11.3 Allowable Pollution Load and Required Pollution Load Reduction

Table 11.3.1 Allowable Pollution Load by Source Category (BOD, Scenario 1)

2005

Water Quality Checking Point	Planned Flow Rate (m3/day)	Water Quality Standard (mg/l)	Allowable Run-off Pollution Load (kg/d)	BOD Load Source Category	Present Run-off BOD Composition (%)	Allowable Run-off Pollution Load (kg/d)
C_{R1}	31,000	5.0		Domestic	65.46%	98
				Ind.(Unsewered)	0.00%	0
			149	Livestock	34.54%	52
				Solid Waste	0.00%	0
				WTW	0.00%	0
			6	Natural	-	6
			155	Total	100.00%	155
C_{R2}	335,300	5.0		Domestic	80.28%	1,318
				Ind.(Unsewered)	6.91%	113
			1,642	Livestock	12.25%	201
				Solid Waste	0.00%	0
				WTW	0.57%	9
			12	Natural	-	12
			22	C_{R1}*	-	22
			1,677	Total	100.00%	1,677

2015

Water Quality Checking Point	Planned Flow Rate (m3/day)	Water Quality Standard (mg/l)	Allowable Run-off Pollution Load (kg/d)	BOD Load Source Category	Present Run-off BOD Composition (%)	Allowable Run-off Pollution Load (kg/d)
C_{R1}	31,000	3.0		Domestic	65.46%	57
				Ind.(Unsewered)	0.00%	0
			87	Livestock	34.54%	30
				Solid Waste	0.00%	0
				WTW	0.00%	0
			6	Natural	-	6
			93	Total	100.00%	93
C_{R2}	430,700	5.0		Domestic	80.28%	1,708
				Ind.(Unsewered)	6.91%	147
			2,128	Livestock	12.25%	261
				Solid Waste	0.00%	0
				WTW	0.57%	12
			12	Natural	-	12
			13	C_{R1}*	-	13
			2,154	Total	100.00%	2,154

Note: Natural Pollution Load is fixed.

C_{R1}* = Allowable Run-off Load at C_{R1} x Pollution Load remaining Ratio ($C_{1,1}$ x R_{R3} x C_{R2})

Table 11.3.2 Allowable Polllution Load by Source Category (BOD, Scenario 2)

2005

Water Quality Checking Point	Planned Flow Rate (m3/day)	Water Quality Standard (mg/l)	Allowable Run-off Pollution Load (kg/d)	BOD Load Source Category	Present Run-off BOD Composition (%)	Allowable Run-off Pollution Load (kg/d)
C_{R1}	31,000	5.0		Domestic	65.46%	98
				Ind.(Unsewered)	0.00%	0
			149	Livestock	34.54%	52
				Solid Waste	0.00%	0
				WTW	0.00%	0
			6	Natural	-	6
			155	Total	100.00%	155
C_{R2}	310,600	5.0		Domestic	80.28%	1,219
				Ind.(Unsewered)	6.91%	105
			1,519	Livestock	12.25%	186
				Solid Waste	0.00%	0
				WTW	0.57%	9
			12	Natural	-	12
			22	C_{R1}*	-	22
			1,553	Total	100.00%	1,553

2015

Water Quality Checking Point	Planned Flow Rate (m3/day)	Water Quality Standard (mg/l)	Allowable Run-off Pollution Load (kg/d)	BOD Load Source Category	Present Run-off BOD Composition (%)	Allowable Run-off Pollution Load (kg/d)
C_{R1}	31,000	3.0		Domestic	65.46%	57
				Ind (Unsewered)	0.00%	0
			87	Livestock	34.54%	30
				Solid Waste	0.00%	0
				WTW	0.00%	0
			6	Natural	-	6
			93	Total	100.00%	93
C_{R2}	432,800	5.0		Domestic	80.28%	1,717
				Ind.(Unsewered)	6.91%	148
			2,138	Livestock	12.25%	262
				Solid Waste	0.00%	0
				WTW	0.57%	12
			12	Natural	-	12
			13	C_{R1}*	-	13
			2,164	Total	100.00%	2,164

Note: Natural Pollution Load is fixed.

C_{R1}* = Allowable Run-off Load at C_{R1} x Pollution Load remaining Ratio (C_{L1} x R_{R3} x C_{R2})

Table 11.3.3 Allowable Polllution Load (T-N, Scenario 1)

Basic formula for projection of T-N concentration:

$N = L(N) / ((rw + sN) \times V)$ or $L(N) = N \times ((rw + sN) \times V)$

where:
- N: T-N concentration of lake/dam (mg/l)
- L(N): Quantity of inflow Nitrogen to lake (g/day)
- rw: Rate of change of water (1/day)
- sN: Self-purification (reduction) coefficient for Nitrogen
- V: Volume of lake (m3)

Allowable Pollution Load in 2005:

CL1 (Seke & Harava Dams);

N:	T-N concentration of lake/dam (mg/l)	=	0.4	
rw:	Rate of change of water (1/day)	=	0.015484	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.187972	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(N) = 1,009,632 (g/day) or	1,010	(kg/day)	

CL2 (Lake Chivero)

N:	T-N concentration of lake/dam (mg/l)	=	0.4	
rw:	Rate of change of water (1/day)	=	0.002025	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.042699	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(N) = 4,600,841 (g/day) or	4,601	(kg/day)	

CL3 (Lake Manyame)

N:	T-N concentration of lake/dam (mg/l)	=	0.4	
rw:	Rate of change of water (1/day)	=	0.000550	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.011512	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(N) = 2,317,013 (g/day) or	2,317	(kg/day)	

Allowable Pollution Load in 2015:

CL1 (Seke & Harava Dams);

N:	T-N concentration of lake/dam (mg/l)	=	0.2	
rw:	Rate of change of water (1/day)	=	0.015750	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.187972	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(N) = 505,476 (g/day) or	505	(kg/day)	

CL2 (Lake Chivero)

N:	T-N concentration of lake/dam (mg/l)	=	0.2	
rw:	Rate of change of water (1/day)	=	0.002515	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.042699	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(N) = 2,325,661 (g/day) or	2,326	(kg/day)	

CL3 (Lake Manyame)

N:	T-N concentration of lake/dam (mg/l)	=	0.2	
rw:	Rate of change of water (1/day)	=	0.000555	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.011512	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(N) = 1,159,007 (g/day) or	1,159	(kg/day)	

Table 11.3.4 Allowable Polllution Load (T-N, Scenario 2)

Basic formula for projection of T-N concentration:

$N = L(N) / ((rw + sN) \times V)$ or $L(N) = N \times ((rw + sN) \times V)$

where:
- N: T-N concentration of lake/dam (mg/l)
- L(N): Quantity of inflow Nitrogen to lake (g/day)
- rw: Rate of change of water (1/day)
- sN: Self-purification (reduction) coefficient for Nitrogen
- V: Volume of lake (m3)

Allowable Pollution Load in 2005:

CL1 (Seke & Harava Dams);

N:	T-N concentration of lake/dam (mg/l)	=	0.4	
rw:	Rate of change of water (1/day)	=	0.015428	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.187972	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(N) = 1,009,352 (g/day) or	1,009	(kg/day)	

CL2 (Lake Chivero)

N:	T-N concentration of lake/dam (mg/l)	=	0.4	
rw:	Rate of change of water (1/day)	=	0.001713	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.042699	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(N) = 4,568,801 (g/day) or	4,569	(kg/day)	

CL3 (Lake Manyame)

N:	T-N concentration of lake/dam (mg/l)	=	0.4	
rw:	Rate of change of water (1/day)	=	0.000549	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.011512	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(N) = 2,316,853 (g/day) or	2,317	(kg/day)	

Allowable Pollution Load in 2015:

CL1 (Seke & Harava Dams);

N:	T-N concentration of lake/dam (mg/l)	=	0.2	
rw:	Rate of change of water (1/day)	=	0.015662	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.187972	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(N) = 505,256 (g/day) or	505	(kg/day)	

CL2 (Lake Chivero)

N:	T-N concentration of lake/dam (mg/l)	=	0.2	
rw:	Rate of change of water (1/day)	=	0.002311	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.042699	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(N) = 2,315,141 (g/day) or	2,315	(kg/day)	

CL3 (Lake Manyame)

N:	T-N concentration of lake/dam (mg/l)	=	0.2	
rw:	Rate of change of water (1/day)	=	0.000552	
sN:	Self-purification (reduction) coefficient for Nitrogen	=	0.011512	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(N) = 1,158,727 (g/day) or	1,159	(kg/day)	

Table 11.3.5 Allowable Pollution Load (T-P, Scenario 1)

Basic formula for projection of T-P concentration:

$P = L(P) / ((rw + sP) \times V)$ or $L(P) = P \times ((rw + sP) \times V)$

where:
- P: T-P concentration of lake/dam (mg/l)
- L(P): Quantity of inflow Phosphorus to lake (g/day)
- rw: Rate of change of water (1/day)
- sP: Self-purification (reduction) coefficient for Phosphorus
- V: Volume of lake (m3)

Allowable Pollution Load in 2005:

CL1 (Seke & Harava Dams);

P:	T-P concentration of lake/dam (mg/l)	=	0.05	
rw:	Rate of change of water (1/day)	=	0.015484	
sP:	Self-purification (reduction) coefficient for Phosphorus	=	0.205736	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(P) = 137,223 (g/day) or	137	(kg/day)	

CL2 (Lake Chivero)

P:	T-P concentration of lake/dam (mg/l)	=	0.10	
rw:	Rate of change of water (1/day)	=	0.002025	
sP:	Self-purification (reduction) coefficient for Phosphorus	=	0.008675	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(P) = 275,177 (g/day) or	275	(kg/day)	

CL3 (Lake Manyame)

P:	T-P concentration of lake/dam (mg/l)	=	0.03	
rw:	Rate of change of water (1/day)	=	0.000550	
sP:	Self-purification (reduction) coefficient for Phosphorus	=	0.027691	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(P) = 406,869 (g/day) or	407	(kg/day)	

Allowable Pollution Load in 2015:

CL1 (Seke & Harava Dams);

P:	T-P concentration of lake/dam (mg/l)	=	0.01	
rw:	Rate of change of water (1/day)	=	0.015750	
sP:	Self-purification (reduction) coefficient for Phosphorus	=	0.205736	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(P) = 27,478 (g/day) or	27	(kg/day)	

CL2 (Lake Chivero)

P:	T-P concentration of lake/dam (mg/l)	=	0.01	
rw:	Rate of change of water (1/day)	=	0.002515	
sP:	Self-purification (reduction) coefficient for Phosphorus	=	0.008675	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(P) = 28,780 (g/day) or	29	(kg/day)	

CL3 (Lake Manyame)

P:	T-P concentration of lake/dam (mg/l)	=	0.01	
rw:	Rate of change of water (1/day)	=	0.000555	
sP:	Self-purification (reduction) coefficient for Phosphorus	=	0.027691	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(P) = 135,648 (g/day) or	136	(kg/day)	

Table 11.3.6 Allowable Pollution Load (T-P, Scenario 2)

Basic formula for projection of T-P concentration:

$P = L(P) / ((rw + sP) \times V)$ or $L(P) = P \times ((rw + sP) \times V)$

where:
- P: T-P concentration of lake/dam (mg/l)
- L(P): Quantity of inflow Phosphorus to lake (g/day)
- rw: Rate of change of water (1/day)
- sP: Self-purification (reduction) coefficient for Phosphorus
- V: Volume of lake (m3)

Allowable Pollution Load in 2005:

CL1 (Seke & Harava Dams);

P:	T-P concentration of lake/dam (mg/l)	=	0.05	
rw:	Rate of change of water (1/day)	=	0.015428	
sP:	Self-purification (reduction) coefficient for Phosphoru	=	0.205736	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(P) = 137,188 (g/day) or	137	(kg/day)	

