			M		2,500		2,500	7,000		2001	50	50	
621	Purchase of Desalination Equipment - TRP			M		250		250	125		1992	10	15	
622	Construction of Buildings - TRP			M		1,500		1,500	1,000		1994	10	15	
651	Rehabilitation of Water Irrigation Scheme II - NIB			M		2,000		2,000	500		1990	20	50	
652	Water Irrigation Scheme (Low) - NIB			M		1,000		1,000	100		1989	50	20	
653	Water Irrigation Scheme (Low) - NIB			M		1,000		1,000	50		1988	20	10	
684	Water Irrigation Pump Replacement - NIB			M		70		70	40		1988	20	30	
685	Water Irrigation Agricultural Development Project - NIB			M		100		100	40		1988	20	30	
686	Water Power Project - NIB			M		200		200	100		1991	20	50	
687	Construction of Water Supply - Eseri/Gege			M		2,500		2,500	1,800		1989	200	300	
699	Construction of Water Supply - Gucha/Kinyua/Oleno			M		2,500		2,500	2,400		1988	200	1,600	
716	Construction of Water Supply - Naurik			M		750		750	500		2002	150	75	
718	Construction of Water Supply - Mchikaa			M		2,000		2,000	200		1991	20	50	
720	Construction of Water Supply - Sor			M		900		900	800		2001	170	50	
721	Construction of Buildings - Non Residential - TRP			M		2,400		2,400	400		1991	110	30	
770	Construction of Water Supply - Luyisi			M		2,000		2,000	500		2001	150	250	

Table - 4.2.1 (5/6) Public Investment Programme of MWR, 1997/1998 - 1999/2000

No.	Project Name	Water-Related Projects		Priority	Source of Fund	Total Estimated Costs		Balance Required to Complete		Year Started	Year of Completion	Proposed Investment Schedule		Balance Remaining	
		Water Supply	Sewerage/Sanitation			Internal Grant	External Loan	COG	Total			COG	External		1997/98
771	Construction of Water Supplies - Yala	•		M	NETHERLANDS	500	150	300	300	1991	2001	50	150	100	
772	Construction of Water Supplies - Pusan Nakhon	•		M	NETHERLANDS	3,200	3,200	1,000	1,000	1990	2001	150	100	150	
773	Construction of Water Supply - Chalongkui	•		M	NETHERLANDS	2,400	2,400	500	500	1991	2001	50	150	250	
SUB-TOTAL: COG-FUNDED PROJECTS															
A.2. External Fund Projects (48 Projects)						899,191	899,191	608,016	608,016				42,365	75,007	95,844
607	Kajado ASAL	•		C	NETHERLANDS	1,744	16,503	1,684	11,446	1987	2004	3,000	1,544	1,000	
608	Lalupa ASAL	•		C	NETHERLANDS	70	21,070	60	21,000	1995	1999	6,600	6,700	7,700	
611	Water Pumps ASAL	•		C	NETHERLANDS	44	4,345	20	205	1995	2000	90	65	50	
612	Elkayo Mwanishi ASAL	•		C	NETHERLANDS	70	5,066	20	217	1995	1999	404	400	907	
617	Chimaji ASAL Development Project	•		C	NETHERLANDS	634	3,595	20	2,171	1991	1995	1,400	1,867	962	
636	Rescaled Kien Project (ADP/OPRC) - LBDA	•		C	ADP	2,309	20,127	1,718	6,516	1988	1999	10,000	10,000	9,500	
257	Construction of Water Supplies - Garam Urban	•		C	SAUDI	12,100	106,490	13,530	62,050	1991	2001	10,000	10,000	9,500	
345	2nd Rombease & Central Water Supplies - Engineering and Rehabilitation - NW/CPC	•		C	ITALY	34,000	85,000	30,480	42,916	1992	2006	9,625	3,625	5,850	
351	Construction of Dams - Kruaidiki - NW/CPC	•		C	NETHERLANDS	20	6,020	20	6,020	1995	1997	6,020	-	-	
484	Training of Water Works Personnel - KEMV	•		C	FRANCE	98	5,398	98	5,398	1995	2001	1,000	720	3,268	
628	Mwaa Irrigation Scheme (Mjijini) - NID	•		C	OTRIBUS	150	3,150	150	2,671	1990	2000	1,000	777	1,000	
707	Interphone Irrigation Scheme	•		C	IDA	11,100	11,100	11,000	177,000	1996	2000	2,500	2,500	2,500	
035	Construction of Water Supplies - Mawee Pipeline	•		H	AUSTRIA	850	33,350	850	11,666	1994	2000	10,000	1,000	1,506	
087	Construction of Water Supplies - Mawee/Mawee/Kulu	•		H	JAPAN	3,400	2,600	2,500	2,500	1992	2003	750	850	1,000	
087	Construction of Water Supplies - Mawee/Mawee/Kulu	•		H	NETHERLANDS	1,000	6,000	1,000	5,000	1991	1999	1,200	2,400	2,400	
087	Construction of Water Supplies - Tigiano	•		H	NETHERLANDS	2,075	6,820	775	1,344	1991	1999	1,300	1,300	660	
304	Rural Water Supply and Sanitation Programme - Phase IV	•		H	IDA	5,000	16,400	400	2,265	1987	2001	2,000	1,000	1,25	
331	Construction of Water Supply - Kuti ASAL	•		H	IDA	600	7,000	2,438	4,420	1994	1999	1,440	1,000	1,000	
334	Construction of Water Supply - Burigo	•		H	IDA	600	2,046	227	2,046	1994	2000	800	473	1,000	
365	Construction of Water Supply - Garam Mawee - NW/CPC	•		H	FRANCE	385	6,817	385	5,672	1991	2003	1,000	1,000	1,000	
418	Construction of Water Supplies - Napambur - NW/CPC	•		H	JAPAN	600	25,600	600	25,000	1994	2005	2,000	2,000	4,334	
450	Construction of Water Supply - Napambur - NW/CPC	•		H	IDA	1,000	10,000	855	9,000	1994	1999	500	5,000	3,995	
455	Majidi Pipeline Project	•		H	IDA	1,132	5,132	501	5,012	1994	2002	1,001	1,000	2,412	
493	Construction of Water Supply - Sabale (Benche Inake II)	•		H	IDA	300	24,000	300	22,000	1994	2004	3,000	50	10	
502	Community Water Supply Management Programme (Wawatu)	•		H	NETHERLANDS	1,350	9,100	1,350	7,700	1991	1999	3,500	3,500	2,100	
502	Opp Areas Small Holders & Community Services	•		H	NETHERLANDS	413	2,107	246	1,090	1991	1999	300	436	600	
537	Women Group and Community Support	•		H	NETHERLANDS	1,023	10,921	1,423	5,488	1991	2001	1,467	3,060	1,322	
540	Construction of Water Supply - Kilifi	•		H	NETHERLANDS	1,500	10,500	941	3,693	1990	1999	785	2,500	1,149	
552	Burigo P.F. Project	•		H	NETHERLANDS	20	6,020	20	6,020	1989	1999	2,000	2,000	2,020	
555	Fish Processing Plant & Cold Storage - LBDA	•		H	ITALY	6,000	6,000	-	5,995	1990	1999	2,049	2,549	1,397	
575	Fish Processing Plant - LBDA	•		H	ITALY	729	729	146	146	1984	2000	50	50	46	
595	Construction of Community Wells	•		H	NETHERLANDS	7,000	147,000	3,080	136,343	1990	2006	380	20,000	20,000	
700	Development of Small Scale Fish Farming - LBDA	•		H	NETHERLANDS	1,000	6,500	1,000	5,500	1990	2005	1,200	1,500	1,000	
701	Construction of Water Supply - Greater Chusabwa	•		H	UNDP	729	3,044	729	2,315	1991	2002	300	300	600	
703	Abis River Basin Management	•		H	FRANCE	20,000	20,000	-	19,000	1996	1999	2,000	8,250	17,250	
704	Soilless Palm Oil Perpetua Project	•		H	FRANCE	136,000	136,000	-	125,000	1996	2000	3,000	3,000	5,000	
705	Construction of Water Supply - Mwanibale	•		H	ADP	20,000	20,000	-	19,000	1996	2005	3,000	49,000	10,000	
706	Pre-Investment Study/Small Urban Centre	•		H	JAPAN	20,000	20,000	-	19,000	1996	2000	1,500	61,500	62,000	
708	Construction of Water Supply - Mwanibale/Tungwe	•		H	JAPAN	20,000	20,000	-	20,000	1996	2000	2,000	9,000	9,000	
709	Construction of Water Supply - Sinik	•		H	JAPAN	15,000	15,000	-	15,000	1996	2000	1,000	7,000	7,000	
404	Construction of Water Supply - Mwanibale - NW/CPC	•		H	IDA	60,000	60,000	-	60,000	1996	2000	2,000	9,000	9,000	
717	Construction of Water Supply - Mwanibale - NW/CPC	•		M	IDA	1,000	26,000	50	25,000	1992	2004	20	30	20	
719	Construction of Water Supply - Liten	•		M	IDA	1,200	20,000	200	20,000	1990	2001	50	100	200	
SUB-TOTAL: EXTERNAL PROJECTS						103,332	594,503	66,501	1,101,957	1,168,358		115,544	275,416	234,896	
GRAND TOTAL						103,332	1,393,520	66,501	1,101,957	1,168,358		115,544	275,416	234,896	544,502

Table - 4.2.1 (6/6) Public Investment Programme of MWR, 1997/1998 - 1999/2000

No.	Project Name	Water-Ketard Projects Water Supply Sewerage/ Sanitation	Priority	Source of Fund	Total Estimated Costs			Balance Required to Complete		Year Started	Year of Completion	Proposed Expenditure Schedule			Balance Remaining
					GOK	External Grant	Loan	GOK	External			Total	1997/98	1998/99	
11. NEW PROJECTS (33 PROJECTS)															
634	Construction of Pottum Dam		H		20,000			20,000		1997	2004	500	3,000	4,000	125,000
635	Construction of Water Supply - Lamsai	•	H		1,960			1,960		1997	2003	100	70	30	1,740
664	Lake Chala Water Resources Development - CDA		H		800			800		1987	2001	100	100	150	350
729	Construction of Water Supply - Nibha Nisar Urban	•	H		2,250			2,250		1997	2001	925	125	200	1,000
730	Water Sanitation Project	•	H		50,000			50,000		1998	2006	700	1,500	7,000	40,800
732	Grasshopper and Water Project	•	H		5,000			5,000		1997	2004	600	500	1,000	2,400
734	Construction of Water Supply - Nyanaba Urban	•	H		2,000			2,000		1998	2000	700	1,000	300	
735	Construction of Water Supply - Nyanaba Urban	•	H		2,000			2,000		1998	2000	500	700	300	
736	Bombala Rehabilitation - ENNDA	•	H		1,500			1,500		1998	2000	375	250	250	
737	Construction of Water Supply - Mbatani	•	H		875			875		1997	2003	50	130	50	1,700
765	Construction of Tropic Dam	•	H		1,930			1,930		1998	1999		300	200	
767	Construction of Water Supply - Tushara	•	H		500			500		1998	1999		150	100	
769	Construction of Water Supply - Nyanaba Urban	•	H		250			250		1998	2002	200	300	400	3,100
667	Feasibility Development for Small Scale Rural Villages - CDA		H	ADB	4,000	8,000		12,000	9,000	1998	2002	515	2,573	1,666	4,000
630	Construction of Water Supply - Kapka	•	M		1,930			1,930		1987	2002	100	200	300	1,330
642	Levitation Development Project	•	M		50			50		1987	2000	16	16	18	
646	Greenhouse Monitoring and Conservation	•	M		600			600		1988	2001	200	100	100	200
651	Construction of Water Supply - Omboko Bombala	•	M		1,930			1,930		1977	2002	50	50	65	1,265
656	Buangi Bombala and Water Pans - NWQPC	•	M		500			500		1995	2005	100	200	100	100
657	Nyanaba Dam & Associated Work - NWQPC	•	M		35,000			35,000		1998	2003	100	14,750	15,750	4,400
658	Kiva Dam & Associated Work - NWQPC	•	M		15,000			15,000		1997	2002	500	15,000	8,000	5,000
660	Ampago Dam and Associated Work - NWQPC	•	M		27,000			27,000		1997	2003	100	12,100	12,200	2,600
661	Changani Dam and Associated Work - NWQPC	•	M		13,000			13,000		1997	2004	80	800	800	11,320
662	Poro Dam and Associated Work - NWQPC	•	M		18,000			18,000		1998	2005	100	2,000	5,000	10,400
667	Chai Horticultural and Feeding Facilities - CDA	•	M		220			220		1997	2001	20	70	30	80
688	Integrated Regional Development Master Plan - ENNDA	•	M		4,500			4,500		1998	2002	200	1,500	2,000	900
691	Emergency Water Supply Programme - ENNDA	•	M		4,000			4,000		1998	2002	100	1,000	1,500	900
696	Construction of Water Supply - Kambao/Kabwai	•	M		200			200		1997	2000	50	50	100	
711	Construction of Water Supply - Kariba	•	M		2,000			2,000		1997	2002	50	50	250	1,600
768	Construction of Water Supply - Bulew	•	M		1,500			1,500		1997	2002	50	100	100	1,250
673	On-farm Water & Stationing Dam, (Barren Province)	•	M	IPAD	4,500	7,645		12,145	7,645	1997	2003	500	500	500	6,145
674	Integrated Regional Development Master Plan - ENNDA	•	M	ADB	15,200	100,000		115,200	100,000	1998	2003	30,000	30,000	40,000	15,200
676	2nd Mombasa & Coastal Water Project - NWQPC	•	M	IDA	236,969	7,645		244,614	244,614	1998	2003	38,881	77,834	104,499	131,400
SUB-TOTAL: NEW PROJECTS					1,239,692	602,148		1,841,840	1,841,840			157,609	349,023	334,740	953,090
SUB-TOTAL ON-GOING PROJECTS					1,062,523	594,503		1,657,026	1,657,026			38,881	77,834	104,499	131,400
SUB-TOTAL NEW PROJECTS					236,969	7,645		244,614	244,614			38,881	77,834	104,499	131,400
GRAND TOTAL					1,239,692	602,148		1,841,840	1,841,840			196,790	426,857	439,239	1,086,298

(Unit: 1,000 Kshs)

Table - 4.2.2 (1/2) Public Investment Programme of MOLA, 1997/1998 - 1999/2000

No.	Project Name	Water-Related Projects		Priority	Source of Fund	Total Estimated Costs			Balance Required to Complete			Year Started	Year of Completion	Proposed Expenditure Schedule	Balance Remaining	
		Water Supply	Sewerage/Sanitation			GOK	External Loan	Total	GOK	External Loan	Total					1997/98
A. ON-GOING PROJECTS (18 PROJECTS)																
A-1. GOK-Funded Projects (25 Projects)																
073	Elitoni Land Acquisition			C		2,000		2,000			2,000	1993	1993	1,000	500	
276	Carica Sluiceway House			C		225		225			100	1990	1997	100	100	
307	Local Authority Dev. Programme - NIS			C		600		600			600	1993	2000	200	250	
434	Small Town Shelter - Malindi			C		600		600			600	1986	1988	150		
436	Local Authority Government Training (Water & Sewerage)			C		700		700			700	1991	2000	105	105	245
438	Marathi Slaughter House			C		300		300			300	1994	1998	150		
442	Marathi Slaughter House			C		325		325			325	1990	1998	150		
443	Construction of Chuka Slaughter House			C		310		310			310	1994	1998	150		
444	Home Bay Small Town Shelter			C		5,200		5,200			5,195	1988	2001	2,000	2,000	1,995
445	Home Bay Small Town Shelter			C		230		230			75	1993	1997	75		
446	Landfill Slaughter House			H		5,000		5,000			3,750	1991	2000	150	2,000	600
481	Napaki Sewerage Extension			H		7,200		7,200			7,100	1995	1998	100	3,000	4,000
224	Mtiti Town Sewerage			I		250		250			150	1990	2000	50	50	50
424	Mtiti Town Water Supply			I		500		500			220	1993	1994	200	300	
021	Mtiti Sewerage			M		400		400			400	1993	1998	100	300	
022	Ohaya Sewerage			M		4,000	6,000	10,000			4,750	1992	2001	500	500	1,000
023	Nyeri Municipal Council Sewerage			M		5,000		5,000			4,750	1992	2001	500	500	1,000
026	Empaka Sewerage Project			M		500		500			400	1989	1996	150	250	
223	Marathi Sewerage Project			M		225		225			225	1994	2000	125	100	
225	Marathi Town Sewerage Study			M		500		500			25	1992	1997	25		
341	Construction of Sewerage - Karatina			M		400		400			250	1992	1997	250		
342	Water Town Sewerage (Sanitation)			M		750		750			703	1993	2000	103	300	
344	Bomet - Sewerage(Sanitation)			M		750		750			750	1996	2000	100	150	
367	Mtiti Sanitation Study - Chuka			M		250		250			250	1994	1999	100	100	
368	Karatina Sanitation Improvement			M		750		750			750	1996	2000	100	150	
441	Thika Town Sewerage			M		750		750			750	1994	1999	300	250	
SUB-TOTAL GOK-FUNDED PROJECTS																
						33,065	6,000	39,065			30,668			10,700	4,333	5,630
A-2. External Fund Projects (23 Projects)																
019	Mtiti Sewerage			C	ADP	12,500		12,500			500	1992	1998	2,000	2,000	
040	Nyeri Municipal Council Sewerage			C	FRG	2,400		2,400			2,400	1991	2000	2,000		24,000
044	Kajiado Town Sewerage			C	JAPAN	10,000	9,500	19,500			9,500	1990	2000	3,000	1,000	
048	Bwacha Municipal Council Sewerage			C	ADP	5,000		5,000			600	1992	1998	1,000	1,500	
051	Nairobi Water III			C	ADP	15,520		15,520			15,452	1989	1999	2,000	2,000	60,700
055	Thika Municipal Council Water Supply			C	ADP	10,000		10,000			37,500	1993	2000	1,250	1,000	
061	Bidart Municipal Water			C	FRG	1,110		1,110			279,250	1991	2001	2,000	4,000	14,000
309	Kwaja Urban Transport Infrastructure Project			C	IDA	1,110	316,250	317,360			260,360	1991	2001	2,000	87,000	15,000
003	Kiabu Water Supply			I	FRG	500		500			500	1982	2000	2,000	1,000	16,300
027	Mombasa Municipal Council Sewerage			H	FRG	3,000		3,000			1,200	1988	2000	1,200	1,250	
056	Nyeri Water Supply			I	FRG	200		200			500	1992	1998	500		
228	Nyeri Water Supply			H	FRG	1,000		1,000			10,000	1986	2000	1,000	6,500	
319	Nairobi Wholesale Market			H	FRG	3,000		3,000			26,500	1989	2000	2,000	15,500	
320	Kenya Sewerage			H	ADP	7,500		7,500			20,000	1989	2000	2,000	5,000	
006	Kenya Urban Development			M	UNICEF	8,000		8,000			8,000	1989	1999	2,000	4,000	3,000
007	Nairobi Integrated Child Survival UNICEF			M	NETHERLANDS	2,200		2,200			2,030	1994	1999	60	1,970	
014	Environment and Urban Development Training Project			M	NETHERLANDS	5,220		5,220			3,085	1992	2000	1,500	2,265	
043	Elitoni Municipal Council Sewerage			M	FRG	100		100			800	1992	1999	270	350	
048	Mombasa Municipal Council Sewerage			M	UNICEF	2,300		2,300			1,800	1984	1998	40	1,760	
071	Kisumu Municipality Integrated CSD			M	UNICEF	2,300		2,300			1,550	1984	1999	30	1,320	
097	Pfizer Fighting Equipment			M	FRANCE	7,500		7,500			7,500	1992	2000	1,000	5,000	
437	Urban Settlement Upgrading Programme			M	FRG	400		400			50	1991	2000	50	100	
440	Sanitation of Nairobi CTC Casino			M	FRG/PPC	2,500		2,500			1,000	1992	1997	1,000		
SUB-TOTAL EXTERNAL PROJECTS						60,330	248,420	308,750			252,562			146,580	201,245	57,470

Table - 4.2.2 (2/2) Public Investment Programme of MOLA, 1997/1998 - 1999/2000

(Unit: 1,000 Ksbs)

No.	Project Name	Water-Related Projects		Priority	Source of Fund	Total Disbursed Costs			Balance Required to Complete			Year Started	Year of Completion	Proposed Expenditure Schedule		Balance Remaining		
		Water Supply	Sewerage/Sanitation			COK	External Grant	External Loan	Total	COK	External			Total	1997/98		1998/99	1999/00
14 NEW PROJECTS (8 PROJECTS)																		
448	Urban Settlement and Waste Management Program - Nant (SDD)			C		200			200			1996	1999	80	80			
449	Kinnyas Childrens Home (SDP)			C		75			75			1997	1999	25	50		40	
450	Women in Development (SDP)			C		192			192			1996	1999	50	100		42	
451	Construction of Markets in Nabaouja, Trages, Mochowan and KIAOI (SDD)			C		320			320			1996	1999	120	150		50	
452	Sanitation Improvement in Nanyuki (SDD)		•	C	IDA	50			50			1996	1999	20	20		10	
455	Local Government Referral Programme			C	UNDP	13,763			13,763			1998	2000		4,013		1,041	
456	Local Government Capacity Building			M		1,004			1,004			1996	1999	600	600		406	
790	Wejiu Town Sewerage Study		•	M		300			300			1994	1998	101	200			
SUB-TOTAL NEW PROJECTS																		
						1,137	15,667		16,804	1,137	12,613	13,518		995	9,213	2,542	1,000	
SUB-TOTAL ON-GOING PROJECTS																		
						115,335	346,420	695,800	1,159,555	83,230	489,493	572,723	0	0	54,593	157,280	21,120	63,100
SUB-TOTAL NEW PROJECTS																		
						1,137	15,667	0	16,804	1,137	12,613	13,518	0	0	995	9,213	2,542	1,000
GRAND TOTAL																		
						116,472	364,047	695,800	1,176,359	84,267	502,106	566,231			55,588	166,493	23,792	64,100

**Table - 4.2.3 Summary of Investment Costs for Public Investment Programme,
1997/1998 - 1999/2000
- MWR -**

(Unit: 1,000 Ksts)

	No. of Projects	Costs /Project	GOK Fund	External Fund				Estimated Costs
				External Grant		External Loan		
Water Related Core Projects (A)	18	20,361	176,172	52,380	(27.5%)	137,945	(72.5%)	366,497
			48.1%	51.9%		100.0%		
Total Core Projects	27	24,599	219,486	58,380	(13.1%)	386,313	(86.9%)	664,179
			33.0%	(67.0%)		100.0%		
Water Related PIP Projects (B)	201	9,526	714,499	870,413	(72.5%)	329,867	(27.5%)	1,914,779
			37.3%	62.7%		100.0%		
Total PIP Projects	313	8,279	1,239,492	602,148	(44.5%)	749,685	(55.5%)	2,591,325
			47.8%	52.2%		100.0%		

Water Related Core Projects (A)			
Project Type	No. of Projects	Costs /Project	GOK Fund
On-Going Projects	18	176,172	9,787
(GOK Fund)	(10)	(153,852)	(15,385)
(External Fund)	(8)	(22,320)	(2,790)
New Projects	0	189,875	0
Total	18	366,047	20,336

Total Water Related PIP Projects (B)			
Project Type	No. of Projects	Costs /Project	GOK Fund
On-Going Projects	185	1,458,106	7,882
(GOK Fund)	(154)	(714,499)	(4,640)
(External Fund)	(31)	(743,607)	(23,987)
New Projects	16	195,650	12,228
Total	201	1,653,756	8,228

Source : Public Investment Program, 1997/1998 - 1999/2000, Ministry of Planning and National Development, December 1996

**Table - 4.2.4 Summary of Investment Costs for Public Investment Programme,
1997/1998 - 1999/2000
- MOLA -**

(Unit: 1,000 Kshs)

	No. of Projects	Costs /Project	GOK Fund	External Fund		Estimated Costs		
				External Grant	External Loan			
Water Related Core Projects (A)	8	83,171	53,870	9,500	(1.6%)	602,000	(98.4%)	665,370
			8.1%	91.9%				100.0%
Total Core Projects	24	41,992	66,297	339,513	(36.1%)	602,000	(63.9%)	1,007,810
			6.6%	(93.4%)				100.0%
Water Related PIP Projects (B)	30	25,642	90,945	9,500	(1.4%)	668,800	(98.6%)	769,245
			11.8%	88.2%				100.0%
Total PIP Projects	56	21,006	116,472	364,087	(34.4%)	695,800	(65.6%)	1,176,359
			9.9%	90.1%				100.0%

Water Related Core Projects (A)			
Project Type	No. of Projects	Costs /Project	GOK Fund
On-Going Projects	7	665,320	95,046
(GOK Fund)	(0)	(0)	(0)
(External Fund)	(7)	(665,320)	(95,046)
New Projects	1	50	0
Total	8	665,370	83,171

Total Water Related PIP Projects (B)			
Project Type	No. of Projects	Costs /Project	GOK Fund
On-Going Projects	28	768,895	27,461
(GOK Fund)	(15)	(30,475)	(2,032)
(External Fund)	(13)	(738,420)	(56,802)
New Projects	2	350	175
Total	30	769,245	25,642

Source : Public Investment Program, 1997/1998 - 1999/2000, Ministry of Planning and National Development, December 1996

Table - 5.1.1 Comparison of Population Projection by Method

	Method A JICA Study Team (A)	Method B World Bank Model (B)	Residual Ratio
2000	31,187,000	32,586,000	4.3%
2001	31,897,000	32,493,000	1.8%
2002	32,590,000	32,682,000	0.3%
2003	33,259,000	33,060,000	-0.6%
2004	33,922,000	33,635,000	-0.9%
2005	34,555,000	34,428,000	-0.4%
2006	35,178,000	35,039,000	-0.4%
2007	35,772,000	35,578,000	-0.5%
2008	36,344,000	36,047,000	-0.8%
2009	36,882,100	36,445,000	-1.2%
2010	37,405,000	36,752,000	-1.8%

Table - 5.3.2 (1/4) Population Projection of Urban Centres by Classification

Urban Centres (20,000 < P < 100,000)									
	1995		2000		2005		2010		
1	U - 1	Nairobi	1,657,000	U - 1	Nairobi	2,243,000	U - 1	Nairobi	2,639,000
2	U - 52	Mombasa	573,000	U - 52	Mombasa	637,000	U - 52	Mombasa	693,000
3	U - 159	Nakuru	231,687	U - 159	Nakuru	402,560	U - 159	Nakuru	630,866
4	U - 120	Kisumu	231,327	U - 120	Kisumu	314,460	U - 120	Kisumu	489,348
5	U - 71	Machakos	154,006	U - 166	Eldoret	247,486	U - 166	Eldoret	378,415
6	U - 166	Eldoret	148,204	U - 71	Machakos	240,701	U - 71	Machakos	351,071
7	U - 85	Meru	124,412	U - 86	Meru	199,692	U - 86	Meru	290,856
8	U - 36	Nyeri	123,508	U - 36	Nyeri	191,728	U - 36	Nyeri	282,940
9	-	-	-	U - 164	Kitale	128,530	U - 164	Kitale	193,913
10	-	-	-	U - 210	Kakamega	123,558	U - 210	Kakamega	177,064
11	-	-	-	U - 9	Thika	116,313	U - 9	Thika	166,252
12	-	-	-	-	-	-	U - 158	Naivasha	140,157
13	-	-	-	-	-	-	U - 148	Kenicho	132,237
14	-	-	-	-	-	-	U - 40	Malindi	114,547
15	-	-	-	-	-	-	U - 117	Kisii	107,195
16	-	-	-	-	-	-	U - 205	Webuye	102,762
17	-	-	-	-	-	-	U - 104	Garissa	101,498
18	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-
Total Population		3,443,145		4,875,027		6,991,121		8,259,428	
Total No. of Urban Centers		8		11		17		19	

Urban Centres (20,000 ≤ P < 100,000)									
	1995		2000		2005		2010		
1	U - 210	Kakamega	77,306	U - 148	Kenicho	91,602	U - 199	Bungoma	97,172
2	U - 164	Kitale	73,956	U - 158	Naivasha	89,460	U - 206	Busia	89,110
3	U - 9	Thika	73,718	U - 117	Kisii	77,666	U - 153	Nanyuki	81,989
4	U - 148	Kenicho	56,108	U - 49	Malindi	77,339	U - 60	Embu	79,735
5	U - 158	Naivasha	51,442	U - 104	Garissa	72,261	U - 20	Maragua	74,091
6	U - 117	Kisii	50,604	U - 205	Webuye	68,887	U - 63	Isiolo	70,131
7	U - 40	Malindi	48,227	U - 199	Bungoma	65,103	U - 146	Ongara Longai	68,122
8	U - 205	Webuye	41,935	U - 206	Busia	60,049	U - 8	Ruiru	64,180
9	U - 104	Garissa	40,000	U - 20	Maragua	55,259	U - 129	Homa Bay	64,065
10	U - 199	Bungoma	39,679	U - 60	Embu	55,102	U - 153	Narok	62,377
11	U - 20	Maragua	39,411	U - 153	Nanyuki	53,207	U - 211	Mumias	59,682
12	U - 60	Embu	34,309	U - 8	Ruiru	46,943	U - 116	Wajir	57,066
13	U - 206	Busia	32,441	U - 129	Homa Bay	46,428	U - 21	Muranga	55,613
14	U - 8	Ruiru	32,302	U - 63	Isiolo	45,676	U - 156	Gilgil	54,234
15	U - 153	Nanyuki	31,559	U - 211	Mumias	43,681	U - 28	Nyahururu	50,593
16	U - 129	Homa Bay	30,995	U - 146	Ongara Longai	43,481	U - 38	Kilifi	48,767
17	U - 211	Mumias	29,676	U - 21	Muranga	39,680	U - 155	El Burgen	45,399
18	U - 63	Isiolo	26,958	U - 116	Wajir	39,542	U - 109	Mandera	45,389
19	U - 21	Muranga	26,376	U - 163	Narok	37,253	U - 157	Molo	43,459
20	U - 116	Wajir	26,239	U - 156	Gilgil	34,627	U - 125	Siaya	42,062
21	U - 146	Ongara Longai	25,080	U - 38	Kilifi	32,943	U - 69	Athi River	41,713
22	U - 109	Mandera	22,856	U - 109	Mandera	32,775	U - 194	Lodwar	39,840
23	U - 125	Siaya	20,762	U - 28	Nyahururu	32,704	U - 185	Kapsabet + Barot	38,277
24	U - 38	Kilifi	20,555	U - 125	Siaya	30,281	U - 3	Karuri	37,113
25	-	-	-	U - 155	El Burgen	28,954	U - 141	Ngong	34,577
26	-	-	-	U - 69	Athi River	28,602	U - 160	Njoro	34,394
27	-	-	-	U - 194	Lodwar	28,353	U - 82	Marsabit	33,116
28	-	-	-	U - 157	Molo	27,708	U - 77	Tala + Kangundo	32,858
29	-	-	-	U - 3	Karuri	27,229	U - 68	Kitui	32,485
30	-	-	-	U - 185	Kapsabet + Barot	25,747	U - 59	Hola	32,235
31	-	-	-	U - 82	Marsabit	23,441	U - 55	Voi	31,353
32	-	-	-	U - 77	Tala + Kangundo	22,680	U - 12	Kerugoya Kutus	31,142
33	-	-	-	U - 55	Voi	22,676	U - 136	Migori	30,831
34	-	-	-	U - 59	Hola	22,421	U - 42	Marikani	29,761
35	-	-	-	U - 136	Migori	22,316	U - 188	Maralal	29,012
36	-	-	-	U - 68	Kitui	22,131	U - 179	Kabaret	27,776
37	-	-	-	U - 144	Ngong	22,070	U - 141	Kajiado	27,010
38	-	-	-	U - 160	Njoro	21,909	U - 145	Oloitokitiki	25,817
39	-	-	-	U - 12	Kerugoya Kutus	21,479	U - 47	Lamu	25,463
40	-	-	-	U - 42	Marikani	20,044	U - 197	Kapenguria	25,206
41	-	-	-	-	-	-	U - 122	Muhoroni	24,721
42	-	-	-	-	-	-	U - 54	Taveta	23,689
43	-	-	-	-	-	-	U - 119	Ahero	21,989
44	-	-	-	-	-	-	U - 202	Kikilili	21,637
45	-	-	-	-	-	-	U - 143	Namanga	20,821
46	-	-	-	-	-	-	U - 45	Lunguanga	20,656
47	-	-	-	-	-	-	U - 83	Moyale	20,360
48	-	-	-	-	-	-	U - 198	Makutano	20,004
49	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-
Total Population		952,454		1,660,206		2,066,895		2,348,672	
Total No. of Urban Centers		24		40		48		54	