CL2 (Lake Chivero)

P:	T-P concentration of lake/dam (mg/l)	=	0.10	
rw:	Rate of change of water (1/day)	=	0.001713	
sP:	Self-purification (reduction) coefficient for Phosphoru	=	0.008675	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(P) = 267,167 (g/day) or	267	(kg/day)	

CL3 (Lake Manyame)

P:	T-P concentration of lake/dam (mg/l)	=	0.03	
rw:	Rate of change of water (1/day)	=	0.000549	
sP:	Self-purification (reduction) coefficient for Phosphoru	=	0.027691	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(P) = 406,857 (g/day) or	407	(kg/day)	

Allowable Pollution Load in 2015:

CL1 (Seke & Harava Dams);

P:	T-P concentration of lake/dam (mg/l)	=	0.01	
rw:	Rate of change of water (1/day)	=	0.015662	
sP:	Self-purification (reduction) coefficient for Phosphoru	=	0.205736	
V:	Volume of lake (m3)	=	12,406,000	
	Therefore, L(P) = 27,467 (g/day) or	27	(kg/day)	

CL2 (Lake Chivero)

P:	T-P concentration of lake/dam (mg/l)	=	0.01	
rw:	Rate of change of water (1/day)	=	0.002311	
sP:	Self-purification (reduction) coefficient for Phosphoru	=	0.008675	
V:	Volume of lake (m3)	=	257,181,000	
	Therefore, L(P) = 28,254 (g/day) or	28	(kg/day)	

CL3 (Lake Manyame)

P:	T-P concentration of lake/dam (mg/l)	=	0.01	
rw:	Rate of change of water (1/day)	=	0.000552	
sP:	Self-purification (reduction) coefficient for Phosphoru	=	0.027691	
V:	Volume of lake (m3)	=	480,236,000	
	Therefore, L(P) = 135,634 (g/day) or	136	(kg/day)	

Table 11.3.7 Allowable Polllution Load (COD, Scenario 1)

Basic formula for projection of T-P concentration:

$COD = L(COD) / ((rw + sCOD) \times V) + DCOD$ or $L(COD) = (COD - DCOD) \times ((rw + sCOD) \times V)$

where:
- COD: Concentration of COD of lake (g/m3)
- L(COD): Quantity of inflow COD to lake (g/day)
- rw: Rate of change of water (1/day)
- sCOD: Self-purification (reduction) coefficient for inflow COD
- V: Volume of lake (m3)
- DCOD: Secondary production COD (mg/l)
  DCOD = a(N) x T-N x 17.73
  a(N); Conversion rate of Nitrogen to DCOD

Allowable Pollution Load in 2005:

CL1 (Seke & Harava Dams);

COD:	Concentration of COD of lake (g/m3)	=	10.00	
rw:	Rate of change of water (1/day)	=	0.015484	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.075514	
V:	Volume of lake (m3)	=	12,406,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.8246	
DCOD:	Secondary production COD for standard T-N (0.4mg/l)	=	5.8481	
	Therefore, L(COD) = 4,687,212 (g/day) or	4,687	(kg/day)	

CL2 (Lake Chivero)

COD:	Concentration of COD of lake (g/m3)	=	16.00	
rw:	Rate of change of water (1/day)	=	0.002025	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.009081	
V:	Volume of lake (m3)	=	257,181,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	1.0024	
DCOD:	Secondary production COD for standard T-N (0.4mg/l)	=	7.1094	
	Therefore, L(COD) = 25,392,986 (g/day) or	25,393	(kg/day)	

CL3 (Lake Manyame)

COD:	Concentration of COD of lake (g/m3)	=	16.00	
rw:	Rate of change of water (1/day)	=	0.000550	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.004401	
V:	Volume of lake (m3)	=	480,236,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.4287	
DCOD:	Secondary production COD for standard T-N (0.4mg/l)	=	3.0400	
	Therefore, L(COD) = 30,813,086 (g/day) or	30,813	(kg/day)	

Allowable Pollution Load in 2015:

CL1 (Seke & Harava Dams);

COD:	Concentration of COD of lake (g/m3)	=	6.00	
rw:	Rate of change of water (1/day)	=	0.015750	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.075514	
V:	Volume of lake (m3)	=	12,406,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.8246	
DCOD:	Secondary production COD for standard T-N (0.2mg/l)	=	2.9240	
	Therefore, L(COD) = 3,482,678 (g/day) or	3,483	(kg/day)	

CL2 (Lake Chivero)

COD:	Concentration of COD of lake (g/m3)	=	6.00	
rw:	Rate of change of water (1/day)	=	0.002515	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.009081	
V:	Volume of lake (m3)	=	257,181,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	1.0024	
DCOD:	Secondary production COD for standard T-N (0.2mg/l)	=	3.5547	
	Therefore, L(COD) = 7,292,785 (g/day) or	7,293	(kg/day)	

CL3 (Lake Manyame)

COD:	Concentration of COD of lake (g/m3)	=	6.00	
rw:	Rate of change of water (1/day)	=	0.000555	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.004401	
V:	Volume of lake (m3)	=	480,236,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.4287	
DCOD:	Secondary production COD for standard T-N (0.2mg/l)	=	1.5200	
	Therefore, L(COD) = 10,662,637 (g/day) or	10,663	(kg/day)	

Table 11.3.8 Allowable Pollution Load (COD, Scenario 2)

Basic formula for projection of T-P concentration:

$COD = L(COD)/((rw+sCOD) \times V) + DCOD$ or $L(COD) = (COD - DCOD) \times ((rw + sCOD) \times V)$

where:
- COD: Concentration of COD of lake (g/m3)
- L(COD): Quantity of inflow COD to lake (g/day)
- rw: Rate of change of water (1/day)
- sCOD: Self-purification (reduction) coefficient for inflow COD
- V: Volume of lake (m3)
- DCOD: Secondary production COD (mg/l)

DCOD = a(N) x T-N x 17.73

a(N); Conversion rate of Nitrogen to DCOD

Allowable Pollution Load in 2005:

CL1 (Seke & Harava Dams);

COD:	Concentration of COD of lake (g/m3)	=	10.00	
rw:	Rate of change of water (1/day)	=	0.015428	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.075514	
V:	Volume of lake (m3)	=	12,406,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.8246	
DCOD:	Secondary production COD for standard T-N (0.4mg/l)	=	5.8481	
	Therefore, L(COD) = 4,684,305 (g/day) or	4,684	(kg/day)	

CL2 (Lake Chivero)

COD:	Concentration of COD of lake (g/m3)	=	16.00	
rw:	Rate of change of water (1/day)	=	0.001713	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.009081	
V:	Volume of lake (m3)	=	257,181,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	1.0024	
DCOD:	Secondary production COD for standard T-N (0.4mg/l)	=	7.1094	
	Therefore, L(COD) = 24,680,847 (g/day) or	24,681	(kg/day)	

CL3 (Lake Manyame)

COD:	Concentration of COD of lake (g/m3)	=	16.00	
rw:	Rate of change of water (1/day)	=	0.000549	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.004401	
V:	Volume of lake (m3)	=	480,236,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.4287	
DCOD:	Secondary production COD for standard T-N (0.4mg/l)	=	3.0400	
	Therefore, L(COD) = 30,807,902 (g/day) or	30,808	(kg/day)	

Allowable Pollution Load in 2015:

CL1 (Seke & Harava Dams);

COD:	Concentration of COD of lake (g/m3)	=	6.00	
rw:	Rate of change of water (1/day)	=	0.015662	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.075514	
V:	Volume of lake (m3)	=	12,406,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.8246	
DCOD:	Secondary production COD for standard T-N (0.2mg/l)	=	2.9240	
	Therefore, L(COD) = 3,479,294 (g/day) or	3,479	(kg/day)	

CL2 (Lake Chivero)

COD:	Concentration of COD of lake (g/m3)	=	6.00	
rw:	Rate of change of water (1/day)	=	0.002311	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.009081	
V:	Volume of lake (m3)	=	257,181,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	1.0024	
DCOD:	Secondary production COD for standard T-N (0.2mg/l)	=	3.5547	
	Therefore, L(COD) = 7,164,162 (g/day) or	7,164	(kg/day)	

CL3 (Lake Manyame)

COD:	Concentration of COD of lake (g/m3)	=	6.00	
rw:	Rate of change of water (1/day)	=	0.000552	
sCOD:	Self-purification (reduction) coefficient for inflow COD	=	0.004401	
V:	Volume of lake (m3)	=	480,236,000	
a(N):	Conversion rate of Nitrogen to DCOD	=	0.4287	
DCOD:	Secondary production COD for standard T-N (0.2mg/l)	=	1.5200	
	Therefore, L(COD) = 10,656,365 (g/day) or	10,656	(kg/day)	

11.4 Allowable Pollution Load and Required Pollution Load Reduction by Pollution Source

Table 11.4.1 Required Pollution Load Reduction (BOD, Domestic)

Scenario 1

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	122	24	98	-73
C_{R2}	7,801	1,862	1,318	543
2015				
C_{R1}	147	29	57	-28
C_{R2}	11,244	2,403	1,708	.695

Scenario 2

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	76	15	98	-83
C_{R2}	7,255	1,654	1,219	435
2015				
C_{R1}	92	18	57	-39
C_{R2}	10,947	2,097	1,717	381

Table 11.4.2 Required Pollution Load Reduction (BOD, Industrial-Unsewered)

Scenario 1

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	0	0	0	0
C_{R2}	29	6	113	-108
2015				
C_{R1}	0	0	0	0
C_{R2}	29	6	147	-141

Scenario 2

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	0	0	0	0
C_{R2}	29	6	105	-99
2015				
C_{R1}	0	0	0	0
C_{R2}	29	6	148	-142

Table 11.4.3 Required Pollution Load Reduction (BOD, Livestock)

Scenario 1

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	53	11	52	-41
C_{R2}	159	21	201	-180
2015				
C_{R1}	53	11	30	-20
C_{R2}	159	21	261	-240

Scenario 2

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	53	11	52	-41
C_{R2}	159	21	186	-165
2015				
C_{R1}	53	11	30	-20
C_{R2}	159	21	262	-241

Table 11.4.4 Required Pollution Load Reduction (BOD, WTW)

Scenario 1

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	0	0	0	0
C_{R2}	3	1	9	-8
2015				
C_{R1}	0	0	0	0
C_{R2}	7	2	12	-10

Scenario 2

Water Quality Checking Point	Concentrated BOD Load (kg/day)	Run-off BOD Load (kg/day)	Allowable Pollution Load (kg/day)	Required Run-off Load Reduction (kg/day)
2005				
C_{R1}	0	0	0	0
C_{R2}	3	1	9	-8
2015				
C_{R1}	0	0	0	0
C_{R2}	6	2	12	-10

12.2.3 Fundamentals for Design of Sewerage Facilities

Table 12.2.3.1 Design Sewage Quantity in Scenario-1 in ADWF

(Unit : m^3/day)