Table - 5.3.2 (2/4) Population Projection of Urban Centres by Classification

Urban Centres (5,000 ≤ P < 20,000)												
	1995		2000		2005		2010					
1	U-156	Gilgil	19,960	U-188	Maralal	19,101	U-174	Kilgoris	19,862	U-65	Merit	19,533
2	U-163	Narok	19,859	U-179	Kabarnet	18,812	U-178	Eldama Ravine	19,393	U-33	Karatina	19,471
3	U-28	Nyahururu	19,446	U-54	Taveta	17,848	U-180	Maji Mazuri	19,077	U-87	Nkubu	19,261
4	U-3	Karuri	18,716	U-47	Lamu	17,401	U-4	Kiambu	18,605	U-140	Nyamira + Kebingo	17,592
5	U-69	Athi River	18,304	U-122	Muhoroni	17,389	U-46	Msamwani	18,251	U-37	Othaya	16,981
6	U-155	Elburgon	16,693	U-141	Kajiado	16,916	U-5	Kikuyu	18,058	U-134	Awendo/Sare	16,258
7	U-82	Marsabit	16,084	U-197	Kapenguria	16,846	U-7	Njumbeni	17,883	U-108	Etwak	15,808
8	U-157	Molo	15,940	U-119	Ahero	16,197	U-170	Simat	17,287	U-91	Mwingi	15,747
9	U-55	Voi	15,772	U-145	Oloitokitoki	16,137	U-65	Merit	17,288	U-142	Magadi	15,471
10	U-194	Lodwar	15,588	U-45	Lungalunga	15,118	U-33	Karatina	16,685	U-183	Ten	14,951
11	U-136	Mogoi	14,913	U-202	Kikilili	14,482	U-87	Nkubu	16,549	U-80	Korr	14,816
12	U-77	Tala + Kangundo	14,656	U-83	Moyale	14,354	U-140	Nyamira + Kebingo	15,693	U-79	Kargi	14,518
13	U-185	Kapsabet + Baraton	14,604	U-198	Makutano	13,320	U-134	Awendo/Sare	15,171	U-189	Wamba	13,572
14	U-12	Kerugoya/Kulus	13,784	U-178	Eldama Ravine	13,142	U-108	Etwak	14,578	U-41	Kwale	13,230
15	U-141	Taveta	13,223	U-143	Namanga	13,035	U-37	Othaya	14,546	U-90	Chuka	12,729
16	U-68	Kitui	13,201	U-4	Kiambu	13,001	U-80	Korr	13,599	U-215	Vihiga + Majengo	12,600
17	U-59	Hela	12,853	U-174	Kilgoris	12,888	U-91	Mwingi	13,527	U-133	Oyugis	12,235
18	U-141	Ngong	12,730	U-46	Msamwani	12,858	U-183	Ten	13,475	U-98	Mtito Andei	12,205
19	U-160	Njoro	12,635	U-180	Maji Mazuri	12,858	U-142	Magadi	12,782	U-89	Maua	12,144
20	U-42	Marikani	12,496	U-5	Kikuyu	12,623	U-79	Kargi	12,724	U-85	Sololo	12,125
21	U-179	Kabarnet	11,804	U-7	Njumbeni	12,336	U-131	Mbita	11,820	U-2	Githunguri	12,062
22	U-122	Muhoroni	11,694	U-170	Simat	12,270	U-44	Kwale	11,627	U-151	Londiani	11,852
23	U-119	Ahero	11,661	U-65	Merit	11,988	U-215	Vihiga + Majengo	11,591	U-131	Mbita	11,531
24	U-188	Maralal	11,660	U-134	Awendo/Sare	11,456	U-189	Wamba	11,503	U-213	Luanda	11,138
25	U-47	Lamu	11,437	U-140	Nyamira + Kebingo	11,435	U-90	Chuka	11,446	U-167	Lemok	11,048
26	U-197	Kapenguria	10,201	U-87	Nkubu	11,357	U-133	Oyugis	11,399	U-195	Lokitaung	10,882
27	U-83	Moyale	9,853	U-33	Karatina	11,313	U-89	Maua	10,926	U-181	Marigat	10,746
28	U-141	Kajiado	9,434	U-108	Etwak	10,977	U-98	Mtito Andei	10,679	U-182	Mogotio	10,554
29	U-45	Lungalunga	9,329	U-80	Korr	10,657	U-195	Lokitaung	10,678	U-152	Soik	10,259
30	U-145	Oloitokitoki	8,955	U-37	Othaya	9,832	U-85	Sololo	10,651	U-58	Garsen	10,110
31	U-202	Kikilili	8,812	U-183	Ten	9,654	U-2	Githunguri	10,558	U-110	Rhamu	10,031
32	U-178	Eldama Ravine	8,272	U-91	Mwingi	9,221	U-151	Londiani	10,190	U-30	Oi Kalou	9,944
33	U-4	Kiambu	8,239	U-79	Kargi	9,064	U-213	Luanda	9,759	U-123	Asiro	9,373
34	U-134	Awendo/Sare	8,213	U-131	Mbita	8,889	U-167	Lemok	9,729	U-172	Turbo	9,175
35	U-198	Makutano	8,096	U-133	Oyugis	8,525	U-181	Marigat	9,656	U-41	Mamburi	8,964
36	U-108	Etwak	8,087	U-215	Vihiga + Majengo	8,499	U-152	Soik	9,335	U-169	Moi's Bridge	8,869
37	U-180	Maji Mazuri	8,083	U-195	Lokitaung	8,304	U-110	Rhamu	9,319	U-207	Malaba Town	8,770
38	U-5	Kikuyu	7,962	U-90	Chuka	8,259	U-58	Garsen	9,253	U-16	Wanguru	8,724
39	U-65	Merit	7,779	U-44	Kwale	8,198	U-182	Mogotio	9,038	U-203	Mawale + Malakisi	8,436
40	U-7	Njumbeni	7,759	U-142	Magadi	8,019	U-30	Oi Kalou	8,945	U-56	Wundanyi	8,344
41	U-170	Simat	7,717	U-89	Maua	7,879	U-16	Wanguru	8,253	U-137	Nyatakaye	8,341
42	U-174	Kilgoris	7,665	U-189	Wamba	7,560	U-123	Asiro	8,255	U-121	Maseno	8,054
43	U-80	Korr	7,382	U-85	Sololo	7,539	U-172	Turbo	8,103	U-138	Rongo	8,012
44	U-33	Karatina	7,299	U-98	Mtito Andei	7,451	U-41	Mamburi	8,011	U-74	Matuu	7,947
45	U-143	Namanga	7,262	U-2	Githunguri	7,254	U-169	Moi's Bridge	7,852	U-19	Makuyu	7,943
46	U-46	Msamwani	7,247	U-151	Londiani	7,101	U-137	Nyatakaye	7,807	U-200	Chapatais	7,930
47	U-140	Nyamira + Kebingo	7,130	U-110	Rhamu	7,015	U-107	Malaba Town	7,723	U-208	Nambale	7,929
48	U-87	Nkubu	7,059	U-181	Marigat	6,865	U-203	Mawale + Malakisi	7,572	U-214	Mbale	7,887
49	U-37	Othaya	6,379	U-167	Lemok	6,807	U-34	Matuu	7,555	U-43	Watamu	7,857
50	U-79	Kargi	6,215	U-152	Soik	6,771	U-214	Mbale	7,546	U-93	Kibwezi	7,702
51	U-133	Oyugis	6,167	U-213	Luanda	6,765	U-121	Maseno	7,409	U-32	Endarasha	7,564
52	U-183	Ten	6,034	U-58	Garsen	6,698	U-138	Rongo	7,371	U-130	Kendu Bay	7,534
53	U-131	Mbita	5,751	U-30	Oi Kalou	6,431	U-56	Wundanyi	7,369	U-154	Rumuruti	7,532
54	U-90	Chuka	5,607	U-16	Wanguru	6,114	U-208	Nambale	7,222	U-190	Kakumati T.C	6,971
55	U-91	Mwingi	5,469	U-182	Mogotio	6,097	U-109	Chapatais	7,091	U-105	Liboi	6,850
56	U-195	Lokitaung	5,373	U-137	Nyatakaye	5,871	U-19	Makuyu	7,015	U-149	Kipkelion	6,738
57	U-89	Maua	5,349	U-123	Asiro	5,776	U-43	Watamu	6,767	U-209	Butere	6,526
58	U-215	Vihiga + Majengo	5,274	U-41	Mamburi	5,696	U-93	Kibwezi	6,739	U-191	Kalekol	6,437
59	U-85	Sololo	5,146	U-138	Rongo	5,677	U-130	Kendu Bay	6,692	U-64	Madogash	6,074
60	U-110	Rhamu	5,144	U-214	Mbale	5,675	U-32	Endarasha	6,661	U-165	Burn Forest	5,939
61	-	-	-	U-172	Turbo	5,658	U-154	Rumuruti	6,591	U-84	North Horr	5,596
62	-	-	-	U-74	Matuu	5,631	U-191	Kalokol	6,316	U-39	Majengo	5,542
63	-	-	-	U-121	Maseno	5,470	U-190	Kakumati T.C	6,141	U-113	Bate	5,491
64	-	-	-	U-169	Moi's Bridge	5,428	U-105	Liboi	6,049	U-139	Keroka	5,343
65	-	-	-	U-203	Mawale + Malakisi	5,415	U-209	Butere	6,020	U-61	Runyenjes	5,239
66	-	-	-	U-207	Malaba Town	5,404	U-149	Kipkelion	5,893	U-114	Eldas	5,185
67	-	-	-	U-56	Wundanyi	5,321	U-64	Madogash	5,588	U-49	Mokwe T.C	5,151
68	-	-	-	U-208	Nambale	5,154	U-165	Burn Forest	5,308	U-135	Kehancha	5,008
69	-	-	-	U-200	Chapatais	5,057	U-84	North Horr	5,182	-	-	-
70	-	-	-	U-19	Makuyu	5,007	U-39	Majengo	5,025	-	-	-
Total Population		625,460		690,681		740,767		692,421				
Total No. of Urban Centers		60		70		70		68				

Urban Centres (1,000 ≤ P < 5,000)												
	1995		2000		2005		2010					
1	U-98	Mtito Andei	4,938	U-191	Kalekol	4,912	U-113	Bate	4,989	U-128	Yala	4,955
2	U-181	Marigat	4,707	U-130	Kendu Bay	4,843	U-139	Keroka	4,931	U-44	Motondon T.C	4,833
3	U-2	Githunguri	4,706	U-105	Liboi	4,704	U-61	Runyenjes	4,710	U-111	Tokaba	4,719
4	U-189	Wamba	4,618	U-93	Kibwezi	4,702	U-114	Eldas	4,695	U-124	Bondo	4,662
5	U-44	Kwale	4,594	U-32	Endarasha	4,661	U-135	Kehancha	4,674	U-53	Mwalale	4,640

Table - 5.3.2 (3/4) Population Projection of Urban Centres by Classification

Urban Centres (1,000 ≤ P < 5,000)								
	1995		2000		2005		2010	
6	U-152 Sorik	4,509	U-154 Rumarufi	4,596	U-49 Mokowe T.C	4,665	U-94 Kikima	4,629
7	U-167 Lemok	4,405	U-43 Watamu	4,574	U-128 Yala	4,616	U-15 Sagana	4,617
8	U-142 Magadi	4,398	U-209 Butere	4,385	U-111 Takaba	4,515	U-101 Wote	4,595
9	U-151 Londiani	4,346	U-190 Kakumat T.C	4,297	U-48 Matondon T.C	4,376	U-175 Lolgorian	4,497
10	U-213 Luanda	4,246	U-119 Kipkelion	4,035	U-94 Kikima	4,343	U-6 Limuru	4,347
11	U-58 Garsen	4,232	U-64 Madgash	3,973	U-124 Bondo	4,308	U-34 Mweiga	4,315
12	U-137 Nyabikaye	4,184	U-84 North Horr	3,808	U-15 Sagana	4,277	U-23 Mairo Inya	4,091
13	U-158 Rongu	3,982	U-165 Burn Forest	3,724	U-53 Mwatate	4,202	U-51 Witu	4,036
14	U-16 Wanguru	3,956	U-139 Keroka	3,695	U-175 Lolgorian	4,022	U-99 Sultan Hamud	3,981
15	U-121 Maseno	3,890	U-113 Bute	3,621	U-34 Mweiga	3,969	U-150 Litein	3,968
16	U-41 Mamburui	3,859	U-39 Majengo	3,596	U-6 Limuru	3,964	U-62 Garbatula	3,947
17	U-30 Ol Kalou	3,840	U-135 Kehancha	3,495	U-101 Wote	3,946	U-35 Naro Moru	3,822
18	U-182 Mogoto	3,808	U-61 Runyenjes	3,455	U-23 Mairo Inya	3,858	U-192 Kapendo T.C	3,748
19	U-123 Asiro	3,737	U-128 Yala	3,418	U-150 Litein	3,795	U-132 Ndihiwa	3,720
20	U-56 Wandanyi	3,733	U-94 Kikima	3,406	U-35 Naro Moru	3,750	U-186 Nandi Hills	3,693
21	U-172 Turbo	3,703	U-111 Takaba	3,395	U-132 Ndihiwa	3,696	U-127 Usenge T.C	3,490
22	U-214 Mbale	3,672	U-114 Eldas	3,361	U-99 Sultan Hamud	3,614	U-81 Laisamis	3,358
23	U-74 Maturu	3,644	U-49 Mokowe T.C	3,339	U-62 Garbatula	3,497	U-184 Tambach	3,206
24	U-169 Moi's Bridge	3,556	U-124 Bondo	3,244	U-51 Witu	3,485	U-85 Lare	3,200
25	U-207 Malaba Town	3,497	U-15 Sagana	3,189	U-192 Kapendo T.C	3,391	U-102 Dadaab	3,197
26	U-200 Chapatais	3,361	U-48 Matondon T.C	3,132	U-186 Nandi Hills	3,300	U-204 Sirisia	3,195
27	U-19 Makuyu	3,355	U-53 Mwatate	3,007	U-127 Usenge T.C	3,161	U-26 Ndunyu Njeru	3,191
28	U-130 Kendu Bay	3,262	U-132 Ndihiwa	2,920	U-27 Njabini	3,096	U-18 Kangema	3,088
29	U-191 Katokei	3,178	U-175 Lolgorian	2,915	U-81 Laisamis	3,077	U-27 Njabini	3,038
30	U-203 Mawale + Malakisi	3,119	U-6 Limuru	2,874	U-88 Lare	2,943	U-187 Baragoi	2,993
31	U-93 Kibwezi	3,116	U-150 Litein	2,855	U-102 Dadaab	2,941	U-24 Miharati	2,959
32	U-208 Nambale	3,080	U-23 Mairo Inya	2,843	U-204 Sirisia	2,894	U-171 Soy	2,946
33	U-105 Liboi	3,014	U-34 Mweiga	2,822	U-26 Ndunyu Njeru	2,890	U-106 Mudo Gashe	2,775
34	U-32 Endarasha	3,016	U-101 Wote	2,705	U-184 Tambach	2,890	U-161 Rongai	2,539
35	U-209 Butere	2,947	U-99 Sultan Hamud	2,604	U-18 Kangema	2,797	U-78 Wamu	2,534
36	U-154 Rumarufi	2,941	U-35 Naro Moru	2,500	U-24 Miharati	2,680	U-10 Baricho	2,448
37	U-43 Watamu	2,846	U-192 Kapendo T.C	2,429	U-171 Soy	2,619	U-70 Kathiani T.C	2,388
38	U-84 North Horr	2,806	U-51 Witu	2,395	U-106 Mudo Gashe	2,560	U-31 Wanjohi	2,307
39	U-190 Kakumat T.C	2,780	U-62 Garbatula	2,395	U-187 Baragoi	2,531	U-14 Kimunya	2,302
40	U-139 Keroka	2,640	U-186 Nandi Hills	2,329	U-161 Rongai	2,300	U-162 Nairagie (Enkare)	2,262
41	U-64 Modogash	2,571	U-88 Lare	2,302	U-78 Wamu	2,295	U-126 Ukwala	2,222
42	U-15 Sagana	2,569	U-27 Njabini	2,293	U-10 Baricho	2,202	U-100 Tawa Market	2,111
43	U-128 Yala	2,552	U-127 Usenge T.C	2,262	U-70 Kathiani T.C	2,163	U-112 Buna	2,111
44	U-113 Bute	2,543	U-81 Laisamis	2,202	U-31 Wanjohi	2,089	U-73 Masinga	2,106
45	U-135 Kehancha	2,528	U-102 Dadaab	2,178	U-14 Kimunya	2,084	U-25 Murunguru	2,078
46	U-149 Kipkelion	2,472	U-18 Kangema	2,097	U-126 Ukwala	2,075	U-115 Wagalla	2,053
47	U-165 Burn Forest	2,463	U-184 Tambach	2,071	U-162 Nairagie (Enkare)	1,977	U-196 Chepareria	2,053
48	U-39 Majengo	2,399	U-26 Ndunyu Njeru	2,068	U-112 Buna	1,919	U-107 Bannisa	2,022
49	U-124 Bondo	2,348	U-204 Sirisia	2,010	U-100 Tawa Market	1,912	U-118 Ogembo	2,003
50	U-61 Runyenjes	2,346	U-24 Miharati	1,918	U-73 Masinga	1,907	U-193 Kathi T.C	2,000
51	U-94 Kikima	2,272	U-106 Mudo Gashe	1,910	U-118 Ogembo	1,883	U-177 Arabal	1,960
52	U-111 Takaba	2,265	U-171 Soy	1,766	U-25 Murunguru	1,882	U-201 Kapsakwony	1,919
53	U-114 Eldas	2,242	U-187 Baragoi	1,660	U-115 Wagalla	1,859	U-72 Masii T.C	1,871
54	U-49 Mokowe T.C	2,228	U-161 Rongai	1,646	U-196 Chepareria	1,837	U-76 Syathani	1,827
55	U-48 Matondon T.C	2,090	U-78 Wamu	1,642	U-107 Bannisa	1,831	U-173 Bomet	1,817
56	U-53 Mwatate	2,006	U-10 Baricho	1,601	U-193 Kathi T.C	1,811	U-176 Nkararo	1,809
57	U-6 Limuru	1,958	U-126 Ukwala	1,593	U-173 Bomet	1,783	U-50 Mpeketoni T.C	1,765
58	U-132 Ndihiwa	1,948	U-70 Kathiani T.C	1,548	U-177 Arabal	1,775	U-75 Mitaboni	1,748
59	U-175 Lolgorian	1,945	U-31 Wanjohi	1,495	U-76 Syathani	1,775	U-95 Kifala Market	1,709
60	U-150 Litein	1,905	U-14 Kimunya	1,492	U-201 Kapsakwony	1,695	U-57 Bura & Madogo	1,700
61	U-34 Mweiga	1,883	U-76 Syathani	1,434	U-72 Masii T.C	1,694	U-29 Ol Joro Orok	1,682
62	U-23 Mairo Inya	1,846	U-112 Buna	1,396	U-176 Nkararo	1,639	U-66 Kabai	1,591
63	U-99 Sultan Hamud	1,833	U-173 Bomet	1,387	U-75 Mitaboni	1,633	U-168 Magoon	1,583
64	U-101 Wote	1,731	U-118 Ogembo	1,383	U-50 Mpeketoni T.C	1,598	U-67 Kijungu	1,552
65	U-35 Naro Moru	1,668	U-100 Tawa Market	1,369	U-95 Kifala Market	1,547	U-103 Damajare	1,512
66	U-192 Kapendo T.C	1,621	U-73 Masinga	1,365	U-29 Ol Joro Orok	1,547	U-11 Kagumo	1,393
67	U-62 Garbatula	1,565	U-25 Murunguru	1,347	U-57 Bura & Madogo	1,540	U-17 Kandara	1,358
68	U-51 Witu	1,563	U-115 Wagalla	1,336	U-66 Kabai	1,441	U-22 Engineer Town	1,247
69	U-88 Lare	1,536	U-107 Bannisa	1,311	U-168 Magoon	1,433	U-96 Machinery T.C	1,091
70	U-27 Njabini	1,530	U-196 Chepareria	1,306	U-67 Kijungu	1,406	U-212 Chavakali	1,058
71	U-127 Usenge T.C	1,509	U-193 Kathi T.C	1,296	U-103 Damajare	1,336	U-13 Kiungya	1,057
72	U-18 Kangema	1,491	U-162 Nairagie (Enkare)	1,295	U-11 Kagumo	1,261	-	-
73	U-186 Nandi Hills	1,491	U-177 Arabal	1,221	U-17 Kandara	1,249	-	-
74	U-81 Laisamis	1,455	U-72 Masii T.C	1,213	U-22 Engineer Town	1,130	-	-
75	U-204 Sirisia	1,389	U-201 Kapsakwony	1,205	U-212 Chavakali	1,012	-	-
76	U-26 Ndunyu Njeru	1,380	U-29 Ol Joro Orok	1,192	-	-	-	-
77	U-102 Dadaab	1,358	U-75 Mitaboni	1,187	-	-	-	-
78	U-184 Tambach	1,294	U-176 Nkararo	1,173	-	-	-	-
79	U-24 Miharati	1,279	U-50 Mpeketoni T.C	1,144	-	-	-	-
80	U-106 Mudo Gashe	1,170	U-95 Kifala Market	1,108	-	-	-	-
81	U-171 Soy	1,156	U-57 Bura & Madogo	1,102	-	-	-	-
82	U-126 Ukwala	1,127	U-103 Damajare	1,039	-	-	-	-
83	U-10 Baricho	1,110	U-66 Kabai	1,031	-	-	-	-
84	U-161 Rongai	1,098	U-168 Magoon	1,028	-	-	-	-
85	U-78 Wamu	1,096	U-67 Kifanga	1,008	-	-	-	-
86	U-70 Kathiani T.C	1,035	-	-	-	-	-	-
87	U-187 Baragoi	1,006	-	-	-	-	-	-
Total Population		232,108			207,818			197,267
Total No. of Urban Centers		87			85			71

Table - 5.3.2 (4/4) Population Projection of Urban Centres by Classification

Urban Centres (P < 1,000)												
1995			2000			2005			2010			
1	U - 31	Wanjiki	998	U - 17	Kandara	962	U - 96	Machinery T.C	988	U - 147	Kedowa	998
2	U - 14	Kinonye	995	U - 11	Kagumo	903	U - 13	Kianyaga	973	U - 97	Mbumkumi Market	694
3	U - 112	Buna	989	U - 22	Engineer Town	808	U - 147	Kedowa	904	U - 92	Kamku T.C	521
4	U - 118	Ogembo	978	U - 212	Chavakali	261	U - 97	Mbumkumi Market	628	-	-	-
5	U - 76	Sythoni	957	U - 96	Machinery T.C	707	U - 92	Kamku T.C	471	-	-	-
6	U - 173	Bomet	925	U - 13	Kianyaga	691	-	-	-	-	-	-
7	U - 100	Tawa Market	913	U - 147	Kedowa	647	-	-	-	-	-	-
8	U - 73	Masinga	911	U - 97	Mbumkumi Market	456	-	-	-	-	-	-
9	U - 25	Murungu	899	U - 92	Kamku T.C	337	-	-	-	-	-	-
10	U - 115	Wagalla	888	-	-	-	-	-	-	-	-	-
11	U - 107	Bancisa	874	-	-	-	-	-	-	-	-	-
12	U - 193	Karibu T.C	865	-	-	-	-	-	-	-	-	-
13	U - 177	Arabal	848	-	-	-	-	-	-	-	-	-
14	U - 196	Chepareria	836	-	-	-	-	-	-	-	-	-
15	U - 72	Masil T.C	809	-	-	-	-	-	-	-	-	-
16	U - 162	Nairagie (Enkare)	799	-	-	-	-	-	-	-	-	-
17	U - 204	Kapsakwony	795	-	-	-	-	-	-	-	-	-
18	U - 75	Mitakoni	792	-	-	-	-	-	-	-	-	-
19	U - 29	Oi Joro Orok	792	-	-	-	-	-	-	-	-	-
20	U - 176	Nkararo	782	-	-	-	-	-	-	-	-	-
21	U - 50	Mpeketoni T.C	763	-	-	-	-	-	-	-	-	-
22	U - 95	Kilala Market	739	-	-	-	-	-	-	-	-	-
23	U - 57	Bura & Madogo	735	-	-	-	-	-	-	-	-	-
24	U - 103	Damajare	693	-	-	-	-	-	-	-	-	-
25	U - 66	Kaban	688	-	-	-	-	-	-	-	-	-
26	U - 168	Magoon	684	-	-	-	-	-	-	-	-	-
27	U - 67	Kilungu	671	-	-	-	-	-	-	-	-	-
28	U - 17	Kandara	640	-	-	-	-	-	-	-	-	-
29	U - 11	Kagumo	602	-	-	-	-	-	-	-	-	-
30	U - 22	Engineer Town	539	-	-	-	-	-	-	-	-	-
31	U - 212	Chavakali	508	-	-	-	-	-	-	-	-	-
32	U - 13	Kianyaga	498	-	-	-	-	-	-	-	-	-
33	U - 96	Machinery T.C	472	-	-	-	-	-	-	-	-	-
34	U - 147	Kedowa	432	-	-	-	-	-	-	-	-	-
35	U - 97	Mbumkumi Market	300	-	-	-	-	-	-	-	-	-
36	U - 92	Kamku T.C	225	-	-	-	-	-	-	-	-	-
Total Population			26,833				6,267				3,964	2,212
Total No. of Urban Centers			36				9				5	3

PART II

**WATER SUPPLY DEVELOPMENT
PLAN**

**THE AFTERCARE STUDY
ON THE NATIONAL WATER MASTER PLAN**

SUPPORTING REPORT

PART II : WATER SUPPLY DEVELOPMENT PLAN

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CHAPTER I PRESENT STATUS OF WATER SUPPLY SECTOR

1.1 National Target and Policy

1.1.1 National Development Plan

The broad national sector objective for the water supply was, by 1974, stated to be the provision of water of acceptable quality to all urban and rural population by the year 2000. In order to realise this objective, the then ministry responsible for water development embarked on the task of taking over: 1) the government constructed water supplies, 2) county council water supplies, 3) settlement schemes water supplies and 4) self-help water supply schemes. However, this objective of supplying water to all by the year 2000 does not seem possible to be achieved due to a number of constraints including scarcity of qualified manpower and financial resources and many problems associated with implementation.

The Government, in the 1989-1993 Five - Year National Development Plan, launched a more practical target for increasing the population having access to water in the rural areas from 26% to 50% by 1993 and in the urban areas from 75% to 95% by 1993. In line with this policy, the NWMP adopted the development target for provision of safe and reliable water within a reasonable distance to all the population by the year 2010.

The Welfare Monitoring Survey II indicates that 90% of the population in the urban areas have access to safe water, while merely 35% of the population in the rural area have access. From the comparison of these target and actual values, it can be said that majority of the population particularly residing in rural areas still depend on unsanitary water despite efforts exerted by the water sector.

The Government, in the 8th National Development Plan (1997-2001), clarified its intention to push development towards agricultural and industrial activities in the coming decades to improve the living standards of the Kenyan and create employment opportunities for the rapidly increasing working force. The plan, recognising needs for an adequate and reliable supply of clean water as essential input to all sectors of economy, suggests urgent rehabilitation and augmentation of many existing schemes which are currently inoperable due to managerial, technical, and financial problems.

1.1.2 National Water Policy

The Government has prepared the National Water Policy in 1998, addressing the following four important aspects:

(1) Water Resources Management:

To preserve, conserve, and protect available water resources and allocate it in a sustainable, rational, and commercial manner.

(2) Water Supply and Sewerage Development:

To supply water of good quality and in sufficient quantities to meet the various needs while ensuring safe disposal of wastewater and environmental protection.

Development of water supplies in the urban areas will be accompanied by corresponding sewerage development systems to handle wastewater. In particular, wastewater from industrial sectors will be properly treated before discharging it into natural river courses. Strict water quality standards will be established to protect all water bodies receiving wastewater.

(3) Institutional Framework:

That is to establish an efficient and effective institutional framework to achieve systematic development and management of the water sector.

(4) Financing of the Water and Sanitation Sector

That is to develop a sound and sustainable financing system for effective water resources and management, water supply and sanitation development.

As stated in the Policy, the basic sector objective of the National Water Development is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance so as to meet the needs of human beings, agriculture, livestock, and industry. To achieve the above objective the department in-charge of water within MWR applies the strategy of supporting and co-ordinating all water projects and programmes in urban and rural areas. This support concentrates on the on-going water developments as a priority to assure a timely completion. The department also concentrates its activities in the rehabilitation of existing water facilities in order to improve their utilisation and coverage, focuses on management of water resources in the country, and encourages the private sector to participate more in water conservation, and work with ministries of health and local authorities to monitor dangers of pollution of rivers and open water bodies so as to protect the water users and the environment.

1.2 On-going Projects

To achieve the above targets, the Government and agencies concerned are developing many water supply schemes in the country. Scheme classification, operational body, and project status are described below summarising the MWR Project Status Report.

1.2.1 Classification

There are many types of water supply schemes developed in the country. The typical types are:

- 1) urban water supply schemes that cover mainly urban centres and their peripheral area,
- 2) community based water supply schemes that serve rural communities, and
- 3) regional water supply schemes that supply to several urban and rural areas simultaneously.

They are tentatively classified into urban water supply schemes (UWS) and rural water supply schemes (RWS). With a view to population size, the rural water supply schemes are further divided into two groups: large scale (more than 5,000 served population) and small scale (5,000 served population or less) rural water supply schemes as will be discussed in Section 2.1.

Apart from the domestic water supplies, many water pans/dams are constructed particularly in the ASAL areas for watering livestock. They are defined as livestock water supply.

As the data and information on present status of these schemes are limited, description made in the following paragraphs are mainly for UWS and RWS.

1.2.2 Operational Body

The water supply schemes in the country are operated and managed by many authorities including MWR, NWCPC, Local Authorities, Communities, Institutions and NGOs.

(1) MWR

MWR established District Water Office (DWO) in each district centre to operate the water supply systems in urban centres and rural areas. DWO is responsible for operation and maintenance of the water supply facilities from intake to pipe reticulation. DWO further undertakes rehabilitation and augmentation of water supply systems within the budget allocated by MWR.

(2) NWCPC

NWCPC established regional and operational offices in provincial centre and every urban centre under its jurisdiction to operate the systems. In addition, NWCPC operates the systems including meter reading, billing and collecting water charges, and undertakes rehabilitation and augmentation of the water supply facilities. Some municipal and town councils are supplied water from the NWCPC as bulk supply.

(3) Local Authorities

Water supply systems of municipal and town councils are operated and managed by the local authorities. The water supply division of the council is responsible for operation of the system and maintenance of the facilities. Augmentation and expansion to the water supply systems are under control of Ministry of Local Authority.

(4) Community, Institution and NGO

There are a large number of small scale rural water supply schemes operated by communities, institutions and NGOs. Most of these rural water supply systems do not apply metering systems. No water tariff except membership fee is charged.

1.2.3 Development Status

(1) Progress of the On-going Projects

The government has made utmost efforts in the past decade to supply safe and potable water by augmenting a number of water supply projects. This is evident from comparison of the latest 1995 project status report and the 1992 NWMP. Out of 479 on-going projects listed in the NWMP, 147 projects are currently under operation. Most of these projects, including rehabilitation and expansion of the existing schemes, are executed by MWR, NWCP, and other water undertakers.

Comparison of the 1992 and 1995 project status reports also explains project progress in the past three years. Out of 691(=280+411) on-going projects as of 1992, 177 projects (=15+46+116) are completed and currently in operation.

Status '92	Status '95			Grand Total
	1	2	3	
1	230	35	15	280
2	2	363	46	411
3	0	5	574	579
4. New	151	130	116	397
Grand Total	383	533	751	1667

Note: 1 -Projects under Investigation, Planning and Design

2 -Project under Implementation

3 -Project under Operation and Maintenance

4 -New Projects in 1995 Status Report

Source: The 1992 and 1995 Water supply Projects and Schemes Status Reports

Despite some deviation in these statistics, it is clear that implementation of these schemes has contributed significantly to an increase of coverage ratio particularly in urban areas.

(2) Projects under Implementation

As stated above, approximately 10% of the on-going projects as of 1992 have been completed and in operation at present, while the other 90% of the projects are still in progress. Reasons for the delay are:

- 1) awaiting fund allocation for project implementation and rehabilitation,
- 2) more fund required for constructing storage tanks and distribution network,
- 3) a lack of construction machinery,
- 4) a lack of skill for community management, and

5) Delayed provision of the water sources.

Completion of these on-going projects will increase coverage ratio from the present 53% to nearly 65% of the present population. In order to implement the projects, however, huge amount of funds, Kshs 8.9 billion or US\$ 146 million will be required as seen in table below:

Province	UWS Projects under Implementation		RWS Projects under implementation			Total Amount Required for Project Completion (Kshs million)		
	MWR	NWCPC	MWR	NWCPC	Others	MWR	NWCPC	Others
Central	4	0	37	28	12	406.7	318.7	69.1
Coastal		12	18	44	2	57.7	81.7	0.8
Eastern	3	0	28	128	15	980.8	491.8	48.7
North East.	4	0	15	0	0	353.3	0	0
Nyanza	0	0	26	5	11	205.3	1.9	34.6
Rift Valley	9	0	105	36	9	674.1	255.2	80.9
Western	2	0	10	10	5	4,633.7	69.2	110.6
Total	22	12	239	251	54	7,311.6	1,218.5	344.7

Source: MWR water supply projects and schemes status report in 1996,

Note: 1) Others include RDF, MOA, NGO, Institution and Community (including S/H) water supply schemes

2) Total amount is converted from K£ to Kshs by K£ 1.0 = Kshs 20

Table - 1.2.1 shows the present status of the on-going projects by district. The projects in the implementation stage are largely rural water supply schemes, located mainly in Eastern and Rift Valley Districts which are densely populated area.

(3) Planned Projects

MWR and NWCPC have been shifting their strategy with more attention to the rural areas rather than the urban centres. This is seen from the table below. A large number of the 373 projects in the rural areas are in the planning stage, while merely 21 water supply projects in the urban centres are under design. Rural population newly served from these schemes are 10 times as large as those by UWS.