Authority	Sewage Works	2000				
		Domestic	Industry	Commerce	Groundwater	Total
Harare	Crowborough	50,871	11,392	12,057	11,148	85,468
	Firle	70,518	37,932	48,227	23,502	180,179
	Marlborough	1,429	0	0	214	1,643
	Donnybrook	6,665	0	0	1,000	7,665
	Sub-Total	129,483	49,324	60,284	35,864	274,955
Harare Expansion	Harare South	9,948	1,533	0	1,722	13,203
	Harare East	4,790	0	0	719	5,509
	Sub-Total	14,738	1,533	0	2,441	18,712
Chitungwiza	Zengeza	29,903	1,206	1,495	4,891	37,495
Norton	Norton	4,213	1,154	211	837	6,414
Ruwa	Ruwa	4,413	2,660	221	1,094	8,388
Authority	Sewage Works	2005				
Harare	Crowborough	94,451	11,392	22,917	19,314	148,074
	Firle	86,142	37,932	91,668	32,361	248,103
	Marlborough	1,429	0	0	214	1,643
	Donnybrook	6,877	0	0	1,032	7,909
	Sub-Total	188,899	49,324	114,584	52,921	405,729
Harare Expansion	Harare South	15,781	39,533	0	8,297	63,611
	Harare East	5,459	0	0	819	6,278
	Sub-Total	21,240	39,533	0	9,116	69,889
Chitungwiza	Zengeza	30,752	1,401	1,538	5,054	38,744
Norton	Norton	7,054	3,386	353	1,619	12,412
Ruwa	Ruwa	7,541	3,545	377	1,719	13,183
Authority	Sewage Works	2015				
Harare	Crowborough	111,514	11,392	32,697	23,340	178,944
	Firle	96,765	41,762	130,789	40,397	309,713
	Marlborough	4,184	0	0	628	4,812
	Donnybrook	10,710	0	0	1,607	12,317
	Sub-Total	223,173	53,154	163,486	65,972	505,785
Harare Expansion	Harare South	40,548	39,533	0	12,012	92,093
	Harare East	7,079	25,642	0	4,908	37,629
	Sub-Total	47,627	65,175	0	16,920	129,722
Chitungwiza	Zengeza	45,953	12,764	2,298	9,152	70,167
Norton	Norton	17,023	18,042	851	5,387	41,304
Ruwa	Ruwa	10,807	4,632	540	2,397	18,376

Table 12.2.3.2 Design Sewage Quantity in Scenario-2 in ADWF

(Unit : m^3/day)

Authority	Sewage Works	2000				
		Domestic	Industry	Commerce	Groundwater	Total
Harare	Crowborough	50,866	11,392	11,515	11,066	84,839
	Firle	75,763	37,932	46,061	23,963	183,720
	Marlborough	1,518	0	0	228	1,746
	Donnybrook	6,171	0	0	926	7,097
	Sub-Total	134,318	49,324	57,577	36,183	277,402
Harare Expansion	Harare South	1,551	1,533	0	463	3,547
	Harare East	4,790	0	0	719	5,509
	Sub-Total	6,341	1,533	0	1,181	9,055
Chitungwiza	Zengeza	36,573	1,206	1,829	5,941	45,549
Norton	Norton	2,056	1,154	103	497	3,810
Ruwa	Ruwa	156	2,660	8	424	3,247
Authority	Sewage Works	2005				
Harare	Crowborough	54,992	11,392	14,251	12,095	92,730
	Firle	83,597	37,932	57,003	26,780	205,312
	Marlborough	1,747	0	0	262	2,009
	Donnybrook	7,327	0	0	1,099	8,426
	Sub-Total	147,663	49,324	71,254	40,236	308,477
Harare Expansion	Harare South	1,465	39,533	0	6,150	47,148
	Harare East	5,459	0	0	819	6,278
	Sub-Total	6,924	39,533	0	6,969	53,426
Chitungwiza	Zengeza	46,781	1,401	2,339	7,578	58,099
Norton	Norton	3,092	3,386	155	995	7,627
Ruwa	Ruwa	208	3,545	10	565	4,328
Authority	Sewage Works	2015				
Harare	Crowborough	74,250	11,392	22,334	16,196	124,172
	Firle	110,544	41,762	89,335	36,246	277,887
	Marlborough	2,261	0	0	339	2,600
	Donnybrook	10,215	0	0	1,532	11,747
	Sub-Total	197,270	53,154	111,668	54,314	416,406
Harare Expansion	Harare South	1,679	39,533	0	6,182	47,394
	Harare East	7,079	25,642	0	4,908	37,629
	Sub-Total	8,758	65,175	0	11,090	85,023
Chitungwiza	Zengeza	76,996	12,764	3,850	14,041	107,651
Norton	Norton	4,744	18,042	237	3,453	26,477
Ruwa	Ruwa	278	4,632	14	739	5,662

Table 12.2.3.3 (1) Design Domestic Sewage Quantity in ADWF (Scenario-1)

Authority	Sewage Works	Land Use	2000		
			Pupulation	Unti Quantity	Design Sewage Quantity
			(persons)	(l/capita/day)	(m^3/day)
Harare	Crowborough	Low Density	52,296	315	16,473
		Medium Density	35,280	210	7,409
		High Density	423,000	63	26,649
		Low/Medium Density	0	263	0
		Medium/High Density	0	137	0
		High Density High Income	1,620	210	340
		Total	512,196	-	50,871
	Firle	Low Density	42,636	315	13,430
		Medium Density	53,280	210	11,189
		High Density	561,200	63	35,356
		Low/Medium Density	4,286	263	1,127
		Medium/High Density	52,451	137	7,186
		High Density High Income	10,620	210	2,230
		Total	724,473	-	70,518
	Marlborough	Low Density	4,536	315	1,429
	Donnybrook	High Density	105,800	63	6,665
Harare Expansion	Harare South	Low Density	3,960	315	1,247
		Medium Density	20,610	210	4,328
		High Density	69,400	63	4,372
		Total	93,970	-	9,948
	Harare East	Epworth (High Density)	76,028	63	4,790
Chitungwiza	Zengeza	Low Density	0	315	0
		Medium Density	15,075	210	3,166
		High Density	424,400	63	26,737
		Total	439,475	-	29,903
Norton	Norton	Low Density	3,504	315	1,104
		Medium Density	900	210	189
		High Density	46,350	63	2,920
		Total	50,754	-	4,213
Ruwa	Ruwa	Low Density	4,668	315	1,470
		Medium Density	810	210	170
		High Density	44,010	63	2,773
		Total	49,488	-	4,413

(cont'd)

Table 12.2.3.3 (2) Design Domestic Sewage Quantity in ADWF (Scenario-1)

Authority	Sewage Works	Land Use	2005		
			Pupulation	Unti Quantity	Design Sewage Quantity
			(persons)	(l/capita/day)	(m^3/day)
Harare	Crowborough	Low Density	52,296	315	16,473
		Medium Density	86,940	210	18,257
		High Density	863,000	65	56,095
		Low/Medium Density	12,493	263	3,286
		Medium/High Density	0	138	0
		High Density High Income	1,620	210	340
		Total	1,016,349	-	94,451
	Firle	Low Density	43,728	315	13,774
		Medium Density	59,040	210	12,398
		High Density	759,600	65	49,374
		Low/Medium Density	4,286	263	1,127
		Medium/High Density	52,451	138	7,238
		High Density High Income	10,620	210	2,230
		Total	929,725	-	86,142
	Marlborough	Low Density	4,536	315	1,429
	Donnybrook	High Density	105,800	65	6,877
Harare Expansion	Harare South	Low Density	3,960	315	1,247
		Medium Density	20,610	210	4,328
		High Density	157,000	65	10,205
		Total	181,570	-	15,781
	Harare East	Epworth (High Density)	83,983	65	5,459
Chitungwiza	Zengeza	Low Density	0	315	0
		Medium Density	15,075	210	3,166
		High Density	424,400	65	27,586
		Total	439,475	-	30,752
Norton	Norton	Low Density	6,468	315	2,037
		Medium Density	9,540	210	2,003
		High Density	46,350	65	3,013
		Total	62,358	-	7,054
Ruwa	Ruwa	Low Density	11,328	315	3,568
		Medium Density	810	210	170
		High Density	58,500	65	3,803
		Total	70,638	-	7,541

(cont'd)

Table 12.2.3.3 (3) Design Domestic Sewage Quantity in ADWF (Scenario-1)

Authority	Sewage Works	Land Use	2015		
			Pupulation	Unti Quantity	Design Sewage Quantity
			(persons)	(l/capita/day)	(m^3/day)
Harare	Crowborough	Low Density	52,296	315	16,473
		Medium Density	86,940	210	18,257
		High Density	972,600	70	68,082
		Low/Medium Density	25,007	263	6,577
		Medium/High Density	12,742	140	1,784
		High Density High Income	1,620	210	340
		Total	1,151,205	-	111,514
	Firle	Low Density	45,684	315	14,390
		Medium Density	59,040	210	12,398
		High Density	846,800	70	59,276
		Low/Medium Density	4,286	263	1,127
		Medium/High Density	52,451	140	7,343
		High Density High Income	10,620	210	2,230
		Total	1,018,881	-	96,765
	Marlborough	Low Density	13,284	315	4,184
	Donnybrook	High Density	153,000	70	10,710
Harare Expansion	Harare South	Low Density	3,960	315	1,247
		Medium Density	20,610	210	4,328
		High Density	499,600	70	34,972
		Total	524,170	-	40,548
	Harare East	Epworth (High Density)	101,126	70	7,079
Chitungwiza	Zengeza	Low Density	2,568	315	809
		Medium Density	37,170	210	7,806
		High Density	533,400	70	37,338
		Total	573,138	-	45,953
Norton	Norton	Low Density	21,540	315	6,785
		Medium Density	24,750	210	5,198
		High Density	72,000	70	5,040
		Total	118,290	-	17,023
Ruwa	Ruwa	Low Density	11,328	315	3,568
		Medium Density	11,970	210	2,514
		High Density	67,500	70	4,725
		Total	90,798	-	10,807

Table 12.2.3.4 Design Domestic Sewage Quantity in ADWF (scenario-2)

Authority	Sewage Works	Population (person)			Unit Domestic Sewage Quantity (l/capita/day)			Design Domestic Sewage Quantity (m3/day)		
		2000	2005	2015	2000	2005	2015	2000	2005	2015
Harare	Crowborough	513,799	591,309	765,459	99	93	97	50,866	54,992	74,250
	Firle	781,060	898,888	1,163,625	97	93	95	75,763	83,597	110,544
	Marlborough	4,819	5,546	7,179	315	315	315	1,518	1,747	2,261
	Donnybrook	97,950	112,726	145,926	63	65	70	6,171	7,327	10,215
	Sub-Total	1,397,628	1,608,469	2,082,189	-	-	-	134,318	147,663	197,270
Harare Expansion	Harare South	14,633	16,841	21,801	106	87	77	1,551	1,465	1,679
	Harare East	76,028	83,982	101,126	63	65	70	4,790	5,459	7,079
	Sub-Total	90,661	100,823	122,927	-	-	-	6,341	6,924	8,757
Chitungwiza	Zengeza	537,824	668,304	962,456	68	70	80	36,572	46,781	76,996
Norton	Norton	24,770	27,362	32,947	83	113	144	2,056	3,092	4,744
Ruwa	Ruwa	1,757	1,940	2,336	89	107	119	156	208	278
Total		2,052,640	2,406,898	3,202,855	-	-	-	179,443	204,667	288,046

Table 12.2.3.5 (1) Unit Domestic Sewage Quantity in Scenario-2

Authority	Sewage Works	Land Use	2000		
			Pupulation in Scenario 1 (persons)	Unti Quantity (l/capita/day)	Unit Quantity in Scenario-2 (l/capita/day)
Harare	Crowborough	Low Density	52,296	315	99
		Medium Density	35,280	210	
		High Density	423,000	63	
		Low/Medium Density	0	263	
		Medium/High Density	0	137	
		High Density High Income	1,620	210	
		Total	512,196	-	
	Firle	Low Density	42,636	315	97
		Medium Density	53,280	210	
		High Density	561,200	63	
		Low/Medium Density	4,286	263	
		Medium/High Density	52,451	137	
		High Density High Income	10,620	210	
		Total	724,473	-	
	Marlborough	Low Density	4,536	315	315
	Donnybrook	High Density	105,800	63	63
Harare Expansion	Harare South	Low Density	3,960	315	106
		Medium Density	20,610	210	
		High Density	69,400	63	
		Total	93,970	-	
	Harare East	Epworth (High Density)	76,028	63	63
Chitungwiza	Zengeza	Low Density	0	315	68
		Medium Density	15,075	210	
		High Density	424,400	63	
		Total	439,475	-	
Norton	Norton	Low Density	3,504	315	83
		Medium Density	900	210	
		High Density	46,350	63	
		Total	50,754	-	
Ruwa	Ruwa	Low Density	4,668	315	89
		Medium Density	810	210	
		High Density	44,010	63	
		Total	49,488	-	

Table 12.2.3.5 (2) Unit Domestic Sewage Quantity in Scenario-2 (cont'd)

Authority	Sewage Works	Land Use	2005		
			Pupulation in Scenario 1	Unti Quantity	Unit Quantity in Scenario-2
			(persons)	(l/capita/day)	(l/capita/day)
Harare	Crowborough	Low Density	52,296	315	93
		Medium Density	86,940	210	
		High Density	863,000	65	
		Low/Medium Density	12,493	263	
		Medium/High Density	0	138	
		High Density High Income	1,620	210	
		Total	1,016,349	-	
	Firle	Low Density	43,728	315	93
		Medium Density	59,040	210	
		High Density	759,600	65	
		Low/Medium Density	4,286	263	
		Medium/High Density	52,451	138	
		High Density High Income	10,620	210	
		Total	929,725	-	
	Marlborough	Low Density	4,536	315	315
	Donnybrook	High Density	105,800	65	65
Harare Expansion	Harare South	Low Density	3,960	315	87
		Medium Density	20,610	210	
		High Density	157,000	65	
		Total	181,570	-	
	Harare East	Epworth (High Density)	83,983	65	65
Chitungwiza	Zengeza	Low Density	0	315	70
		Medium Density	15,075	210	
		High Density	424,400	65	
		Total	439,475	-	
Norton	Norton	Low Density	6,468	315	113
		Medium Density	9,540	210	
		High Density	46,350	65	
		Total	62,358	-	
Ruwa	Ruwa	Low Density	11,328	315	107
		Medium Density	810	210	
		High Density	58,500	65	
		Total	70,638	-	

Table 12.2.3.5 (3) Unit Domestic Sewage Quantity in Scenario-2 (cont'd)

Authority	Sewage Works	Land Use	2015		
			Pupulation in Scenario 1 (persons)	Unti Quantity (l/capita/day)	Unit Quantity in Scenario-2 (l/capita/day)
Harare	Crowborough	Low Density	52,296	315	97
		Medium Density	86,940	210	
		High Density	972,600	70	
		Low/Medium Density	25,007	263	
		Medium/High Density	12,742	140	
		High Density High Income	1,620	210	
		Total	1,151,205	-	
	Firle	Low Density	45,684	315	95
		Medium Density	59,040	210	
		High Density	846,800	70	
		Low/Medium Density	4,286	263	
		Medium/High Density	52,451	140	
		High Density High Income	10,620	210	
		Total	1,018,881	-	
	Marlborough	Low Density	13,284	315	315
	Donnybrook	High Density	153,000	70	70
Harare Expansion	Harare South	Low Density	3,960	315	77
		Medium Density	20,610	210	
		High Density	499,600	70	
		Total	524,170	-	
	Harare East	Epworth (High Density)	101,126	70	70
Chitungwiza	Zengeza	Low Density	2,568	315	80
		Medium Density	37,170	210	
		High Density	533,400	70	
		Total	573,138	-	
Norton	Norton	Low Density	21,540	315	144
		Medium Density	24,750	210	
		High Density	72,000	70	
		Total	118,290	-	
Ruwa	Ruwa	Low Density	11,328	315	119
		Medium Density	11,970	210	
		High Density	67,500	70	
		Total	90,798	-	

Table 12.2.3.6 Design Served Population by Sewage Works

(Scenario-1)

Authority	Sewage Works	Land Use	Land Use Area (km^2)			Population		
			2000	2005	2015	2000	2005	2015
Harare	Crowborough	Low Density	43.58	43.58	43.58	52,296	52,296	52,296
		Medium Density	7.84	19.32	19.32	35,280	86,940	86,940
		High Density	21.15	43.15	48.63	423,000	863,000	972,600
		Low/Medium Mixed Density	0.00	5.83	11.67	0	12,493	25,007
		Medium/High Mixed Density	0.00	0.00	1.46	0	0	12,742
		High Density High Income	0.36	0.36	0.36	1,620	1,620	1,620
		Total	72.93	112.24	125.02	512,196	1,016,349	1,151,205
	Firle	Low Density	35.53	36.44	38.07	42,636	43,728	45,684
		Medium Density	11.84	13.12	13.12	53,280	59,040	59,040
		High Density	28.06	37.98	42.34	561,200	759,600	846,800
		Low/Medium Mixed Density	2.00	2.00	2.00	4,286	4,286	4,286
		Medium/High Mixed Density	6.01	6.01	6.01	52,451	52,451	52,451
		High Density High Income	2.36	2.36	2.36	10,620	10,620	10,620
		Total	85.80	97.91	103.90	724,473	929,725	1,018,881
	Marlborough	Low Density	3.78	3.78	11.07	4,536	4,536	13,284
	Donnybrook	High Density	5.29	5.29	7.65	105,800	105,800	153,000
Harare Expansion	Harare South	Low Density	3.30	3.30	3.30	3,960	3,960	3,960
		Medium Density	4.58	4.58	4.58	20,610	20,610	20,610
		High Density	3.47	7.85	24.98	69,400	157,000	499,600
		Total	11.35	15.73	32.86	93,970	181,570	524,170
	Harare East	Epworth (High Density)	-	-	-	76,028	83,983	101,126
Chitungwiza	Zengeza	Low Density	0.00	0.00	2.14	0	0	2,568
		Medium Density	3.35	3.35	8.26	15,075	15,075	37,170
		High Density	21.22	21.22	26.67	424,400	424,400	533,400
		Total	24.57	24.57	37.07	439,475	439,475	573,138
Norton	Norton	Low Density	2.92	5.39	17.95	3,504	6,468	21,540
		Medium Density	0.20	2.12	5.50	900	9,540	24,750
		High Density	5.15	5.15	8.00	46,350	46,350	72,000
		Total	8.27	12.66	31.45	50,754	62,358	118,290
Ruwa	Ruwa	Low Density	3.89	9.44	9.44	4,668	11,328	11,328
		Medium Density	0.18	0.18	2.66	810	810	11,970
		High Density	4.89	6.50	7.50	44,010	58,500	67,500
		Total	8.96	16.12	19.60	49,488	70,638	90,798
Grand Total			-	-	-	2,056,720	2,894,433	3,743,892

Table 12.2.3.7 Design Served Population by Sewage Works

(Scenario-2)

Authority	Sewage Works	1992/1993	2000	2005	2015
Harare	Crowborough	413,573	513,799	591,309	765,459
	Firle	628,700	781,060	898,888	1,163,625
	Marlborough	3,879	4,819	5,546	7,179
	Donnybrook	78,843	97,950	112,726	145,926
	Sub-Total	1,124,995	1,397,627	1,608,470	2,082,189
Harare Expansion	Harare South	11,498	14,633	16,841	21,801
	Harare East	62,630	76,028	83,982	101,126
	Sub-Total	74,128	90,662	100,823	122,927
Chitungwiza	Zengeza	354,541	537,824	668,304	962,456
Norton	Norton	20,405	24,770	27,362	32,947
Ruwa	Ruwa	1,447	1,757	1,940	2,336
Total		1,575,516	2,052,639	2,406,899	3,202,855

Note : Base year ; 1993 for Harare and 1992 for other authorities
Population growth rate ; Refer to Case 3 in Section 6.2.3

Table 12.2.3.8 Area by Sewage Treatment Works and Suburban in Harare in 1993

Suburban Name		Area (km^2)				
		Crowborough	Firle	Marlborough	Donnybrook	Total
1	Marimba Park	2.35				2.35
2	Haffield		22.20			22.20
3	Waterfalls		28.14			28.14
4	Milton Park	3.83				3.83
5	Avondale	13.09				13.09
6	Borrowdale					0.00
7	Kuwadzana	10.10				10.10
8	Alexandra Park	5.84				5.84
9	Warren Park	17.94				17.94
10	Mufakose	14.03				14.03
11	Rugare	1.44				1.44
12	Budiriro		18.65			18.65
13	Glen View		7.45			7.45
14	Glen Norah		8.48			8.48
15	Highfields		8.24			8.24
16	Mbare		10.09			10.09
17	Mavuku				7.17	7.17
18	Gunhill		9.38			9.38
19	Belgravia	3.87	0.99			4.86
20	Ridgeview	4.00				4.00
21	Hatcliffe					0.00
22	Queensdale		2.67			2.67
23	Cranborne		2.72			2.72
24	Sunningdale		5.13			5.13
25	Eastlea		5.94			5.94
26	Belvedere	10.36				10.36
27	Mt. Pleasant	0.50				0.50
28	Highlands					0.00
29	Marlborough	0.69		3.78		4.47
30	Mabelreign	19.60				19.60
31	City Centre		6.37			6.37
32	Tafara				9.73	9.73
33	Kambuzuma	4.82				4.82
34	Southerton	8.55	15.09			23.64
35	Dzivaresekwa	7.88				7.88
36	Hillside		2.62			2.62
37	Braeside		2.08			2.08
38	Tynwald	21.45				21.45
39	Greendale		13.96			13.96
40	Westwood	1.66				1.66
41	Arcadia		4.44			4.44
42	Chikurubi					0.00
43	Cleveland Dam					0.00
44	Mukuvisi W'lands		3.13			3.13
Total		152.00	177.77	3.78	16.90	350.45

Note : 0.00 ; Area of septic tank using and open spaces or outside of study area

Table 12.2.3.9 Population by Sewage Treatment Works and Suburban in Harare in 1993

Suburban Name		Population				
		Crowborough	Firle	Marlborough	Donnybrook	Total
1	Marimba Park	7,667				7,667
2	Haffield		30,590			30,590
3	Waterfalls		34,412			34,412
4	Milton Park	3,824				3,824
5	Avondale	16,569				16,569
6	Borrowdale					0
7	Kuwadzana	75,200				75,200
8	Alexandra Park	2,549				2,549
9	Warren Park	68,827				68,827
10	Mufakose	95,593				95,593
11	Rugare	8,922				8,922
12	Budiriro		65,003			65,003
13	Glen View		137,654			137,654
14	Glen Norah		63,729			63,729
15	Highfields		85,396			85,396
16	Mbare		107,064			107,064
17	Mavuku				47,159	47,159
18	Gunhill		2,950			2,950
19	Belgravia	2,030	519			2,549
20	Ridgeview	1,275				1,275
21	Hatcliffe					0
22	Queensdale		6,373			6,373
23	Cranborne		10,197			10,197
24	Sunningdale		7,647			7,647
25	Eastlea		8,923			8,923
26	Belvedere	11,471				11,471
27	Mt. Pleasant	680				680
28	Highlands					0
29	Marlborough	708		3,879		4,587
30	Mabelreign	27,558				27,558
31	City Centre		36,963			36,963
32	Tafara				31,684	31,684
33	Kambuzuma	34,413				34,413
34	Southerton	2,766	4,881			7,647
35	Dzivaresekwa	44,599				44,599
36	Hillside		3,840			3,840
37	Braeside		5,098			5,098
38	Tynwald	7,647				7,647
39	Greendale		14,912			14,912
40	Westwood	1,275				1,275
41	Arcadia		2,549			2,549
42	Chikurubi					0
43	Cleveland Dam					0
44	Mukuvisi W'lands		0			0
Total		413,573	628,700	3,879	78,843	1,124,995