Province	UWS Projects under investigation, planning and design			RWS Projects under investigation, planning and design				Estimated costs (Kshs million)		
	MWR	NWCPC	Design Population	MWR	NWCPC	Others	Design population	MWR	NWCPC	Others
Central	1	2	23,002	27	46	10	861,652	1,504.8	177.0	1.0
Coastal	3	2	82,000	16	10	1	294,797	207.8	1,888.3	0.1
Eastern	2	0	75,000	22	37	16	830,610	328.2	249.6	210.0
North East.	1	0	50,000	14	0	0	227,500	96.5	0	0
Nyauza	4	0	70,125	32	2	8	1,270,339	5,615.7	2.5	5.7
Rift Valley	2	1	104,000	65	72	25	1,955,704	2,490.4	1,141.8	1,572.1
Western	3	0	227,300	15	15	4	1,292,170	628.7	44.6	0
Total	16	5	631,427	191	182	64	6,732,772	10,872.1	3,503.9	1,788.9

Source: MWR water supply projects and schemes status report in 1996

Note: 1) Others include RDF, MOA, NGO, Institution, Community (S/H)

2) Total amount is converted from K£ to Kshs by K£ 1.0 = Kshs 20

By the implementation of above planned schemes, about 7.4 million population will be benefited by safe water. Most of these schemes are located in Rift Valley, Central and Eastern Provinces.

- 1) Rift Valley province is the lowest among the whole provinces in terms of population coverage by the water supply systems, staying at merely 16% of the provincial population. As the province is located in arid zone, people are obliged to spend several hours to fetch water from their sources particularly in dry season. If the planned projects are successfully implemented, 33% of the provincial population will have access to safe water, contributing significantly to alleviation of heavy tasks mainly undertaken by women and children.
- 2) Central province has the second total population among the eight provinces and a high density of population. Service coverage is 47% of the provincial population. After completion of the projects, the coverage will improve to 71%.
- 3) Eastern province also has a high population density. Present service coverage is 32% and after completion of the project, the coverage is expected to rise, 62%.
- 4) Rural population in Western province are supplied mainly from the water supply schemes operated by communities under assistance of KFWWSP. Successful implementation of the planned projects may contribute to a significant increase of population coverage from the present 50% to 93%.

Out of projects listed in the 1996 project status report, 4% of schemes are under implementation and 38% under investigating and planning. Remaining 58% are under design or completed design and awaiting loan arrangement. Details are shown on Table - 1.2.2. The implementation of these projects shall be continued as considered most cost effective. To this end, financial resources of Kshs 25 billion or US\$378 million are required for implementing all of these projects.

(4) Design Population vs. 2010 Population

Comparison of the 1995 population served including design population of the above schemes (under implementation and planning) with the district population in 2010 gives important information, to which districts the project are concentrating. Expected service coverage in 2010 in each district is estimated by the following equation.

$$\text{Service Coverage in 2010 (\%)} = \frac{\text{(1995 population served + Design population of the on-going projects)}}{\text{(2010 district population forecast)}}$$

The estimated coverage that exceeds 100% is seen in 10 districts including Kirinyaga (132%), Nyandarua (119%), Nyeri (108%), Masaku (128%), Mandera (396%), Siaya (185%), Laikipia (109%), Nandi (113%), Turkana (108%), and West Pokot (202%).

1.2.4 Donors' Support to Water Supply Sector

Since the establishment of MWR in 1974, many bilateral and multilateral donors have extended support to various projects and programmes of the water sector. Magnitude of the supports extended in the past five years are summarised in monetary term in Tables - 1.2.3 (MWR) and 1.2.4 (MOLA). Major activities of these donor countries/agencies as of 1997 are summarised below.

Donor	Objective or Strategy	Projects/Studies
Belgium	1995 to date: overcome management problem, by implementing community based management strategy	Water Users Association Support (WUAS) Project in Machakos, Makueni and Kajiado with many constraints
Finland	Provide safe and adequate supply of potable water Transfer responsibilities to communities Increase community management skills	Kenya-Finland Western Water Supply Programme(1981-1996) in Kakamega, Busia, Bungoma districts and a part of Siaya district Community Water Supply Management Project in Western Province
Germany	Promote community based approaches Support and encourage commercialisation and private sector participation	Strengthen KEWI capability Kilifi Integrated Development Programme Eldoret W/S Phase II, Eldoret Sanitation Kericho W/S and Sanitation Malindi W/S Nyeri W/S Urban water supply and sanitation management projects at Kitale, Eldoret, Nyahururu, Kisumu, Nakuru, Nanyuki, Kericho, Nyeri and Thika
Italy	Develop new water source	Kirandich Dam Project (NWCPC), 45% dam embankment completed as of Sep. 1997
Japan	Support in every aspect of water and sewerage sector by conducting studies, training and assigning experts and volunteers Support institutional capacity building Nationwide water resource assessment and management Support water supply system development both in urban and rural areas	Study on Seven Town Water Supplies in Eastern Province Study on Sewerage System Development Plan in Kisumu Aftercare Study of National Water Master Plan
Netherlands	Decentralise the programme to local entity Provide safe and accessible water	Rural Domestic Water Supply and Sanitation Project, Phases I & II Phases II from 1991 to 1995 in Nyanza Province, Currently interim phase WRAP, Phase I-IV Phase V started in July 1996 in Keiyo, Marakwet, Nakuru, Laikipia, Turkana districts

Donor	Objective or Strategy	Projects/Studies
Sweden	1990's: Community managed water supply To improve public health and general socio-economic development	Community Management of Water Supplies Project National Water Policy Project Feasibility Study on Self-help Water and Sanitation Project in Meru, Nyandarua and Baringo Districts in 1996 Office support and staff training
The World Bank	To reduce poverty To promote equitable, efficient and sustainable development To promote policy reforms, institutional adaptation and capacity building	2nd Mombasa, 3rd Nairobi W/S Project
UNICEF	Develop sustainable water and sanitation projects by strengthening inter-sectoral linkages and increasing capacity building for operation and maintenance Provide safe water particularly in refugee area	Five Year programme under Child Survival and Protection Project providing access to safe drinking water and sanitation facilities

In addition to the above, many donor countries and agencies including Egypt, Saudi Arabia, Italy, France, Denmark, Austria, and EEC are currently assisting the Government in developing the water and sanitation sector in the following areas:

- Egypt: Construction of 100 boreholes in ASAL in North Eastern and Rift Valley Provinces
- Saudi Arabia: Mombasa Sewerage Project (in progress), Garissa Urban Water Supply and Sanitation Project
- France: Human resource development planning projects in Nakuru and Eldoret. The study of the upper Athi River basin and the Nairobi aquifer
- Denmark: Water programme in Coast and Eastern Provinces
- EEC: Desilting dams in ASAL areas
- Austria: Masinga-Kitui Water Project

Many donors are involved actively in the field of water and sanitation sectors by providing various type of assistance. From these activities and strategies, it can be said that:

- (1) Most donors have clear strategy for technical and financial assistance. To attain sustainable development of water and sanitation projects, they tend to support decentralisation of management and operation to the local communities and the private sectors in the form of commercialisation and privatisation of water and sanitation schemes.
- (2) Coordination between donor countries are being carried out in the series of Coordination Meetings from June 1996. It is expected that these activities will be intensified in the future to avoid duplication and to have effective coordination of actors.

- (3) Many facilities constructed are not necessarily functioning as designed and have been left without proper maintenance. Due to various operational and financial problems resulting from weak management and organisation, most donors are paying far more attention to institutional and operational aspects of the schemes rather than investment on physical facilities.
- (4) Financial resources for water and sanitation sector development have increased in the last decade. Donors financing still remains significant but declining with the leading donors being Netherlands, Sida, Belgium Cooperation, and Japan.

1.3 Existing Water Supply Schemes

1.3.1 Present Status of Existing Water Supply Schemes

The present status of the urban water supply and the integrate large scale rural water supply schemes serving more than 5,000 persons are given in **Tables - 1.3.1** and **1.3.2**. Data sources are the MWR Status Report 1996 and the Water Supply Schemes Operation Status in 1997.

According to the National Development Plan 1997 - 2001, a number of schemes operated as of 1994 is as follows:

Operator/Supplier	No. of Water Projects, 1994
Ministry of Water Resource	579
National Water Conservation and Pipeline Corporation	188
Community Water Supplies	339
Self-helps Schemes	243
Local Authorities	164
Non Governmental Organisation	266
Total	1,779

Source: The 8th Five Year National Development Plan, 1996-2001

MWR, NWCPC, and Local Authorities operate 931 water supply schemes in urban centres and rural areas, or equivalent to nearly 50% of all schemes. Other authorities of Communities, various institutions, and NGO are also involved in operation and management of their own water supply systems.

In the last two decades, many community based water supply schemes have been established throughout the country. Many of these schemes, however, are not functioning well as defective equipment and facilities are left without repair. The major reason is financial weakness of the authorities resulting from low level of accounted-for water ratio, unreliable water supply and less quality of water.

To the contrary, several water supply schemes in municipal and town councils under technical and financial assistance of foreign donor countries are working well. The schemes intend to apply metering system for whole beneficiaries aiming at commercialisation of water business management and operation.

(1) MWR and NWCPC Water Supply Schemes

According to the MWR Status Report on water supply schemes in 1996, MWR covers 372 water supply schemes in urban centres and rural areas in all provinces and NWCPC 287 water supply schemes in urban centres and rural water supply schemes mainly in Central, Coastal, Eastern and Rift Valley Provinces as shown in table below. Some municipal councils and town councils are supplied with treated water as bulk supply by NWCPC. Regarding majority of the small scale community and self-help water supply schemes and NGOs, the present status are unknown to MWR.

Coverage of the water supply schemes managed by MWR and NWCPC is estimated at 28% of total population in 1997. This percentage increases to 39% when the schemes operated by the municipal councils are considered.

Province	Urban Water Supply Schemes			Rural Water Supply Schemes			'95 Total Population	Total Pop. Served
	MWR	NWCPC	Pop. Served	MWR	NWCPC	Pop. Served		
Central	14	0	744,853	32	41	1,003,783	3,712,000	1,748,636
Coastal	3	18	379,443	13	28	135,331	2,250,000	514,774
Eastern	8	9	173,552	36	92	764,620	4,652,000	938,172
North East.	8	0	118,418	42	0	122,635	657,000	241,053
Nyanza	10	3	261,000	28	12	627,652	4,767,000	888,652
Rift Valley	19	12	304,010	126	64	703,974	6,405,000	1,007,984
Western	10	1	371,310	23	7	541,457	3,219,000	912,767
Total	72	43	2,352,586	300	244	3,899,452	25,663,000	6,252,038

Source: MWR water supply projects and schemes status report in 1996

Note: Population served is only of the schemes managed by MWR and NWCPC and does not include that of the schemes of Municipal and Town Councils and Community and Institute schemes

(2) Municipal Council Water Supply Schemes

JICA Study Team surveyed 18 water supply schemes of municipal, town and county councils during the field study. Total population served is about 2,901,000 and its coverage shows 79% against the population in the service area. Almost all the schemes established a metering system and 95% of the house connections are metered.

The Urban Water and Sanitation Management Project assisted by GTZ (German Technical Cooperation Agency) are in progress in Eldoret, Kericho and Nyeri Municipal Councils to establish fully fledged, autonomous and commercially oriented water and sanitation companies as pilot towns. The executive agency is the Ministry of Local Authority. Table - 1.3.3 summarises their performance in the field of operation and management.

In these municipal councils, water supply schemes are well operated, maintained, and managed adopting effective universal metering system, billing and collecting system, accounting system, water quality control, etc. The improvement of the management is seen in the following areas:

- 1) Significant increase of revenue,
- 2) Decreasing unaccounted-for water, and
- 3) Appropriate operation and maintenance.

Actual progress of the financial management in 1994 to 1997 is shown below:

Indicators	Eldoret				Kericho				Nyeri			
	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997
Unaccounted-for Water	-	24	26	26	-	45	42	37	-	37	34	36
Collection Efficiency (collection/billing)	77	98	93	81	21	85	89	85	-	89	72	86
Increase of revenue	-	64	172	-	56	89	45	-	-	16	32	-
Expenditure of revenue	-	35	25	-	-	67	73	-	-	73	67	-
Surplus of revenue	-	65	75	54	-	33	27	4	-	27	33	18

Source: Financial performance of MOLG/GTZ - UWASAM 1994 to 1996

Note: Percentage in 1997 is the actual performance from Jan to Jun

In addition to the above three pilot projects, schemes of Thika, Nyahururu, Kisumu, Nakuru, Kitale and Nanyuki municipal/town councils are to be programmed under UWASAM project.

The water supply systems of the City of Nairobi and Mombasa municipal council are under the implementation of phased augmentation project. Kisumu, Eldoret and Nakuru municipal councils conducted or intend to conduct some studies on improvement for the water supply system. The present situations of the water supply schemes in the municipal councils are as follows:

1) Nairobi City Council

Succeeding the Nairobi water supply extension which was completed at the end of 1984 under the Chania-Kimakia-Thika Phase II project, the third Nairobi water supply development project has been initiated to meet water demands up to 1995 as short term target and to 2010 as long-term target. The project covered the City of Nairobi and parts of Kiambu, Mutang'a, Machakos, Kajiado and Nyandarua Districts with total population of 2.49 million. Total production capacity is increased to 440,000 m³/d. The project also completed in 1996.

2) Mombasa and coastal townships of Malindi, Kilifi, and Kwale

The second Mombasa and coastal water supply project is in progress for the rehabilitation and augmentation of the facilities under financial and technical assistance by IBRD. The project is to be completed in January 1998. Succeeding the second Mombasa and coastal water supply project, the Interim Project for Mombasa and Coastal Water Supply

III is scheduled to start in 1999/2000. The project scope includes leakage control, reinforcement and renewal of pipe network and metering system.

3) Kisumu Municipal Council

Study on Kisumu water supply and sewerage systems improvement project is now in progress under technical assistance of JICA. The study will be completed in September 1998.

4) Eldoret Municipal Council

Dam construction for the water supply system of Eldoret Municipal Council is at the final stage, financed by KfW. Following the dam construction, the water supply expansion project will start.

5) Nakuru Municipal Council

The study of Greater Nakuru Water supply project started in 1997 under the financing of the African Development Bank (AfDB) for preparation of master plan and feasibility study with the target year of 2020. The preliminary and final design works are planned to be commenced under the financing of AfDB.

6) Nyeri Municipal Council

Nyeri MC is in the study stage on privatisation of water supply and sewerage systems under the technical assistance of GTZ. The privatised independent company is to be established near future. The extension project of water supply system with 3,000 m³/d that requires investment cost, Kshs 600 million, has been committed by KfW.

7) Kericho Municipal Council

Kericho MC is currently conducting study on privatisation of water supply and sewerage systems under GTZ as pilot projects.

The extension of water supply system is required to overcome chronic water shortage and to supply potable water to expanded area of MC from 66 km² to 105 km². The project has been already committed by MOLA and is waiting for the financing of donors.

1.3.2 Service Coverage

Tables - 2.2.3 and 2.2.4 in the succeeding section present the 1995 service coverage which are also summarised below:

Water Supply System	Population Served		Population in 1995
	Population Served	Service Coverage (%)	
Urban Water Supply	4,974,000	92	5,191,000
Rural Water Supply	9,724,000	44	22,329,000
Total	14,698,000	53	27,520,000

Source: The Aftercare Study Team

Since the supply areas of the UWS usually extend to the peripheral rural areas of the urban centres, service coverage of the UWS is slightly high in comparison with the figures obtained in the previous surveys. The completion of the on-going projects will increase the service coverage from 53% to 67% of the whole population. The population served in 1995 by district and by type of scheme are plotted on the district map, which are presented in Figure - 1.3.1.

1.3.3 Estimated Water Consumption

Data on the production capacity of the existing schemes are not available for whole water supply schemes. Based on the obtained data on the capacity and per capita consumption, it is estimated as below:

Water Supply System	Population Served	Supply Quantity (m ³ /d)	Per Capita Consumption (lpcd)
Urban Centre	4,970,000	709,000	143
Rural Areas	9,724,000	754,000	78
Total	14,640,000	1,462,000	100

Source: The Aftercare Study Team

This is further discussed in Section 2.3, Chapter 2 of this report.

1.3.4 Water Supply Facilities

(1) Urban Water Supply

1) Water sources

MWR executed the water resources assessment and the development study at a number of districts in the course of the Water Resource Assessment Project in co-operation with Netherlands. The study carries out an evaluation of water resource potentials by district basis and proposes district water development plans.

Present water sources for the water supply schemes of 128 urban centre and 184 rural areas, of which water sources are identified, are summarised in the table below:

Water Source	Surface water				Groundwater				Un-identified Sources	Total
	River	Lake	Offtake from Pipeline	Sub-total	Borehole/Shallow	Spring	Rock catchment	Sub-total		
Urban water supply schemes	70	2	6	78	36	14	0	50	13	141
Rural water supply schemes	94	7	7	108	54	22	0	76	111	295
Total	164	9	11	186	90	36	0	126	124	436

Source : IICA Field Survey Results in 1998 and MWR Operation and Maintenance Report ,1997

Note : River water source includes river, stream, dam and irrigation canal

Intake facilities that extract the surface water are grouped into four: (i) run-of river intake, (ii) a large dam with a reservoir having enough capacity to regulate the river runoff through the year, (iii) pumping facilities on lake and river, and (iv) small dam.

Actual intake rate is recorded below a design capacity in many schemes. This is due to an estimated flow rate based on operation hours of raw water pumps. Most pumps are malfunctioning and are not overhauled or repaired. Any repair work cannot be done due to financial constraint.

Groundwater is extracted from boreholes, dug wells, and springs. At present, 8,448 boreholes have been registered with water right for various purposes, of which more than 50% is supposed to be used for domestic and livestock supply.

Water supply schemes relying on groundwater of boreholes are obliged to exercise water rationing because no renovation of damaged boreholes and pumps is carried out. Water sources of the small scale schemes are mainly groundwater of boreholes, dug-wells, and springs. River and small dam water is also used.

2) Treatment process

Treatment process is mostly composed of conventional chemical coagulation, flocculation, sedimentation and filtration, and finally chlorination is applied for filtered water. Chemicals are used of sulphate aluminium as coagulant, soda ash as coagulant aid and tropical chloride of lime as disinfectant. Chemicals are dosed by dripping from a solution tank and mixed by hydraulic cascade from weir. Flocculation is of horizontal baffled chamber type. Sedimentation tank is mostly employed of up-flow type for easy desludging and cost saving. Filter is rapid sand filter of conventional type with a filtration rate less than $5 \text{ m}^3/\text{m}^2/\text{hr}$.

Municipal Councils water works where reconnaissance survey are carried out by the Team are well operated under control of chemical dosing process applying Jar-test twice a day. Most of the treatment works operated by DWO have few laboratory apparatus and

Jar-tester or they are unusable. If any, alum dosing is not efficiently made with suitable dosing rate. In these schemes, filters are washed by air scouring and backwash water every 24 hours. In case of the treatment works with poor sedimentation efficiency, filter is washed twice a day.

As a whole, the treatment works are not operating effectively, due to a limited number of operational staff and a lack of proper advice and guidance by technicians/engineers. When turbidity of raw water is low in dry season, no chemical is dosed according to operator's decision. Due to a shortage of enough budget allocation to purchase chemicals, small scale treatment works hardly perform chemical dosing resulting in poor quality water. KIWWSP points out the following reasons for this abominable situation:

- a) lack of adequate skill in operation and maintenance procedure of operators,
- b) laxity of supervision,
- c) lack of the necessary working tool,
- d) Irregular supply of coagulants,
- e) overloading of treatment works, and
- f) lack of water quality control.

These issues are common in all water supply schemes in Kenya operated by MWR and NWPC.

Groundwater sources of boreholes, dug-wells and springs only apply chlorination as a treatment process. Low turbid water from river, stream and small dam in many rural schemes are supplied without proper treatment. It is of the Team's opinion that schemes using surface water should have an adequate treatment process with chlorination as minimum requirement to produce safe water

3) Storage reservoir

Storage reservoirs are almost all of circular type made of masonry on the ground. They are generally of small capacity and shallow in depth to save costs. Even after more than 40 years, they are still in use.

Storage capacity of the existing reservoir is quite small. Out of 343 water supply schemes of urban centres and rural areas surveyed, merely 37 schemes or 11% have enough capacity, namely, 24 hour storage. The others have less than 50% of required capacities. Small capacity makes causes of operation hour deduction from 24 hours to 9 hours below. By an expansion of storage capacity, the system is possible to be retained for 24 hours operation. Extension works shall be done under the rehabilitation programme.

4) Transmission and distribution facilities

Distribution systems are maintained by respective water undertakers, that is, municipal councils, MWR, and NWCPC. NWCPC supplies bulk water to the councils as seen in Nakuru and Kisii.

Transmission and distribution pipelines are of galvanised steel or uPVC because they are available locally in Kenya. Push-in type of uPVC pipes and coupling joint of steel pipes are widely used in the country. Steel pipes are limited to pipelines under high pressure.

No master meters for flow and leakage control are installed on the outlets from treatment works, storage reservoirs, or pump stations. Leakage control is not established yet for rationalising water distribution. One exception is Kericho Municipal Council, which organised a leakage detection team consisting of 2 engineers and 4 plumbers and meter readers and started active leakage control with subsequent pipelines repair works. These activities are essential to reduce UFW and increase revenue.

5) Service connections

Galvanised steel pipe of screw joint and uPVC of solvent cement joint are used for service connections particularly, those less than 1" in diameter. Typical individual connections are 1/2" in diameter with customer meters. The water undertakers maintain service pipelines up to customer meters. For low income households, water kiosks or communal water points are constructed.

According to JICA survey, accessibility to meters is generally in good condition but most of them are not encased in meter boxes. While MWR and NWCPC established a metering system for the system operation, there are many urban centres without house meters. In the schemes of municipal councils, most of house connections are installed with water meters which are maintained well.

(2) Rural Water Supply

No data are available on present conditions for rural water supply schemes other than those listed in the status report. According to the 1996 Project Status Report, 637 rural water supply schemes are under operation including small and large scale rural schemes. Out of them, 300 schemes are operated by MWR and 244 schemes by NWCPC. Another 93 schemes are operated by communities and other institutions. Total population served reaches to about 4,500,000. The report suggests that 544 rural water supply projects are under implementation and 437 projects in planning and design stages. Table below classifies the existing 295 large scale rural water supply schemes by their water sources, reproducing from Table - 1.3.2.

Items	Surface Water Source	Groundwater Source	Unidentified Source	Total
Number of Schemes	108	76	111	295
Production Capacity (m ³ /d)	154,000	19,200	60,600	234,400
Population Served	2,264,000	686,000	1,534,000	4,484,000

Note: 1) Surface water source includes river, stream, lake, dam and offtake from pipeline.

2) Groundwater source includes borehole, dug-well, spring, offtake from pipeline and rock catchment.

The large scale rural water supply schemes depends on river water as major water sources. Groundwater of boreholes, dug-wells and springs are minor in terms of quantity. These schemes serve approximately 4.5 million population of the total 22.3 million, equivalent to 20.1%. The Team's site investigation identified urgent needs of repair or replacement of defective equipment such as pumps, gates and other mechanical devices for normal operation of the systems. It is merely a few schemes that apply chlorination for treating unsanitary river and small dam water.

1.3.5 Operation and Maintenance

(1) Urban water supply schemes

1) Operating hours

Operating hours of the treatment works affect amount of water production. It is noteworthy that, out of 302 schemes, 171 schemes or 57% are not operated continuously. Further, 122 schemes run less than 12 hours a day as shown in Table - 1.3.4 which is summarised below.

Operating Hours	Surface Water Source (Nos.)			Groundwater Sources (Nos.)			Total	
	River/Lake	Dam	Sub-total	Borehole	Well/Spring	Sub-total	Nos.	%
16 ~ 18 hrs	5	1	6	8	2	10	16	5
10 ~ 12 hrs	17	4	21	7	5	12	33	11
8 ~ 9 hrs	17	4	21	16	7	23	44	15
6 hrs >	21	6	27	18	33	51	78	26
Total	60	15	75	49	47	96	171	57

Source : MWR Water Supply Schemes Operation Status, 1997

The restricted operation may be explained by; (i) obsolete and malfunctioning facilities, (ii) improper attendance by operation and maintenance staff, (iii) saving of chemicals and fuels, and suspension of electric power supply, and (iv) decrease in river discharge or borehole/dug well production.

Intermittent and unreliable water supply inconveniences customers. Various sectors of the economy are seriously affected, including dairy processing, leather factories, restaurants, hotels, health care facilities, etc.

Provided that there is sufficient water resources available, the scheme could be restored to its original function by rehabilitation. Effective implementation of the rehabilitation will increase water production and supply areas could be accordingly expanded.

Taking this into account and the recent damage caused by the El Nino phenomena, MWR currently stresses on urgent implementation of the rehabilitation plan.

2) Flow control and metering system

To ensure sustainable development of the schemes, metering, billing and bill collection are most important aspects of the water supply. The survey completed by the Team indicates that a lack of effective metering system is causing an extraordinary low efficiency of accounted-for water (AFW).

In order to attain accountability of the schemes, functional metering system and flow control are indispensable.

a) Flow control

Master meters are normally installed at treatment works or pump stations for measurement of water production and distribution. Only a few schemes, however, have functional master meters according to the Survey, whereas the majority of the schemes have the malfunctioning meters or none at all. Once meters are broken, they are usually no repaired. Therefore, effective flow control to reduce wastage, minimise water losses and to operate storage reservoirs cannot be achieved at present.

b) Metering

The Government's policy and strategy toward metering system have accelerated customer meter installation. There are still many schemes (about 40% of all schemes) that adopt flat rate tariff due to a lack of customer meters. Meter installation is urgently required to normalise water supply operation and management at all schemes.

Billing and revenue collection are also one of the important aspects to be addressed in view of ensuring sustainability of the schemes. Present billing and collecting system was investigated by the Study Team and problems are identified as reported in Chapter 11, Main Report.

3) Water quality control

Water quality control is hardly recognised in most schemes. In addition, no routine testing is being done. When raw water is rather clean in dry season, no chemical is added. This is done according to operators' decision. Due to an extremely low level of financial capability, many treatment works can hardly procure and add chemicals to ensure safety of produced water. Unknown quality of water is being supplied to consumers. This is seen particularly in small scale community based water supply schemes.

Only a few urban water supply schemes have their own laboratories. They are conducting periodical water sampling and testing. Turbidity, conductivity, pH and residual chlorine with Jar-testing are major testing items to attain appropriate chemical dosing. Testing apparatus, however, are in general few and defective.

The drinking water quality standards in Kenya are presented in Table - 1.3.5. The standards recommend the following drinking water quality for specific items taking into account regional characteristics, particularly small scale schemes. A maximum value of permissible quality is allowed to make supply of drinking water by only chlorination and no removal of turbidity, colour, iron and manganese.

Items	Unit	Desirable Quality	Permissible Quality
Turbidity	NTU	5	25
Colour	TCU	15	50
pH		6.5 - 8.5	6.5 - 9.2
Hardness (as CaCO ₃)	mg/l	500	500
Total Dissolved Solid	mg/l	1,000	1,500
Chloride (Cl)	mg/l	250	600
Iron (Fe)	mg/l	0.3	1.0
Manganese (Mn)	mg/l	0.1	0.5
Copper (Cp)	mg/l	1.0	1.5
Zinc (Zn)	mg/l	5.0	15

Source: Design Manual for Water Supply in Kenya, 1986

4) Laboratory testing

Major urban water supply schemes have their own laboratory and test water quality on turbidity, conductivity, pH and residual chlorine and Jar-test to manage the appropriate chemical dosing and the treatment process. Test apparatus are in general few and defective. It is recommended that simple test apparatus, at least turbidity, colour and residual chlorine and Jar-test equipment be provided immediately to maintain the water quality at the required minimum level so that any inconvenience due to degraded water quality could be eliminated.

5) Staffing for operation

One operator, in most cases, is assigned for system operation particularly in small waterworks and pumping stations. Effective operation could be hardly achieved. It is recommended that treatment works should be operated by several qualified operators under shifting schedule to produce and supply safe water to consumers.

6) Training

Periodical training of staff is carried out in KEWI. Operational staff, however, are rarely involved in the training. As O/M for treatment works and pumping station generally require some special skills, it is recommended that periodical training of site staff shall be carried out from the standpoints of both technical and social aspects to produce safe water.

(2) Rural water supply schemes

1) Flow and quality control

Most rural water supply schemes have no flow meters. Water production will be estimated by pump operation hours. The schemes operated by communities have no flow meters. Regarding house connections, MWR and NWPCPC install water meters to the service connections in medium scale schemes. However, billing and bill collection are not functional.

In rural schemes no chlorination is used due to lack of supply of chemicals. Especially small schemes have no chlorination facilities due to shortage of funds.

2) Routine maintenance

No routine maintenance is conducted in most schemes. Particularly, the community schemes have no operational staff.

3) Staffing for operation

Operators have inadequate skills for operation and maintenance of the facilities. It is desirable to train operators for adequate operation and maintenance and to assign new operators for the schemes having no operator.

4) Financial status

The schemes have also similar issues as urban water supply systems on the lack of budget allocation for O&M.

1.3.6 People's Behaviour for Water Use

Many studies and questionnaire surveys on people's behaviour for water use and sanitation, living circumstances and income levels have been done in the country. Out of them, important are the 1996 Welfare Monitoring Survey carried out under assistance of IBRD and UNICEF (WMS) and the 1997 JICA Study on Seven Towns in Eastern province. The former provides information particularly on major water sources of the entire population in the country and average time taken to collect water. The latter clarifies various aspects of people's behaviour for water in the limited areas in Eastern Province. Under the current study, a nationwide questionnaire survey was done in the period from January to February 1998. Note, due to serious floods during the survey period, the survey method and sampling areas has to be changed. Sample households for rural population were selected from the suburban areas of the urban centres due to lack of access to transportation. This arrangement biased slightly survey results of major water sources in rural areas. However, it still retains useful information on general trend of the living standard and water use practice by households in urban and rural areas.

The results are summarised in Data Book attached to the present Report. The following paragraphs, reproducing the results of these surveys and studies, summarise important aspects of water sources, typical patterns of water usage and people's response against water supply services, which are key information to formulate future development plan of the water supply schemes.

(1) Water Sources

1) Major water sources in urban and rural areas

According to the household survey, main water sources of households in urban and rural areas are piped water, as given below. Other water sources of rural population are river water, rain water harvesting, and shallow wells.

Water Sources in Urban and Rural Areas

Area	Piped	River	Well	Borehole	Rain	Spring	Dam	Others
Urban	89.3	7.5	10.2	7.4	16.0	2.2	0.3	1.3
Rural	75.3	26.0	20.0	2.2	22.3	7.4	4.6	1.1
Total	84.0	14.5	13.9	5.4	18.4	4.2	1.9	1.2

Note: As some households are depending on plural water sources, total percentage exceeds 100%.

Source: Household survey, JICA Study, 1998

2) Water availability in dry season

In ASAL area in Kenya, people suffer from a long dry spell that continues more than 6 months every year. Water is essential for those people and livestock. The survey indicates 20% of the urban and rural population are facing serious water shortage during the dry season. The situation become worse and serious particularly in rural areas.

Water Availability in Dry Season

(Unit: %)

Area	Yes	No
Urban	83.7	16.3
Rural	76.4	23.6
Total	80.9	19.1

Source: Household Survey, 1998 JICA Study

Despite high percentage of service coverage in the country (i.e. 90% in urban and 35% in rural areas according to the 1996 Welfare Monitoring Survey II), more than 50% of the urban and rural population do not have access to water. They get water only one day per week during the dry season. Simple comparison with service coverage rate of piped water supply suggest that many population, even served from piped water supply, cannot get water. Waterworks may frequently stop operation, presumably because of raw water shortage and/or relatively small capacity of storage reservoirs.

Days per Week When Water is Available during Dry Season

(Unit: %)

Area	1 day	2 days	3 days	4 days or more	Not answered	Total
Urban	50.8	18.3	10.7	3.2	17.1	100
Rural	50.1	11.5	9.1	3.3	26.0	100
Total	50.5	15.7	10.1	3.2	20.5	100

Source: Household survey, JICA Study, 1998

3) Distance to water sources and frequency of water collection

The present household survey indicates distance to their water sources. Table below shows time taken to collect water during dry season in urban and rural areas.

Time Taken to Collect Water during Dry Season

Area	From taps	Less than 30 min	30 min - 1 hour	1 hour - 2 hours	More than 2 hours	Total
Urban	39.2	52.5	6.1	1.6	0.7	100
Rural	15.0	68.1	10.4	2.2	2.6	100
Total	30.2	58.8	7.8	1.8	1.4	100

Source: Household survey, JICA Study, 1998

Nearly 90% of the population collect water by spending less than 30 minutes. Some are spending more than one hour for water collection. They access water points to get water as frequently as three times a day or more. Water collection particularly in the rural areas is heavy tasks burdened to housewives and children.

Frequency of Water Collection

(Unit: %)

Area	Twice a day or less	Three times a day	Four times a day or more	Not answered	Total
Urban	30.6	10.2	42.6	16.7	100
Rural	27.5	16.1	48.4	8.0	100
Total	29.4	12.4	44.8	13.4	100

Source: Household survey, JICA Study, 1998

4) Water sources versus health conditions

This aspect is important to evaluate benefits of public health improvement, usually endowed with water supply schemes. As shown in the table below, any significant traces of contribution by piped water scheme development to public health was not recognised from the survey results. The survey previously carried out in the 1997 JICA Meru Study has resulted in the same.

In many countries, piped water is considered the most effective means to protect public health from waterborne diseases. However, in case of Kenya, it is not necessarily right. It is premature to conclude, but it may be possible that many water supply schemes so far established are not effectively operated from a sanitary point of view.

Water Sources vs. Health Conditions (Samples)

Water Source	None	Malaria	Typhoid	Cholera	Dysentery	Others	Total
Piped	198	360	121	22	27	19	747
River	5	15	4	0	2	0	26
Hand dug well	5	68	41	6	25	2	147
Private borehole	3	6	3	1	3	0	16
Rain water	0	0	0	0	0	0	0
Spring	3	12	4	0	1	0	20
Dam	0	3	3	2	1	1	10
Others	1	1	0	0	0	0	2
Total	215	465	176	31	59	22	968

Source: Household survey, JICA Study, 1998

(2) Water Usage

1) Unit Water Consumption

Flow measurement survey done in Meru Township during the 1997 JICA Study suggests that actual water consumption by metered customers ranges 80 - 100 lpcd and unit water consumption rates at the kiosks ranges 10 - 20 lpcd. It further suggests that customers that are levied a flat rate tariff consume plenty of water, nearly 500 lpcd. Under the study, water production collected in the questionnaire survey was reviewed. Complete absence of master and customer meters in many waterworks reduces number of reliable data.