Note : 0.00 ; Population of septic tank using and open spaces or outside of study area

Table 12.2.3.10 (1) Sewerage and Septic Tank Service Area by Suburban and Sub-Basin in Harare in 1993

	Suburban Name	Area (km^2)										Total
		Gwebi		Lake Chivero		Marimba		Mukuvisi		Ruwa		
		Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	
1	Marimba Park					2.35						2.35
2	Haffield							22.20				22.20
3	Waterfalls							28.14				28.14
4	Milton Park					3.83						3.83
5	Avondale	2.19 *1				10.90						13.09
6	Borrowdale		7.97									7.97
7	Kuwadzana					10.10						10.10
8	Alexandra Park	0.47 *2				5.37						5.84
9	Warren Park					17.94						17.94
10	Mufakose					14.03						14.03
11	Rugare					1.44						1.44
12	Budiriro			11.20 *6		7.45 *7						18.65
13	Glen View							7.45				7.45
14	Glen Norah							8.48				8.48
15	Highfields							8.24				8.24
16	Mbare							10.09				10.09
17	Mavuku									7.17		7.17
18	Gunhill	2.85 *3	2.78					6.53				12.16
19	Belgravia					3.87		0.99				4.86
20	Ridgeview					4.00						4.00
21	Hatcliffe		1.17									1.17
22	Queensdale							2.67				2.67
23	Cranborne							2.72				2.72
24	Sunningdale							5.13				5.13
25	Eastlea							5.94				5.94
26	Belvedere					10.36						10.36
27	Mt. Pleasant	0.50 *4	23.87									24.37
28	Highlands		3.08						9.69			12.77
29	Marlborough	4.47 *5	15.40									19.87

Table 12.2.3.10 (2) Sewerage and Septic Tank Service Area by Suburban and Sub-Basin in Harare in 1993 (cont'd)

	Suburban Name	Area (km^2)										
		Gwebi		Lake Chivero		Marimba		Mukuvisi		Ruwa		Total
		Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	
30	Mabelreign		1.25			19.60						20.85
31	City Centre							6.37				6.37
32	Tafara									9.73		9.73
33	Kambuzuma					4.82						4.82
34	Southerton					8.55		15.09				23.64
35	Dzivaresekwa					7.88						7.88
36	Hillside							2.62				2.62
37	Braeside							2.08				2.08
38	Tynwald					21.45						21.45
39	Greendale							13.96	11.79			25.75
40	Westwood					1.66						1.66
41	Arcadia							4.44				4.44
42	Chikurubi								2.50			2.50
43	Cleveland Dam								17.15			17.15
44	Mukuvisi W'lands							3.13				3.13
	Sub-Total	10.48	55.52	11.20	0.00	155.60	0.00	156.27	41.13	16.90	0.00	447.10
	Total	66.00		11.20		155.60		197.40		16.90		447.10

Note : Septic area including the open spaces

*1 Pumped to Marimba Sub-Basin
*2 Pumped to Marimba Sub-Basin
*3 Pumped to Mukuvisi Sub-Basin
*4 Pumped to Marimba Sub-Basin
*5 0.69 km^2 pumped to Marimba Sub-Basin
*6 Pumped to Mukuvisi Sub-Basin
*7 Pumped to Mukuvisi Sub-Basin

Total Area of Using the Sewerage Systems in Study Area in Harare City in 1993: 350.45 km^2

Total Area of Using the Septic Tank and Open Spaces in Study Area in Harare City in 1993: 96.65 km^2

Table 12.2.3.11 (1) Sewerage and Septic Tank Service Population by Suburban and Sub-Basin in Harare in 1993

	Suburban Name	Population										Total
		Gwebi		Lake Chivero		Marimba		Mukuvisi		Ruwa		
		Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	
1	Marimba Park					7,667						7,667
2	Haffield							30,590				30,590
3	Waterfalls							34,412				34,412
4	Milton Park					3,824						3,824
5	Avondale	2,772 *1				13,797						16,569
6	Borrowdale		3,630									3,630
7	Kuwadzana					75,200						75,200
8	Alexandra Park	205 *2				2,344						2,549
9	Warren Park					68,827						68,827
10	Mufakose					95,593						95,593
11	Rugare					8,922						8,922
12	Budiriro			0		65,003 *6						65,003
13	Glen View							137,654				137,654
14	Glen Norah							63,729				63,729
15	Highfields							85,396				85,396
16	Mbare							107,064				107,064
17	Mavuku									47,159		47,159
18	Gunhill	896 *3	874					2,054				3,824
19	Belgravia					2,030		519				2,549
20	Ridgeview					1,275						1,275
21	Hatcliffe		5,098									5,098
22	Queensdale							6,373				6,373
23	Cranborne							10,197				10,197
24	Sunningdale							7,647				7,647
25	Eastlea							8,923				8,923
26	Belvedere					11,471						11,471
27	Mt. Pleasant	680 *4	32,459									33,139
28	Highlands		4,078						12,828			16,906
29	Marlborough	4,587 *5	15,806									20,393

Table 12.2.3.11 (2) Sewerage and Septic Tank Service Population by Suburban and Sub-Basin in Harare in 1993 (cont'd)

	Suburban Name	Population										Total
		Gwebi		Lake Chivero		Marimba		Mukuvisi		Ruwa		
		Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	
30	Mabelreign		1,757			27,558						29,315
31	City Centre							36,963				36,963
32	Tafara									31,684		31,684
33	Kambuzuma					34,413						34,413
34	Southerton					2,766		4,881				7,647
35	Dzivaresekwa					44,599						44,599
36	Hillside							3,840				3,840
37	Braeside							5,098				5,098
38	Tynwald					7,647						7,647
39	Greendale							14,912	12,594			27,506
40	Westwood					1,275						1,275
41	Arcadia							2,549				2,549
42	Chikurubi								0			0
43	Cleveland Dam								0			0
44	Mukuvisi Wlands							0				0
	Sub-Total	9,140	63,702	0	0	474,211	0	562,801	25,422	78,843	0	1,214,119
	Total	72,842		0		474,211		588,223		78,843		1,214,119

*1 Pumped to Marimba Sub-Basin
*2 Pumped to Marimba Sub-Basin
*3 Pumped to Mukuvisi Sub-Basin
*4 Pumped to Marimba Sub-Basin
*5 0.69 km^2 pumped to Marimba Sub-Basin
*6 Pumped to Mukuvisi Sub-Basin

Total Population of Using the Sewerage Systems in Study Area in Harare City in 1993: **1,124,995**
Total Population of Using the Septic Tank in Study Area in Harare City in 1993: **89,124**

Table 12.2.3.12 (1) Land Use Area by Sub-Basin and Sewerage/Septic Tank Using

(Scenario-1)

	Sub-Basin and Authority	Land Use	Land Use Area (km^2)							
			1995		2000		2005		2015	
			Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(1)	Manyame River Upstream Sub-Basin									
	Goromonzi R. D.	-	-	-	-	-	-	-	-	-
	Harare R. D.	-	-	-	-	-	-	-	-	-
	Manyame R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(2)	Ruwa River Sub-Basin									
	Harare City	High Density	5.29	0.00	5.29	0.00	5.29	0.00	7.65	0.00
	Ruwa Local Board	Low Density	2.67	0.28	3.89	0.00	9.44	0.00	9.44	0.00
		Medium Density	0.18	0.00	0.18	0.00	0.18	0.00	2.66	0.00
		High Density	1.76	0.00	4.89	0.00	6.50	0.00	7.50	0.00
	Epworth Local Board	-	-	-	-	-	-	-	-	-
	Goromonzi R. D.	-	-	-	-	-	-	-	-	-
	Harare R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(3)	Seke & Harava Dam Sub-Basin									
	Harare City	Low Density	0.00	0.00	3.30	0.00	3.30	0.00	3.30	0.00
		High Density	0.00	0.00	2.19	0.00	2.19	0.00	2.19	0.00
	Epworth Local Board	-	-	-	-	-	-	-	-	-
	Goromonzi R. D.	-	-	-	-	-	-	-	-	-
	Harare R. D.	-	-	-	-	-	-	-	-	-
	Manyame R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(4)	Nyatsime River Sub-Basin									
	Chitungwiza Municipality	Low Density	0.00	0.00	0.00	0.00	0.00	0.00	2.14	0.00
		Medium Density	3.35	0.00	3.35	0.00	3.35	0.00	8.26	0.00
		High Density	17.78	0.00	17.78	0.00	17.78	0.00	23.23	0.00
	Manyame R. D.	-	-	-	-	-	-	-	-	-
	Marondera R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-

Table 12.2.3.12 (2) Land Use Area by Sub-Basin and Sewerage/Septic Tank Using (cont'd)

(Scenario-1)

Sub-Basin and Authority		Land Use	Land Use Area (km^2)							
			1995		2000		2005		2015	
			Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(5)	Mukuvisi River Sub-Basin									
	Harare City	Low Density	32.14	41.13	32.68	41.13	33.59	41.13	35.22	41.13
		Medium Density	7.47	0.00	11.84	0.00	13.12	0.00	13.12	0.00
		High Density	22.60	0.00	25.51	0.00	29.88	0.00	32.60	0.00
		Low/Medium Mixed Density	2.00	0.00	2.00	0.00	2.00	0.00	2.00	0.00
		Medium/High Mixed Density	6.01	0.00	6.01	0.00	6.01	0.00	6.01	0.00
		High Density High Income	2.36	0.00	2.36	0.00	2.36	0.00	2.36	0.00
	Epworth Local Board	-	-	-	-	-	-	-	-	-
	Harare R. D.	-	-	-	-	-	-	-	-	-
	Zvimba R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(6)	Manyame River Downstream Sub-Basin (Mukuvisi River to Seke Dam)									
	Harare City	Medium Density	0.00	0.00	4.58	0.00	4.58	0.00	4.58	0.00
		High Density	0.00	0.00	1.28	0.00	5.66	0.00	22.79	0.00
	Chitungwiza Municipality	High Density	1.69	0.00	3.44	0.00	3.44	0.00	3.44	0.00
	Harare R. D.	-	-	-	-	-	-	-	-	-
	Manyame R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(7)	Marimba River Sub-Basin									
	Harare City	Low Density	39.73	0.00	39.73	0.00	39.73	0.00	39.73	0.00
		Medium Density	4.74	0.00	7.84	0.00	19.32	0.00	19.32	0.00
		High Density	17.50	0.00	21.15	0.00	35.65	0.00	41.13	0.00
		Low/Medium Mixed Density	0.00	0.00	0.00	0.00	5.83	0.00	11.67	0.00
		Medium/High Mixed Density	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00
		High Density High Income	0.36	0.00	0.36	0.00	0.36	0.00	0.36	0.00
	Zvimba R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-

Table 12.2.3.12 (3) Land Use Area by Sub-Basin and Sewerage/Septic Tank Using (cont'd)

(Scenario-1)