Table below summarises reliable data on unit water consumption rate in terms of water production per capita, obtained from Meter Condition Survey done at 34 selected waterworks.

Unit Water Consumption

Urban Scheme Name	Water Undertaker	Master Meter Working	Customer Meter Working	Water Production (m3/day)	Metered Con. (nos)	Unmetered Con. (nos)	Consumption Rate (lpcd)
Turbo	MWR	Working	Working	300	245	nil	153
Kitui	MWR	Working	Working	800	900	250	111
Nyamira	MWR	Working	Working	466	802	296	73
Eldoret	Municipal Council	Working	Working	37,400	28,850	70	162
Kakamega	NWCPC	Working	Working	5,410	5,422	34	125
Average				44,376	36,219	650	153

Source: Survey on Existing Urban Water Supply, JICA Study, 1998

Average water consumption per capita is 153 lpcd, varying from a low of 73 lpcd to a high of 162 lpcd depending on size and characteristics of urban centres. These unit rates are well consistent with the values envisaged in the 1986 MWR Design Manuals.

2) Storage facilities

Table below indicates percentage of households who have storage facilities in their home.

Storage Facilities

Area	(Unit: %)	
	Yes (%)	No (%)
Urban	66.1	33.9
Rural	48.2	51.5
Total	59.3	40.7

Source: Household survey, JICA Study, 1998

Urban population is more likely to store water for daily and/or emergency use. This may indicate no alternative sources available in the urban areas, when the piped water supply is suspended.

Type of Storage

Area	(Unit: %)		
	Buckets	Drums	Jerrycans
Urban	50.8	14.0	35.2
Rural	40.1	28.4	31.5
Total	47.5	18.4	34.1

Source: Household survey, JICA Study, 1998

Buckets and jerrycans are convenient and popular storage means both in urban and rural areas. The survey further indicates such storage has an average capacity of 2.4 m³.

3) Practice for washing hands, clothes and bathing

Most people wash their hands, wash their clothes, and take baths. However, bathing is practised at a rather low frequency. There may be millions of people in the country who do not practice bathing.

(Unit: %)

Area	Yes	No
Washing Hands	97.5	2.5
Washing Clothes	95.4	4.6
Bathing	87.1	12.9

Source: Household survey, JICA Study, 1998

4) Boiling practice

The survey also indicates that many urban and rural population boil their water before drinking. It is acute particularly in the urban area. Nearly 70% of the urban population may be doubtful about the quality of supplied water.

(Unit: %)

Area	Yes	No
Urban	69.0	31.0
Rural	44.5	55.5
Total	59.7	40.3

Source: Household survey, JICA Study, 1998

Many people, from long-term experience in the past several decades, tend to boil drinking water by spending extra-expenses for fuels, gasses, etc.

(3) Water Supply Services

1) Average payment

A question of average payment for water was asked to customers who get water from piped water system through individual connections, kiosks, water points, and neighbourhood supply. About one quarter of customers fell into a payment band between Kshs 150-300/month as given in table below. It should, however, be noted that 20% of the population are not paying any cost for piped water.

(Unit: %)

Area	No payment	Less than Kshs 150/month	Kshs 150 - 300/month	Kshs 300 - 600/month	More than Kshs 600/month	Not answered	Total
Urban	19.6	18.1	21.0	15.5	14.0	11.8	100
Rural	22.5	29.2	34.4	8.3	5.6	0.0	100
Total	20.5	21.7	25.4	13.2	11.3	8.0	100

Source: Household survey, JICA Study, 1998

2) Satisfaction

More than two thirds of the entire population are not satisfied with water supply services. This can be seen from the table below.

Satisfaction with Water Supply Services

(Unit: %)

Area	Yes	No	Total
Urban	29.8	70.2	100
Rural	32.7	67.3	100
Total	30.9	69.1	100

Source: Household survey, JICA Study, 1998

The reasons for the low level of satisfaction are:

Reasons for Unsatisfaction

(Unit: %)

Area	Poor management	Poor water quality	Low pressure/ less water available	High water tariffs	Others	Total
Urban	24.4	19.3	42.6	6.1	7.5	100
Rural	22.8	19.0	41.6	7.1	9.5	100
Total	23.9	19.2	42.3	6.4	8.2	100

Source: Household survey, JICA Study, 1998

More than 40% of households serviced from piped water systems have complaints about water availability at their taps. Then follows poor management of the water schemes and poor water quality. Complaints against high water tariffs are very low, 6-7%. It may suggest that there are some rooms of tariff amendment if treated safe water is adequately supplied to customers.

3) Metered versus unmetered

There are several sources available. The household survey conducted reveals that about 60% of registered customers are metered on average (80% in urban areas, 43% in rural areas). Survey on Urban Water Supply (based on information obtained at each District Water Office) suggests a slightly higher rate of 90% in urban areas (290,400 metered

connections out of 323,700 connections in total). Out of them, many meters were found broken in the course of the Meter Condition Survey done under the present Study.

Metered and Unmetered Connection

(Unit: %)

Area	Metered	Unmetered	Unanswered
Urban	79.3	20.7	-
Rural	42.9	43.5	13.5
Total	66.9	28.5	4.6

Source: Household survey, JICA Study, 1998

4) Willingness to pay for water

The majority of subscribers in urban areas have expressed their willingness to pay for water, regardless of their income level. However, the willingness of subscribers in rural areas is rather low.

These aspects should be looked into more detail when the schemes are matured, preferably during feasibility studies.

Willing to Pay for Water

(Unit: %)

Area	Yes	No	Not Answered
Urban	94.5	5.5	-
Rural	67.7	30.8	1.4
Total	83.5	15.9	0.6

Source: Household survey, JICA Study, 1998

CHAPTER 2 WATER SUPPLY DEVELOPMENT STRATEGY

Under this heading, planning horizon and target areas of the Study are described first, quoting from the Scope of Work. Secondly, national development objectives set forth in the 8th National Development Plan and the National Water Policy are introduced. Study objectives and targets are then set up within the frame of the National Development Plan and the Water Policy. Finally, population forecast and water demand projection, which are key factors for water supply planning, are made on the basis of the 1989 Population Census and the 1986 MWR Design Manual.

2.1 Targets and Strategy

2.1.1 Planning Horizon

All schemes under the Study in principle shall have a planning horizon year 2010. As for on-going projects currently undertaken by the Government, it is assumed that also have the same planning horizon. In the course of the Study, however, some may be justified more practical to defer their implementation beyond 2010. As regards such deferred projects, the Study also intends to outline scope of works recommended for system rehabilitation and expansion, together with magnitude of the investment and recurrent costs required.

2.1.2 Target Areas

Target areas of the current Study are, in principle, 141 urban centres for urban water supply scheme development. Population forecast and water demand projection was made for all these urban centres. Nairobi and Mombasa, however, where on-going water supply development projects are under way in assistance of the World Bank, are excluded from the succeeding discussion on development plan. The remaining rural areas are for the rural water supply development plans.

The 1989 Census identified 215 urban centres in the country. Some of these urban centres are small in population. From water supply engineering point of view, it might be allowed to cluster these centres into two in terms of population size: large urban centres, which have projected population more than 5,000 by the year 2010; and small urban centres with less population. The large urban centres are targeted for urban water supply scheme development.

The rural water supply schemes are those developed in sparsely populated areas, including small urban centres and the vast rural areas spread throughout the country. Therefore, areas other than the above 141 urban centres are target areas for rural water supply scheme development.

The present report endeavours to discuss water supply planning on scheme basis as far as possible. As of 1996, thousands of small scale community based schemes have been constructed and in operation. Reliable technical and operational data are not available. Accordingly, development

plans for these schemes are worked out on a district basis. Livestock water supply is also dealt with on a district basis.

2.1.3 Development Strategies and Objectives

The 8th National Development Plan attempts to push industrial development in the coming period from 1997 to 2001 by achieving rapid and sustained economic growth. In its water and sanitation section, adequate and reliable supply of clean water is an essential requirement not only for industrial establishment but in all sectors of the economy. It also addresses an urgent need of review of NWMP with a view to many water supply projects currently suffering from serious financial, technical, and managerial problems.

It further recommends the continued effort by MWR to implement a comprehensive plan for the rehabilitation and extension of existing water supply schemes to ensure sustainable water projects and the development of water resources by the various stakeholders.

In line with this policy stated in the Plan, the National Water Policy was prepared by the Ministry. The 1996 National Water Policy sets up its objectives, consisting of the following four (4) mainstreams:

- 1) Water resources management,
- 2) Water supply and sewerage development,
- 3) Institutional framework, and
- 4) Sound and sustainable financing system.

In the 1996 Public Investment Programme, MWR established development strategy to achieve the above objectives, addressing its preparedness for assisting in:

- 1) planning, utilisation and conservation of water resources;
- 2) development and distribution of sufficient and safe water to all rural and urban areas of the country for domestic agricultural, livestock, and industrial use;
- 3) monitoring and assessment of water quality in order to protect consumers from the dangers of pollution of the water resources;
- 4) encouraging the beneficiaries to be involved in the planning, implementation, and operation and maintenance of water supplies.

2.1.4 Planning Target and Fundamental Concept

In planning water supply schemes in urban and rural areas, the following targets and concepts were developed.

(1) Planning Target

The previous Master Plan, in line with the 1989 - 1993 Five Year National Development Plan then in effect, adopted a target of providing safe and potable water within a reasonable distance

to all the population by the year 2010. In the current review, more moderate targets are set up to formulate water supply development plan in Kenya as follows:

- 1) Target service coverage and population: it is assumed that the current 90% service coverage in urban centres will increase to 95% by the year 2010. In rural areas, the present 35% service coverage will increase to 70% by the year 2010. Major target population in rural areas are those who do not have any access to safe water and are spending many hours collecting water. If they are successfully implemented, the overall service coverage in the country will increase to the 80% from the present 50%.
- 2) Target accounted-for water (AFW) ratio: all water supply schemes shall have a certain level of accounted for water ratio (AFW), preferably over 70%. This target ratio will be achieved by each scheme by the year 2010.

(2) Fundamental Concepts

Present review will be based on the various reports and studies available and a series of questionnaire surveys conducted during the Study. Efforts are made to formulate future planning on a scheme basis as far as possible. When any data are not available, interpolation and collation are inevitably made to assume planning fundamentals of the schemes. To ensure sustainable development of the schemes, the following concepts are worked out in the planning.

- 1) Maximum utilisation of the existing schemes: many water supply schemes in operation are suffering from decreased production, far less than the design capacity originally intended. To achieve maximum utilisation of the treatment works constructed, particular attention is paid to rehabilitation rather than expansion of the schemes.
- 2) Appropriate technology: minimum use of mechanical and electrical equipment that requires special skills for operation and maintenance in planning water treatment and distribution. Gravity supplies are proposed, pumping being limited to areas where it requires.
- 3) Cost effectiveness: through cost analyses of the proposed plans, the Study will seek most cost effective solution to achieve the above target.
- 4) Universal metering: all individual and non-individual connections will be metered and water tariff will be levied on the basis of water consumption. In case of small scale water supply like community self-help schemes in rural areas, a flat rate tariff might be allowed although metering system is recommended. Water tariff applied, however, shall be high enough to balance costs required for routine operation and maintenance.

- 5) Safe and potable water: all schemes shall exercise chlorine dosage for disinfection to produce safe and potable water continuously as minimum requirement.

2.2 Population Projection

2.2.1 Population Projection

Population projection is made in Supporting Report Part I Socioeconomy. Population forecast by district and urban centre are summarised in Tables - 2.2.1 and 2.2.2.

2.2.2 Population Served at 1995

In the past decade, the Government has exerted utmost efforts to develop water supply schemes particularly in urban areas. Almost all urban centres, now, have treatment works in operation. These government's efforts contributed significantly to an increase of the coverage ratio in the country.

Coverage of water supply services in rural areas, however, is still at a low level of around 35% as of 1995. As reliable information on present service coverage are not available, it is assumed from the MWR status report, results of the present survey on existing water supply schemes and the Welfare Monitoring Survey carried out by IBRD in 1994. Table - 2.2.3 shows the estimated 1995 population served. Service coverage in Nairobi, Mombasa and Marsabit Districts exceeds 90%, while a number of districts, i.e., Kwale, Tana River, Kitui, Masaku, Nyambene, Thraka Nithi, Mwingi, Makueni, Mandera, Gusii, Siaya, Homa Bay, Migori, Nyamira, Kipsigis, Laikipia, Narok, Trans Nzoia, Bomet, Transmara, Elgeyo Marakwet and West Pokot endure low coverage, less than 50%. Most severest situation is seen in Migori, Transmara, and Kitui Districts. Coverage achieved in these districts is only 20% or less.

Population serviced by schemes are estimated at 14.5 million in total, out of which 5.0 million are served by urban water supply schemes, and 9.5 millions by large and small rural water supply schemes. Non-served population is estimated at 13.0 millions.

2.2.3 Population Served at 2010

Study has a target of 95% coverage in urban centres and 70% in rural areas, to attain the national goal of 80% by the year 2010. For Nairobi, Mombasa, and Marsabit where the present service coverage exceeds the target, the present ratio is set as the target value.

The following three methods are generally applied to estimate serviced population by district and scheme.

- 1) In case the urban population is very small in comparison with the rural population, urban serviced population is first computed on assumption that it will reach target

rate at 2010. The population served in rural areas is then adjusted to surpass the entire target rate, 80% by 2010.

- 2) When the urban water supply covers the fringe rural area of the urban centre, it is assumed that 1995 population served will increase at the same growth rate of urban population up to the year 2010.
- 3) When the rural population is not large enough or almost similar size as urban population, target coverage ratio, 70% is assumed to rural area. Then urban population is adjusted to achieve goal at the district.

The results are summarised in Table - 2.2.4. Development of the water supply schemes will double the number of the serviced population from 14.6 millions in 1995 to 30.6 million in 2010. Based on these estimated population served, water demand projection is made in the paragraphs which follow.

2.3 Water Demand Projection

2.3.1 Review of the Previous National Water Master Plan

Water demand projection made in the JICA 1992 NWMP aimed at providing a basis for water resource potentials assessment in the country in comparison to the projected future water demand for urban and rural areas, and to identify crucial areas where water shortage would be serious. Ultimate target was to seek possible measures to cope with these problems and to propose strategy for optimal water resource development and management, aiming at sustainable development of water supply in the country.

In general, the previous Study tends to provide safety side of the projection, which are seen in the following consideration:

- 1) Assumed to achieve 100% service coverage by the target year, 2010 at each district,
- 2) Applied rather rapid growth rate of livestock population, namely, 2.7% annual growth rate during 1995 to 2000 and 3.8% during 2000 to 2010, while most of the existing district development plans and water supply development schemes apply 0.5-0.8%,
- 3) Utilised data on industrial water consumption rates available in Japan on supposition that industrial sector attain 50% of water recycling inside the plants by the year 2010

To the contrary, it applies slightly optimistic 80% accounted-for water (AFW-water billed/produced) ratio in accordance with the Design Manual. Previous water loss studies or

customer surveys carried out in the country indicate that majority of the existing water supply schemes fall in an unfavourable range of less than 60%. Followings are reliable data of typical urban water supplies in the country.

Accounted-for Water Ratio of Typical Water Supply Schemes

Urban Centres	AFW ratio(%)	Remarks
Eldoret	73.8	Information from MOLA, 1996
Meru	30	Surveyed at the pilot area, 1996
Kericho	62	Information from MOLA, 1996
Embu	52.9	Information from MOLA, 1996
Nyeri	61.2	Information from MOLA, 1996
Mombasa	71	Sep-Nov 93, Water Demand Study
Voi	35	Sep-Nov 93, Water Demand Study
Mazeras	62	Sep-Nov 93, Water Demand Study
Kwale	61	Sep-Nov 93, Water Demand Study
Malindi	58	Sep-Nov 93, Water Demand Study
Kilifi	57	Sep-Nov 93, Water Demand Study

As shown in the above table, most of the waterworks operated by MWR and NWCPC have a low efficiency level of AFW, indicating poor management and operation of the water supply schemes.

Keeping this in mind, the Study will estimate 1995 and 2010 water requirements based on the 1986 Design Manual.