Sub-Basin and Authority		Land Use	Land Use Area (km^2)							
			1995		2000		2005		2015	
			Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(8)	Lake Chivero Sub-Basin									
	Harare City	High Density	0.00	0.00	2.55	0.00	8.10	0.00	9.74	0.00
	Chegutu R. D.	-	-	-	-	-	-	-	-	-
	Manyame R. D.	-	-	-	-	-	-	-	-	-
	Zvimba R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(9)	Muzururu River Sub-Basin									
	Harare City	High Density	0.00	0.00	0.00	0.00	7.50	0.00	7.50	0.00
	Zvimba R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(10)	Gwebi River Sub-Basin									
	Harare City	Low Density	10.48	21.41	10.48	22.50	10.48	24.32	17.77	28.15
	Mazowe R. D.	-	-	-	-	-	-	-	-	-
	Zvimba R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
(11)	Lake Manyame Sub-Basin									
	Norton Town Council	Low Density	0.70	1.13	2.92	0.00	5.39	0.00	17.95	0.00
		Medium Density	0.20	0.00	0.20	0.00	2.12	0.00	5.50	0.00
		High Density	3.25	0.00	5.15	0.00	5.15	0.00	8.00	0.00
	Chegutu R. D.	-	-	-	-	-	-	-	-	-
	Zvimba R. D.	-	-	-	-	-	-	-	-	-
	Total		-	-	-	-	-	-	-	-
Grand Total			-	-	-	-	-	-	-	-

Table 12.2.3.13 (1) Population by Sub-Basin and Sewerage/Septic Tank Using

(Scenario-1)

Sub-Basin and Authority		Land Use	Population							
			1995		2000		2005		2015	
			Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(1)	Manyame River Upstream Sub-Basin									
	Goromonzi R. D.	-	0	25,825	0	28,667	0	31,666	0	38,130
	Harare R. D.	-	0	118	0	131	0	145	0	174
	Manyame R. D.	-	0	2,339	0	2,596	0	2,868	0	3,454
	Total		0	28,282	0	31,394	0	34,679	0	41,758
(2)	Ruwa River Sub-Basin									
	Harare City	High Density	105,800	0	105,800	0	105,800	0	153,000	0
	Ruwa Local Board	Low Density	3,204	336	4,668	0	11,328	0	11,328	0
		Medium Density	810	0	810	0	810	0	11,970	0
		High Density	15,840	0	44,010	0	58,500	0	67,500	0
	Epworth Local Board	-	0	45,660	50,685	0	55,988	0	67,417	0
	Goromonzi R. D.	-	0	6,127	0	6,801	0	7,513	0	9,047
	Harare R. D.	-	0	4,069	0	4,517	0	4,989	0	6,008
	Total		125,654	56,192	205,973	11,318	232,426	12,502	311,215	15,055
(3)	Seke & Harava Dam Sub-Basin									
	Harare City	Low Density	0	0	3,960	0	3,960	0	3,960	0
		High Density	0	0	43,800	0	43,800	0	43,800	0
	Epworth Local Board	-	0	4,936	5,479	0	6,053	0	7,288	0
	Goromonzi R. D.	-	0	117	0	130	0	143	0	173
	Harare R. D.	-	0	7,463	0	2,489	0	2,749	0	3,310
	Manyame R. D.	-	0	973	0	1,080	0	1,193	0	1,436
	Total		0	13,489	53,239	3,699	53,813	4,085	55,048	4,919
(4)	Nyatsime River Sub-Basin									
	Chitungwiza Municipality	Low Density	0	0	0	0	0	0	2,568	0
		Medium Density	15,075	0	15,075	0	15,075	0	37,170	0
		High Density	355,600	0	355,600	0	355,600	0	464,600	0
	Manyame R. D.	-	0	10,179	0	11,300	0	12,482	0	15,030
	Marondera R. D.	-	0	7,467	0	8,289	0	9,156	0	11,026
	Total		370,675	17,646	370,675	19,589	370,675	21,638	504,338	26,056

Table 12.2.3.13 (2) Population by Sub-Basin and Sewerage/Septic Tank Using (cont'd)

(Scenario-1)

Sub-Basin and Authority		Land Use	Population							
			1995		2000		2005		2015	
			Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(5)	Mukuvisi River Sub-Basin									
	Harare City	Low Density	38,568	49,356	39,216	49,356	40,308	49,356	42,264	49,356
		Medium Density	33,615	0	53,280	0	59,040	0	59,040	0
		High Density	452,000	0	510,200	0	597,600	0	652,000	0
		Low/Medium Mixed Density	4,286	0	4,286	0	4,286	0	4,286	0
		Medium/High Mixed Density	52,451	0	52,451	0	52,451	0	52,451	0
		High Density High Income	10,620	0	10,620	0	10,620	0	10,620	0
	Epworth Local Board	-	0	17,894	19,864	0	21,942	0	26,421	0
	Harare R. D.	-	0	1,843	0	2,046	0	2,260	0	2,721
	Zvimba R. D.	-	0	421	0	467	0	516	0	622
	Total		591,540	69,514	689,917	51,869	786,247	52,132	847,082	52,699
(6)	Manyame River Downstream Sub-Basin (Mukuvisi River to Seke Dam)									
	Harare City	Medium Density	0	0	20,610	0	20,610	0	20,610	0
		High Density	0	0	25,600	0	113,200	0	455,800	0
	Chitungwiza Municipality	High Density	33,800	0	68,800	0	68,800	0	68,800	0
	Harare R. D.	-	0	10,128	0	3,081	0	3,404	0	4,099
	Manyame R. D.	-	0	1,466	0	1,627	0	1,797	0	2,164
	Total		33,800	11,594	115,010	4,708	202,610	5,201	545,210	6,263
(7)	Marimba River Sub-Basin									
	Harare City	Low Density	47,676	0	47,676	0	47,676	0	47,676	0
		Medium Density	21,330	0	35,280	0	86,940	0	86,940	0
		High Density	350,000	0	423,000	0	713,000	0	822,600	0
		Low/Medium Mixed Density	0	0	0	0	12,493	0	25,007	0
		Medium/High Mixed Density	0	0	0	0	0	0	12,742	0
		High Density High Income	1,620	0	1,620	0	1,620	0	1,620	0
	Zvimba R. D.	-	0	2,624	0	2,913	0	3,218	0	3,875
	Total		420,626	2,624	507,576	2,913	861,729	3,218	996,585	3,875

Table 12.2.3.13 (3) Population by Sub-Basin and Sewerage/Septic Tank Using (cont'd)

(Scenario-1)

Sub-Basin and Authority		Land Use	Population							
			1995		2000		2005		2015	
			Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(8)	Lake Chivero Sub-Basin									
	Harare City	High Density	0	0	51,000	0	162,000	0	194,800	0
	Chegutu R. D.	-	0	1,384	0	1,537	0	1,697	0	2,044
	Manyame R. D.	-	0	2,017	0	2,239	0	2,474	0	2,979
	Zvimba R. D.	-	0	4,649	0	5,160	0	5,700	0	6,864
	Total		0	8,050	51,000	8,936	162,000	9,871	194,800	11,887
(9)	Muzururu River Sub-Basin									
	Harare City	High Density	0	0	0	0	150,000	0	150,000	0
	Zvimba R. D.	-	0	13,699	0	15,207	0	16,797	0	20,226
	Total		0	13,699	0	15,207	150,000	16,797	150,000	20,226
(10)	Gwebi River Sub-Basin									
	Harare City	Low Density	12,576	25,692	12,576	27,000	12,576	29,184	21,324	33,780
	Mazowe R. D.	-	0	12,423	0	13,791	0	15,233	0	18,343
	Zvimba R. D.	-	0	19,887	0	22,075	0	24,385	0	29,363
	Total		12,576	58,002	12,576	62,866	12,576	68,802	21,324	81,486
(11)	Lake Manyame Sub-Basin									
	Norton Town Council	Low Density	840	1,356	3,504	0	6,468	0	21,540	0
		Medium Density	900	0	900	0	9,540	0	24,750	0
		High Density	29,250	0	46,350	0	46,350	0	72,000	0
	Chegutu R. D.	-	0	6,026	0	6,689	0	7,389	0	8,897
	Zvimba R. D.	-	0	12,250	0	13,598	0	15,021	0	18,087
	Total		30,990	19,632	50,754	20,287	62,358	22,410	118,290	26,984
Grand Total			1,585,861	298,724	2,056,720	232,786	2,894,433	251,335	3,743,892	291,208
			1,884,585		2,289,506		3,145,768		4,035,100	

Table 12.2.3.14 (1) Population Projection by Sub-Basin and Sewerage/Septic Tank Using

(Scenario-2)

	Sub-Basin Name	Population									
		Year 1993		Year 1995		Year 2000		Year 2005		Year 2015	
		Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(1)	Manyame River Sub-Basin										
	Goromonzi R. D. C.	0	24,720	0	25,825	0	28,667	0	31,666	0	38,130
	Harare R. D. C.	0	113	0	118	0	131	0	145	0	174
	Manyame R. D. C.	0	2,239	0	2,339	0	2,596	0	2,868	0	3,454
	Total	0	27,072	0	28,282	0	31,394	0	34,679	0	41,758
(2)	Ruwa River Sub-Basin										
	Harare City	78,843	0	84,165	0	97,950	0	112,726	0	145,926	0
	Ruwa Local Board	1,501	14	1,568	15	1,757	0	1,941	0	2,337	0
	Epworth Local Board	0	43,707	0	45,660	50,685	0	55,988	0	67,417	0
	Goromonzi R. D. C.	0	5,865	0	6,127	0	6,801	0	7,513	0	9,047
	Harare R. D. C.	0	3,895	0	4,069	0	4,517	0	4,989	0	6,008
	Total	80,344	53,481	85,733	55,871	150,392	11,318	170,655	12,502	215,680	15,055
(3)	Seke & Harava Dam Sub-Basin										
	Epworth Local Board	0	4,725	0	4,936	5,479	0	6,053	0	7,288	0
	Goromonzi R. D. C.	0	112	0	117	0	130	0	143	0	173
	Harare R. D. C.	0	7,144	0	7,463	6,077	2,489	6,994	2,749	9,054	3,310
	Manyame R. D. C.	0	931	0	973	0	1,080	0	1,193	0	1,436
	Total	0	12,912	0	13,489	11,557	3,698	13,047	4,085	16,342	4,919
(4)	Nyatsime River Sub-Basin										
	Chitungwiza Municipality	296,121	0	330,840	0	423,856	0	526,688	0	758,507	0
	Manyame R. D. C.	0	9,744	0	10,179	0	11,300	0	12,482	0	15,030
	Marondera R. D. C.	0	7,148	0	7,467	0	8,289	0	9,156	0	11,026
	Total	296,121	16,892	330,840	17,647	423,856	19,589	526,688	21,638	758,507	26,055
(5)	Mukuvisi River Sub-Basin										
	Harare City	562,801	25,422	600,791	27,138	699,191	31,583	804,669	36,347	1,041,656	47,052
	Epworth Local Board	0	17,129	0	17,894	19,864	0	21,942	0	26,421	0
	Harare R. D. C.	0	1,764	0	1,843	0	2,046	0	2,260	0	2,721
	Zvimba R. D. C.	0	403	0	421	0	467	0	516	0	622
	Total	562,801	44,718	600,791	47,296	719,054	34,096	826,611	39,123	1,068,077	50,395
(6)	Manyame River Sub-Basin (Mukuvisi River to Seke Dam)										
	Chitungwiza Municipality	79,622	0	88,957	0	113,968	0	141,618	0	203,950	0
	Harare R. D. C.	0	9,695	0	10,128	8,556	3,081	9,847	3,404	12,747	4,099
	Manyame R. D. C.	0	1,403	0	1,466	0	1,627	0	1,797	0	2,164
	Total	79,622	11,098	88,957	11,594	122,524	4,708	151,464	5,201	216,697	6,263

Table 12.2.3.14 (2) Population Projection by Sub-Basin and Sewerage/Septic Tank Using (cont'd)

(Scenario-2)

	Sub-Basin Name	Population									
		Year 1993		Year 1995		Year 2000		Year 2005		Year 2015	
		Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic	Sewerage	Septic
(7)	Marimba River Sub-Basin										
	Harare City	474,211	0	506,221	0	589,132	0	678,007	0	877,690	0
	Zvimba R. D. C.	0	2,512	0	2,624	0	2,913	0	3,218	0	3,875
	Total	474,211	2,512	506,221	2,624	589,132	2,913	678,007	3,218	877,690	3,875
(8)	Lake Chivero Sub-Basin										
	Harare City	0	0	0	0	0	0	0	0	0	0
	Chegutu R. D. C.	0	1,325	0	1,384	0	1,537	0	1,697	0	2,044
	Manyame R. D. C.	0	1,931	0	2,017	0	2,239	0	2,474	0	2,979
	Zvimba R. D. C.	0	4,450	0	4,649	0	5,160	0	5,700	0	6,864
	Total	0	7,706	0	8,050	0	8,936	0	9,871	0	11,886
(9)	Muzururu River Sub-Basin										
	Zvimba R. D. C.	0	13,113	0	13,699	0	15,207	0	16,797	0	20,226
	Total	0	13,113	0	13,699	0	15,207	0	16,797	0	20,226
(10)	Gwebi River Sub-Basin										
	Harare City	9,140	63,702	9,757	68,002	11,355	79,140	13,068	91,078	16,917	117,902
	Mazowe R. D. C.	0	11,892	0	12,423	0	13,791	0	15,233	0	18,343
	Zvimba R. D. C.	0	19,036	0	19,887	0	22,075	0	24,385	0	29,363
	Total	9,140	94,630	9,757	100,312	11,355	115,005	13,068	130,696	16,917	165,608
(11)	Lake Manyame Sub-Basin										
	Norton Town Council	20,122	1,238	21,021	1,293	24,770	0	27,362	0	32,947	0
	Chegutu R. D. C.	0	5,768	0	6,026	0	6,689	0	7,389	0	8,897
	Zvimba R. D. C.	0	11,726	0	12,250	0	13,598	0	15,021	0	18,087
	Total	20,122	18,732	21,021	19,569	24,770	20,287	27,362	22,409	32,947	26,984
	Grand Total	1,522,361	302,866	1,643,322	318,434	2,052,640	267,152	2,406,900	300,221	3,202,857	373,024
		1,825,227		1,961,755		2,319,792		2,707,122		3,575,881	

Note : Norton septic tank area 21,360 x 1.13/19.5 = 1,238
Ruwa septic tank area 1,515 x 0.28/31.40 = 14

All of population in Norton, Ruwa and Epeorth will change to sewerage in 2000

Population growth rate ; Refer to Case 3 in Sectiobn 6.2

Table 12.2.3.15 (1) Design Sewage Quality in Scenario-1

(Year 2000)

Sewage Works	Design Sewage Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Pollution Load of Industry (kg/day)	Pollution Load of Commerce (kg/day)	Design Sewage Quality (mg/l)
BOD					
Crowborough	85,468	22,961	12,826	5,442	482
Firle	180,179	32,451	42,715	22,193	540
Marlborough	1,643	227	0	0	138
Donnybrook	7,665	4,655	0	0	607
Harare South	13,203	4,220	1,725	0	450
Harare East	5,509	3,345	0	0	607
Zengeza	37,495	19,382	1,412	969	580
Norton	6,414	2,257	1,406	113	589
Ruwa	8,388	2,208	1,907	111	504
T-N					
Crowborough	85,468	5,776	389	1,369	88
Firle	180,179	8,151	1,301	5,574	83
Marlborough	1,643	59	0	0	36
Donnybrook	7,665	1,164	0	0	152
Harare South	13,203	1,062	52	0	84
Harare East	5,509	836	0	0	152
Zengeza	37,495	4,849	51	242	137
Norton	6,414	566	83	28	106
Ruwa	8,388	555	336	28	110
T-P					
Crowborough	85,468	629	121	149	11
Firle	180,179	888	404	607	11
Marlborough	1,643	6	0	0	4
Donnybrook	7,665	127	0	0	17
Harare South	13,203	116	16	0	10
Harare East	5,509	91	0	0	17
Zengeza	37,495	529	21	26	15
Norton	6,414	62	13	3	12
Ruwa	8,388	60	42	3.00	13

(cont'd)

Table 12.2.3.15 (2) Design Sewage Quality in Scenario-1

(Year 2005)

Sewage Works	Design Sewage Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Pollution Load of Industry (kg/day)	Pollution Load of Commerce (kg/day)	Design Sewage Quality (mg/l)
BOD					
Crowborough	148,074	45,361	12,826	11,006	467
Firle	248,103	41,506	42,715	44,169	517
Marlborough	1,643	227	0	0	138
Donnybrook	7,909	4,655	0	0	589
Harare South	63,611	8,075	44,516	0	827
Harare East	6,278	3,695	0	0	589
Zengeza	38,744	19,382	1,641	969	568
Norton	12,412	2,811	5,891	141	712
Ruwa	13,183	3,178	2,543	159	446
T-N					
Crowborough	148,074	11,392	389	2,764	98
Firle	248,103	10,417	1,301	11,085	92
Marlborough	1,643	59	0	0	36
Donnybrook	7,909	1,164	0	0	147
Harare South	63,611	2,026	1,355	0	53
Harare East	6,278	924	0	0	147
Zengeza	38,744	4,849	59	243	133
Norton	12,412	708	188	35	75
Ruwa	13,183	800	450	40	98
T-P					
Crowborough	148,074	1,241	121	301	11
Firle	248,103	1,135	404	1,208	11
Marlborough	1,643	6	0	0	4
Donnybrook	7,909	127	0	0	16
Harare South	63,611	221	421	0	10
Harare East	6,278	101	0	0	16
Zengeza	38,744	529	25	26	15
Norton	12,412	77	31	4	9
Ruwa	13,183	87	56	4.35	11

(cont'd)

Table 12.2.3.15 (3) Design Sewage Quality in Scenario-1

(Year 2015)

Sewage Works	Design Sewage Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Pollution Load of Industry (kg/day)	Pollution Load of Commerce (kg/day)	Design Sewage Quality (mg/l)
BOD					
Crowborough	178,944	51,383	12,826	15,066	443
Firle	309,713	45,440	47,026	61,417	497
Marlborough	4,812	664	0	0	138
Donnybrook	12,317	6,732	0	0	547
Harare South	92,093	23,149	44,516	0	735
Harare East	37,629	4,450	28,877	0	886
Zengeza	70,167	25,345	14,956	1,267	592
Norton	41,304	5,408	35,349	270	993
Ruwa	18,376	4,099	3,322	205	415
T-N					
Crowborough	178,944	12,900	389	3,782	95
Firle	309,713	11,401	1,432	15,410	91
Marlborough	4,812	173	0	0	36
Donnybrook	12,317	1,683	0	0	137
Harare South	92,093	5,794	1,355	0	78
Harare East	37,629	1,112	880	0	53
Zengeza	70,167	6,347	535	317	103
Norton	41,304	1,369	872	68	56
Ruwa	18,376	1,033	588	52	91
T-P					
Crowborough	178,944	1,405	121	412	11
Firle	309,713	1,242	445	1,679	11
Marlborough	4,812	19	0	0	4
Donnybrook	12,317	184	0	0	15
Harare South	92,093	632	421	0	11
Harare East	37,629	121	274	0	10
Zengeza	70,167	692	218	35	13
Norton	41,304	149	143	7	7
Ruwa	18,376	112	74	5.60	10

Table 12.2.3.16 (1) Design Sewage Quality in Scenario-2

(Year 2000)

Sewage Works	Design Sewage Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Pollution Load of Industry (kg/day)	Pollution Load of Commerce (kg/day)	Design Sewage Quality (mg/l)
BOD					
Crowborough	84,839	23,121	12,826	5,234	485
Firle	183,720	35,148	42,715	21,369	540
Marlborough	1,746	241	0	0	138
Donnybrook	7,097	4,310	0	0	607
Harare South	3,547	658	1,725	0	672
Harare East	5,509	3,345	0	0	607
Zengeza	45,549	23,664	1,412	1,183	577
Norton	3,810	1,090	1,406	55	670
Ruwa	3,247	79	1,907	4	613
T-N					
Crowborough	84,839	5,806	389	1,314	89
Firle	183,720	8,826	1,301	5,366	84
Marlborough	1,746	63	0	0	36
Donnybrook	7,097	1,077	0	0	152
Harare South	3,547	165	52	0	61
Harare East	5,509	836	0	0	152
Zengeza	45,549	5,916	51	296	138
Norton	3,810	277	83	14	98
Ruwa	3,247	20	336	1	110
T-P					
Crowborough	84,839	632	121	143	11
Firle	183,720	961	404	584	11
Marlborough	1,746	6	0	0	3
Donnybrook	7,097	118	0	0	17
Harare South	3,547	18	16	0	10
Harare East	5,509	91	0	0	17
Zengeza	45,549	645	21	32	15
Norton	3,810	30	13	2	12
Ruwa	3,247	2	42	0.10	14

(cont'd)

Table 12.2.3.16 (2) Design Sewage Quality in Scenario-2

(Year 2005)

Sewage Works	Design Sewage Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Pollution Load of Industry (kg/day)	Pollution Load of Commerce (kg/day)	Design Sewage Quality (mg/l)
BOD					
Crowborough	92,730	26,609	12,826	6,896	500
Firle	205,312	40,450	42,715	27,582	539
Marlborough	2,009	277	0	0	138
Donnybrook	8,426	4,960	0	0	589
Harare South	47,148	741	44,516	0	960
Harare East	6,278	3,695	0	0	589
Zengeza	58,099	29,405	1,641	1,470	560
Norton	7,627	1,231	5,891	62	942
Ruwa	4,328	87	2,543	4	609
T-N					
Crowborough	92,730	6,623	389	1,716	94
Firle	205,312	10,068	1,301	6,865	89
Marlborough	2,009	72	0	0	36
Donnybrook	8,426	1,240	0	0	147
Harare South	47,148	189	1,355	0	33
Harare East	6,278	924	0	0	147
Zengeza	58,099	7,351	59	368	134
Norton	7,627	312	188	16	68
Ruwa	4,328	22	450	1	109
T-P					
Crowborough	92,730	721	121	187	11
Firle	205,312	1,097	404	748	11
Marlborough	2,009	7	0	0	3
Donnybrook	8,426	135	0	0	16
Harare South	47,148	21	421	0	9
Harare East	6,278	101	0	0	16
Zengeza	58,099	802	25	40	15
Norton	7,627	34	31	2	9
Ruwa	4,328	2	56	0.10	13

(cont'd)

Table 12.2.3.16 (3) Design Sewage Quality in Scenario-2

(Year 2015)

Sewage Works	Design Sewage Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Pollution Load of Industry (kg/day)	Pollution Load of Commerce (kg/day)	Design Sewage Quality (mg/l)
BOD					
Crowborough	124,172	34,446	12,826	10,361	464
Firle	277,887	52,363	47,026	42,317	510
Marlborough	2,600	359	0	0	138
Donnybrook	11,747	6,421	0	0	547
Harare South	47,394	959	44,516	0	960
Harare East	37,629	4,450	28,877	0	886
Zengeza	107,651	42,348	14,956	2,118	552
Norton	26,477	1,516	35,349	76	1,395
Ruwa	5,662	105	3,322	5	606
T-N					
Crowborough	124,172	8,573	389	2,579	93
Firle	277,887	13,033	1,432	10,532	90
Marlborough	2,600	93	0	0	36
Donnybrook	11,747	1,605	0	0	137
Harare South	47,394	242	1,355	0	34
Harare East	37,629	1,112	880	0	53
Zengeza	107,651	10,683	535	534	109
Norton	26,477	382	872	19	48
Ruwa	5,662	27	588	1	109
T-P					
Crowborough	124,172	934	121	281	11
Firle	277,887	1,420	445	1,148	11
Marlborough	2,600	10	0	0	4
Donnybrook	11,747	175	0	0	15
Harare South	47,394	26	421	0	9
Harare East	37,629	121	274	0	10
Zengeza	107,651	1,165	218	58	13
Norton	26,477	42	143	2	7
Ruwa	5,662	3	74	0.15	14