All procedures and methodology applied in the previous report are considered appropriate except in the areas of industrial and livestock water demand projection which may require minor adjustment. Present review, therefore, will be mostly re-calculations based on the latest data available and/or reproduction from the existing reports on water supply development plans in several districts/towns. Working procedures for the water demand forecast is portrayed in **Figure - 2.3.1.**

2.3.2 Residential Demand

The 1986 Manual specifies that residential water demand shall be forecast reflecting income categories and service type (through individual connections, communal water points or share connections) of the customers. Unit consumption rate applied for customers with individual connections range from 75 l/c/d to 250 l/c/d for urban area and from 40 l/c/d to 60 l/c/d for rural area as shown in table below:

Unit Consumption Rate

Category		Unit	Consumption Rate	
Individual connections	Rural	High potential land	l/c/d	60
		Middle potential land	l/c/d	50
		Low potential land	l/c/d	40
	Urban	High class housing	l/c/d	250
		Middle class housing	l/c/d	150
		Low class housing	l/c/d	75
Water kiosks	Rural	l/c/d	10	
/communal water points	Urban	l/c/d	20	

Unit consumption rates above, which have been utilised in numerous projects in the country, are comparable with the rates used elsewhere internationally and considered generally acceptable. However, they assume that:

- 1) All individual connections are metered.
- 2) Billing will take place on a monthly basis using a stepped tariff designed to constrain high water usage.
- 3) All water kiosks will be metered, and water paid for.
- 4) The consumption rates include an allowance for 20% losses.

Although most of the existing water supply systems in the country are not operated in compliance with these assumptions, the above rates are applied for all districts without exception in the Study. In view of the objectives of the water demand projection, this consideration may be allowed.

The only adjustment are the composition rates of land potentials in the rural areas. They are supposed as below. As for housing class in the urban area, the Study applies the same figures as those utilised in the previous report,:

(1) Rural Area:

	<u>Arid & semi-arid</u>	<u>Others</u>
High potential land:	5%	60%
Middle potential land:	15%	30%
Low potential land:	80%	10%

These values are assumed from the results of the previous studies (WRAP project and JICA 1997 Study on Seven Town Projects in Eastern Province).

(2) Urban Area (same as previous NWMP)

	<u>1995</u>	<u>2010</u>
High class housing:	5%	10%
Middle class housing:	70%	75%

Low class housing: 25% 15%

The values above are utilised as far as reasonable. Rates for Nairobi are merely adjusted to obtain the 2010 water demand forecast made in the 1986 Long-Term Development Plan, Third Nairobi Water Supply Project. Using the formula specified in the Manual, the estimated rates are 12%, 78%, and 10% for high, middle, and low class housing, respectively.

2.3.3 Non-residential Demand

(1) Livestock

Latest data on livestock population (1995) are available in the reports of District Development Plans and the 1996 Welfare Monitoring Survey II. Livestock units are estimated for every district using data obtained from these sources. In some districts where significant deviation are seen in these statistics, adjustment is made accordingly. In principle, larger figures between the two are considered bases for the estimation. As data on composition of grade and indigenous cows are not available, it is assumed that grade cows account for 95% of the all cows. This percentage is obtained from the values envisaged in the existing reports. Based on these statistics, livestock units were computed for each district in accordance with the following formula:

1 grade cow	-	1 Livestock Unit
3 indigenous cows	-	1 Livestock Unit
15 sheep or goats	-	1 Livestock Unit

To compute livestock water demand in 2010 from the 1995 estimates, the previous report had applied slightly larger growth rate of the livestock population than those normally adopted in the water development plans in the country. Accordingly, it was adjusted to 0.8% annual growth rate.

(2) Health and Schools

Data on health facilities and schools are also available in the reports on Welfare Monitoring Survey II and District Development Plans. These are carefully reviewed. From this review, it is found that school enrolment significantly changes from district to district. These rates for arid and semi-arid districts are generally as low as 8%, while 20% is estimated for other districts. Mombasa shows relatively low, 14% between these figures. As the design manual proposes separate unit water consumption for boarding schools and day schools, it is necessary to look into composition of these types. Although no accurate data are available, most of the relevant reports assume 7.5% boarding schools to the total.

As for health facilities, related data are available in the district development plan and welfare monitoring surveys. The unit consumption rates assumed in the Design Manual are applied in the current study. To estimate future water demand at 2010, 3% annual growth similar to population growth rate was assumed.

(3) Commercial and Industrial

Data relevant to commercial and industrial activities sufficient to carry out water demand forecast per district are not available. Data on the number of some large scale factories in some districts are available, while data on their water consumption are hardly available. Because of this reason, the previous NWMP report had applied an average unit consumption rate of industry prevailing in Japan. Industrial water consumption, however, is heavily dependent to characteristics of the activities, process applied, scale, raw materials used, etc. Simple statistical analysis (correlation coefficient) verifies that average water consumption has less relation with values of products. The present review, hence, proposes a more practical way of assumption, with a view to composition rate of both residential and commercial & industrial water demands.

Industrial and commercial water consumption closely relates to industrial and commercial activities of the districts concerned. Therefore, attention is paid to number of workers, business men and employees. These data by district, obtained from the Welfare Monitoring Survey II, are plotted on Figure - 2.3.2. Based on deviation from the diagonal line shown in the figure, all districts are clustered into 5 groups as follows:

Group	Feature	District
Group 1	Highly active in commerce and industry	Mombasa
Group 2	Highly active in commerce and industry plus potential agriculture	Nairobi
Group 3	Medium potential in commercial, industrial or agricultural activities	Isiolo, Kajiado, Kiambu, Turkana
Group 4	Medium potential in agricultural activities	Tana River, Kisumu, Nyeri, Muran'ga, Trans Nzoia, Kwale, Nakuru, Uasin Gishu
Group 5	Highly active in agriculture	Districts other than above

It is noted that the grouping above is based on percentage of workers/businessmen and farmers to the total district population, without attention to size of population and industrial & commercial establishments. Therefore, characteristics described above cannot be compared among groups or districts. It is merely an indicator of major activities in each district.

The figure shows that industrial and commercial activities are significantly large in Mombasa and Nairobi. Agriculture is quite active and common in Group 5 districts. Districts located in arid and semi-arid zones are minor both in industrial and agricultural activities. Such districts are Isiolo and Kajiado in Group 3, Tana river in Group-4, Marsabit and Garissa in Group 5.

It might be allowed to assume that a percentage of the industrial and commercial water demand to the residential at a district where industry and commerce is identified active is generally larger than that of the less active district. Based on this assumption, the following rates of industrial and commercial demand are determined, quoting from the existing reports such as (1) NWCP, Second Mombasa and Coastal Water Supply Project Distribution Network Improvement and Extension, Water Demand Study Volume 1 Draft Report June 1996, (2) Kenya-Finland Western

Water Supply Programme, Water Supply Development Plan, 1990-2005 for Western Province, Bungoma, Busia & Kakamega Districts, Volume I, 1993 and (3) Third Nairobi Water Supply Project, Long Term Development Plan (Regional Studies) Volume II Draft Report). Districts or groups where data are not available are interpolated from these data as follows:

Group	1995 Percentage
1	60%
2	45%
3	25%
4	15%
5	5%

The above percentages are applied merely to estimate the 1995 water demand. To forecast 2010 water demand, the GDP growth rate (6.7% annual growth in average) set forth in the Sessional Paper No. 2 of 1996 on Industrial Transformation to the Year 2020 are utilised.

In case of Mombasa, water demand forecast for the year 2010 is 30% larger than the forecast in the 1995 Water Demand Study, Second Mombasa and Coastal Water Supply Project, due mainly to slightly positive estimates for commercial and industrial water demand in our study as discussed above. We consider further adjustment is not required.

2.3.4 Estimated Water Demand

(1) Total Water Demand Estimates

Results of water demand forecast are summarised in **Table - 2.3.1 Water Demand Estimates 1995** and **Table - 2.3.2 Water Demand Estimates 2010**. The estimated 2010 water demand is plotted on district map as shown in **Figure - 2.3.3**. It is to be noted that these theoretical values estimated do not reflect actual situation of the water supply schemes. These estimates are merely results of computation based on the Design Manual under an ideal situation (i.e., 80% AFW and standard unit consumption rates).

The 1995 and 2010 water demand estimated from the above procedures are summed up by district. Water demand for the years, 2000 and 2005 are interpolated using these figures. Livestock water demand values except those in Nairobi and Mombasa are considered imperative to the water demand in the rural areas. Livestock in Nairobi and Mombasa are regarded to constitute a part of the urban centre water demand.

Water demand thus estimated and in previous NWMP are summarised in table below:

Water Demand Estimates

(Unit: 1,000m³/day)

Category	1995		2010	
	Current Study	Previous	Current Study	Previous
Residential				
Urban	616.2	747.8	1,554.0	1,642.8
Rural - large scale	208.8		401.9	
- small scale	110.1	468.2	421.6	932.6
Sub-total	935.1	1,216.0	2,377.5	2,575.4
Non-residential				
Health facilities	16.0		25.4	
Schools	135.3		176.3	
Industry & commerce	201.1		499.6	
Sub-total	352.4	593.9	701.3	986.3
Total	1,287.5	1,809.9	3,078.8	3,561.7
Unit Water Consumption (lpcd)	87.9		100.6	
Livestock Water	517.5	376.6	583.2	621.4
Grand Total	1,805.0	2,186.6	3,662.0	4,183.2

Note: 1995 figures of NWMP are obtained from interpolation of the 1990 and 2000 figures.

Water demand estimates, 1.8 million m³/day in 1995 will increase to 3.7 million m³/day in 2010 mainly due to the rapid population growth expected in the coming 10 - 15 years. Livestock, health, schools, industry and commerce water demand for 2010 estimated in the current study are similar to those in the previous NWMP, although slight differences are seen in livestock and industrial water demand.

Overall unit consumption rate per capita increases from 87.9 lpcd in 1995 to 100.6 lpcd in 2010. This 1995 and 2010 unit rates are almost similar to those estimated in the previous report. When the actual situation of the existing water supply schemes is considered, source water demand in 1995 might be slightly higher than the above figures due to inefficiency of water supply services.

(2) By Urban Water Supply Scheme

To assess water balance by scheme, water demand by scheme is in need. For this purpose, the above total water demand values are further broken down into each urban and rural water supply scheme on the basis of population size. The results are given in **Table -2.3.3**.

(3) By Rural Water Supply Scheme

Technical information available on rural water supply schemes are not necessarily sufficient in accuracy and quality, and almost none as regards a numerous number of community based water supply schemes developed in the country. Accordingly, water demand are estimated by large scale rural water supply basis as given in **Table - 2.3.4**.

CHAPTER 3 PRELIMINARY URBAN WATER SUPPLY DEVELOPMENT PLAN

In the preceding sections, all targets and key planning factors are worked out. The preliminary water supply development plans for the target urban centres are discussed below.

3.1 General Concept and Methodology

All targets set up in the preceding section are possible to achieve, if necessary actions are properly taken in a short period of 10 years. For overview of the project attainment, this section intends to outline methodology and key issues to be overcome for successful implementation of the proposed projects. It is needless to say that huge amount of financial and human resources are prerequisites to attain these goals.

Augmentation and rehabilitation projects of UWS and RWS are intensively undertaken by the Government. 383 projects are under design stage and 533 projects under implementation as of 1995. Progress of these projects are not necessarily smooth as scheduled due to shortage of funds.

Therefore, all schemes are grouped as follows:

- 1) On-going projects
 - a) projects under implementation
 - b) projects under design and planning
- 2) Projects proposed in the current Study
 - a) expansion and augmentation
 - b) rehabilitation
- 3) Operation and management improvement programmes
 - a) operation and maintenance
 - b) institutional restructuring

Description below are for 1) on-going projects and 2) projects newly proposed in the current Study. With regards to institutional restructuring and O&M, it is recommended to refer to Chapters 3 and 5, Part V, the present Report.

3.1.1 On-going Projects

As stated above, there are many projects under way in the country. First priority shall be given to these projects. To incorporate these projects in the current study, key design factors worked out by the Government and agencies concerned are adopted without any amendment. In case some contradictions are found in the design values, minor adjustment are inevitably made.

3.1.2 Projects Proposed

Many existing schemes in operation are facing serious operational and financial problems. They are, for one reason or another, producing less water than the production capacity originally designed. In some schemes, they operate waterworks only five - six hours a day. More than half of the schemes (175 out of 313 schemes surveyed) have operational hours, less than 16 hours. Continuous supply (24 hours) is attained at merely 94 schemes or 30%. This is a serious problem particularly in RWS. If they are normally operated on continuous basis, water production would increase by 20% - 30% of the present production in the whole country. This means water supply conditions could be significantly improved by normalising operational aspects of each scheme. According to the field survey at the existing water schemes, major reason for this may lie in a limited capacity of storage reservoirs and a lack of operational staff.

The 1997 JICA Study titled "Seven Town Water Supply Development Projects" in Eastern Province suggests that households which are levied a flat rate are utilising five times more water than normally metered customers. If this is applicable to other urban schemes, introduction of universal metering system to all schemes would drastically improve the present water supply conditions resulting in increase of water sales and revenue.

From the above discussions, it can be said that rehabilitation and rationalisation are prerequisites for sustainable development of all water supply schemes.

(1) General Concepts for Rehabilitation

The major problems water supply schemes currently facing are: 1) obsolete and malfunctioning facilities left without repair and maintenance, 2) a large amount of the leakage at the pipeline reticulation, 3) wasteful water usage by customers, and 4) a low efficiency of revenue collection.

1) Scope of rehabilitation

Scope of rehabilitation is based on the questionnaire surveys conducted in the study and similar surveys by MWR. Careful review of each scheme (approximately 300 schemes surveyed in total, although not sufficient to cover all schemes) was made for screening, since the results often contain works related to system expansion.

The scope of rehabilitation thus identified, however, is not necessarily effective to rationalise entire system to a satisfactory level of accounted-for water ratio (AFW ratio over 70%). Proposed scope for rationalisation therefore includes: 1) installation of master and zonal meters; 2) repair/installation of chemical dosing equipment; 3) construction of storage facilities, 4) leakage control activities; 5) establishment of metering system; and 6) public campaign on needs of safe water, metering system, hygienic water use, etc.

2) Methodology

Out of the proposed scope for the rationalisation above, work items 4), 5) and 6) shall be attained in the course of routine operation and maintenance. To achieve maximum benefits in a short term period, urgent rehabilitation shall be initiated at such schemes that system operation is in a crucial situation (meter conditions and operational hours).

(2) General Concepts for System Expansion

Based on evaluation of the existing treatment works, the needs for system expansion were also assessed to establish an adequate supply for a planning horizon year of 2010. The Study emphasises the following fundamental aspects of water supply system development.

- 1) Continuous supply with a minimum pressure of 10m.
- 2) Disinfection which is a minimum requirement for all schemes to meet MWR water quality guidelines.
- 3) Measures for increasing cost recovery through a number of initiatives including reduction of unaccounted-for water and the universal application of metering.
- 4) Gravity supplies to reduce recurrent costs and pumping being limited to areas where it is essential.

3.2 Rehabilitation Plan

Rehabilitation works are proposed for all existing urban water supply projects.

In relation with the needs of rehabilitation, the Study Team made a series of reconnaissance and questionnaire surveys on a number of the schemes and conducted the Water Supply Sector Survey. MWR is currently preparing rehabilitation proposals for nearly 300 water supply schemes. From the information obtained, it is identified that rehabilitation requirements are diversified in nature and magnitude. Major work items identified are repair/construction of boreholes, repair/installation of raw water mains, treatment facilities, and repair of malfunctioning equipment, pipeline installation, etc. As these works are not necessarily effective in decreasing water losses, producing safe water and rationalising system operation, the following are proposed in addition as a part of the rehabilitation:

- (1) Repair/replacement of broken/timeworn/malfunctioning equipment, pipe works, valves, gates, gauges and meters in waterworks, which are all indispensable for proper and efficient operation.

Due to absence of proper maintenance, some waterworks are obliged to reduce their production. Minor repair of the damaged equipment may produce more water, resulting in improvement of the water supply conditions.

(2) Installation of chemical dosing equipment

It is one of the sector objectives that all schemes except that for livestock shall supply potable water. To this end, installation of chemical dosing equipment at every waterworks is considered essential.

(3) Installation or repair/replacement of master and zonal meters

Master and zonal meter installation is a first step to reduce water losses from the pipe networks. In a longer run, all subscribers shall be supplied through metered connections.

(4) Construction of additional service reservoir

It is often observed that storage reservoirs constructed in the existing water supply schemes are not sufficient to achieve continuous water supply. In these schemes, the treatment works are in operation far less than the production capacity. It is absolutely necessary to increase water production by implementing the rehabilitation works so that more reliable service can be accomplished.

(5) Miscellaneous works

Substantial parts of mechanical equipment in many waterworks outstrip their lives and/or are not in operation and function. It is necessary to repair/replace such equipment to restore the system into original function.

3.3 On-going, Planned, and Designed Projects

Completion of a number of the on-going water supply projects under implementation or in design/planning stages will significantly improve the present water supply conditions in each urban centre.

It is out of the scope of the Study to make a comprehensive review of such projects, which are being implemented by various authorities concerned including MWR, NWPC, institutions, communities, and consultants. As the obtained information on the planning factors of these projects may sometimes contain inaccurate figures, the JICA Study Team made their comparison, and accordingly minor adjustment where deemed necessary. The Study thus intends to incorporate the key planning factors (design population, design capacity, estimated costs, etc.) of these on-going projects as far as possible.