Table 12.2.3.17 (1) Domestic Sewage Pollution Load in Scenario-1

(Year 2000)

Authority	Sewage Works	Land Use	BOD		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	50	22,961
		Medium Density	35,280	47	
		High Density	423,000	44	
		Low/Medium Density	0	49	
		Medium/High Density	0	46	
		High Density High Income	1,620	47	
		Total	512,196	-	
	Firle	Low Density	42,636	50	32,451
		Medium Density	53,280	47	
		High Density	561,200	44	
		Low/Medium Density	4,286	49	
		Medium/High Density	52,451	46	
		High Density High Income	10,620	47	
		Total	724,473	-	
	Marlborough	Low Density	4,536	50	227
	Donnybrook	High Density	105,800	44	4,655
Harare Expansion	Harare South	Low Density	3,960	50	4,220
		Medium Density	20,610	47	
		High Density	69,400	44	
		Total	93,970	-	
	Harare East	Epworth (High Density)	76,028	44	3,345
Chitungwiza	Zengeza	Low Density	0	50	19,382
		Medium Density	15,075	47	
		High Density	424,400	44	
		Total	439,475	-	
Norton	Norton	Low Density	3,504	50	2,257
		Medium Density	900	47	
		High Density	46,350	44	
		Total	50,754	-	
Ruwa	Ruwa	Low Density	4,668	50	2,208
		Medium Density	810	47	
		High Density	44,010	44	
		Total	49,488	-	

(cont'd)

Table 12.2.3.17 (2) Domestic Sewage Pollution Load in Scenario-1

(Year 2000)

Authority	Sewage Works	Land Use	T-N		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	13	5,776
		Medium Density	35,280	12	
		High Density	423,000	11	
		Low/Medium Density	0	12.5	
		Medium/High Density	0	11.5	
		High Density High Income	1,620	12	
		Total	512,196	-	
	Firle	Low Density	42,636	13	8,151
		Medium Density	53,280	12	
		High Density	561,200	11	
		Low/Medium Density	4,286	12.5	
		Medium/High Density	52,451	11.5	
		High Density High Income	10,620	12	
		Total	724,473	-	
	Marlborough	Low Density	4,536	13	59
	Donnybrook	High Density	105,800	11	1,164
Harare Expansion	Harare South	Low Density	3,960	13	1,062
		Medium Density	20,610	12	
		High Density	69,400	11	
		Total	93,970	-	
	Harare East	Epworth (High Density)	76,028	11	836
Chitungwiza	Zengeza	Low Density	0	13	4,849
		Medium Density	15,075	12	
		High Density	424,400	11	
		Total	439,475	-	
Norton	Norton	Low Density	3,504	13	566
		Medium Density	900	12	
		High Density	46,350	11	
		Total	50,754	-	
Ruwa	Ruwa	Low Density	4,668	13	555
		Medium Density	810	12	
		High Density	44,010	11	
		Total	49,488	-	

(cont'd)

Table 12.2.3.17 (3) Domestic Sewage Pollution Load in Scenario-1

(Year 2000)

Authority	Sewage Works	Land Use	T-P		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	1.40	629
		Medium Density	35,280	1.30	
		High Density	423,000	1.20	
		Low/Medium Density	0	1.35	
		Medium/High Density	0	1.25	
		High Density High Income	1,620	1.30	
		Total	512,196	-	
	Firle	Low Density	42,636	1.40	888
		Medium Density	53,280	1.30	
		High Density	561,200	1.20	
		Low/Medium Density	4,286	1.35	
		Medium/High Density	52,451	1.25	
		High Density High Income	10,620	1.30	
		Total	724,473	-	
	Marlborough	Low Density	4,536	1.40	6
	Donnybrook	High Density	105,800	1.20	127
Harare Expansion	Harare South	Low Density	3,960	1.40	116
		Medium Density	20,610	1.30	
		High Density	69,400	1.20	
		Total	93,970	-	
	Harare East	Epworth (High Density)	76,028	1.20	91
Chitungwiza	Zengeza	Low Density	0	1.40	529
		Medium Density	15,075	1.30	
		High Density	424,400	1.20	
		Total	439,475	-	
Norton	Norton	Low Density	3,504	1.40	62
		Medium Density	900	1.30	
		High Density	46,350	1.20	
		Total	50,754	-	
Ruwa	Ruwa	Low Density	4,668	1.40	60
		Medium Density	810	1.30	
		High Density	44,010	1.20	
		Total	49,488	-	

Table 12.2.3.17 (4) Domestic Sewage Pollution Load in Scenario-1

(Year 2005)

Authority	Sewage Works	Land Use	BOD		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	50	45,361
		Medium Density	86,940	47	
		High Density	863,000	44	
		Low/Medium Density	12,493	49	
		Medium/High Density	0	46	
		High Density High Income	1,620	47	
		Total	1,016,349	-	
	Firle	Low Density	43,728	50	41,506
		Medium Density	59,040	47	
		High Density	759,600	44	
		Low/Medium Density	4,286	49	
		Medium/High Density	52,451	46	
		High Density High Income	10,620	47	
		Total	929,725	-	
	Marlborough	Low Density	4,536	50	227
	Donnybrook	High Density	105,800	44	4,655
Harare Expansion	Harare South	Low Density	3,960	50	8,075
		Medium Density	20,610	47	
		High Density	157,000	44	
		Total	181,570	-	
	Harare East	Epworth (High Density)	83,983	44	3,695
Chitungwiza	Zengeza	Low Density	0	50	19,382
		Medium Density	15,075	47	
		High Density	424,400	44	
		Total	439,475	-	
Norton	Norton	Low Density	6,468	50	2,811
		Medium Density	9,540	47	
		High Density	46,350	44	
		Total	62,358	-	
Ruwa	Ruwa	Low Density	11,328	50	3,178
		Medium Density	810	47	
		High Density	58,500	44	
		Total	70,638	-	

(cont'd)

Table 12.2.3.17 (5) Domestic Sewage Pollution Load in Scenario-1

(Year 2005)

Authority	Sewage Works	Land Use	T-N		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	13	11,392
		Medium Density	86,940	12	
		High Density	863,000	11	
		Low/Medium Density	12,493	12.5	
		Medium/High Density	0	11.5	
		High Density High Income	1,620	12	
		Total	1,016,349	-	
	Firle	Low Density	43,728	13	10,417
		Medium Density	59,040	12	
		High Density	759,600	11	
		Low/Medium Density	4,286	12.5	
		Medium/High Density	52,451	11.5	
		High Density High Income	10,620	12	
		Total	929,725	-	
	Marlborough	Low Density	4,536	13	59
	Donnybrook	High Density	105,800	11	1,164
Harare Expansion	Harare South	Low Density	3,960	13	2,026
		Medium Density	20,610	12	
		High Density	157,000	11	
		Total	181,570	-	
	Harare East	Epworth (High Density)	83,983	11	924
Chitungwiza	Zengeza	Low Density	0	13	4,849
		Medium Density	15,075	12	
		High Density	424,400	11	
		Total	439,475	-	
Norton	Norton	Low Density	6,468	13	708
		Medium Density	9,540	12	
		High Density	46,350	11	
		Total	62,358	-	
Ruwa	Ruwa	Low Density	11,328	13	800
		Medium Density	810	12	
		High Density	58,500	11	
		Total	70,638	-	

(cont'd)

Table 12.2.3.17 (6) Domestic Sewage Pollution Load in Scenario-1

(Year 2005)

Authority	Sewage Works	Land Use	T-P		
			Population (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	1.40	1,241
		Medium Density	86,940	1.30	
		High Density	863,000	1.20	
		Low/Medium Density	12,493	1.35	
		Medium/High Density	0	1.25	
		High Density High Income	1,620	1.30	
		Total	1,016,349	-	
	Firle	Low Density	43,728	1.40	1,135
		Medium Density	59,040	1.30	
		High Density	759,600	1.20	
		Low/Medium Density	4,286	1.35	
		Medium/High Density	52,451	1.25	
		High Density High Income	10,620	1.30	
		Total	929,725	-	
	Marlborough	Low Density	4,536	1.40	6
	Donnybrook	High Density	105,800	1.20	127
Harare Expansion	Harare South	Low Density	3,960	1.40	221
		Medium Density	20,610	1.30	
		High Density	157,000	1.20	
		Total	181,570	-	
	Harare East	Epworth (High Density)	83,983	1.20	101
Chitungwiza	Zengeza	Low Density	0	1.40	529
		Medium Density	15,075	1.30	
		High Density	424,400	1.20	
		Total	439,475	-	
Norton	Norton	Low Density	6,468	1.40	77
		Medium Density	9,540	1.30	
		High Density	46,350	1.20	
		Total	62,358	-	
Ruwa	Ruwa	Low Density	11,328	1.40	87
		Medium Density	810	1.30	
		High Density	58,500	1.20	
		Total	70,638	-	

Table 12.2.3.17 (7) Domestic Sewage Pollution Load in Scenario-1

(Year 2015)

Authority	Sewage Works	Land Use	BOD		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	50	51,383
		Medium Density	86,940	47	
		High Density	972,600	44	
		Low/Medium Density	25,007	49	
		Medium/High Density	12,742	46	
		High Density High Income	1,620	47	
		Total	1,151,205	-	
	Firle	Low Density	45,684	50	45,440
		Medium Density	59,040	47	
		High Density	846,800	44	
		Low/Medium Density	4,286	49	
		Medium/High Density	52,451	46	
		High Density High Income	10,620	47	
		Total	1,018,881	-	
	Marlborough	Low Density	13,284	50	664
	Donnybrook	High Density	153,000	44	6,732
Harare Expansion	Harare South	Low Density	3,960	50	23,149
		Medium Density	20,610	47	
		High Density	499,600	44	
		Total	524,170	-	
	Harare East	Epworth (High Density)	101,126	44	4,450
Chitungwiza	Zengeza	Low Density	2,568	50	25,345
		Medium Density	37,170	47	
		High Density	533,400	44	
		Total	573,138	-	
Norton	Norton	Low Density	21,540	50	5,408
		Medium Density	24,750	47	
		High Density	72,000	44	
		Total	118,290	-	
Ruwa	Ruwa	Low Density	11,328	50	4,099
		Medium Density	11,970	47	
		High Density	67,500	44	
		Total	90,798	-	

(cont'd)

Table 12.2.3.17 (8) Domestic Sewage Pollution Load in Scenario-1

(Year 2015)

Authority	Sewage Works	Land Use	T-N		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	13	12,900
		Medium Density	86,940	12	
		High Density	972,600	11	
		Low/Medium Density	25,007	12.5	
		Medium/High Density	12,742	11.5	
		High Density High Income	1,620	12	
		Total	1,151,205	-	
	Firle	Low Density	45,684	13	11,401
		Medium Density	59,040	12	
		High Density	846,800	11	
		Low/Medium Density	4,286	12.5	
		Medium/High Density	52,451	11.5	
		High Density High Income	10,620	12	
		Total	1,018,881	-	
	Marlborough	Low Density	13,284	13	173
	Donnybrook	High Density	153,000	11	1,683
Harare Expansion	Harare South	Low Density	3,960	13	5,794
		Medium Density	20,610	12	
		High Density	499,600	11	
		Total	524,170	-	
	Harare East	Epworth (High Density)	101,126	11	1,112
Chitungwiza	Zengeza	Low Density	2,568	13	6,347
		Medium Density	37,170	12	
		High Density	533,400	11	
		Total	573,138	-	
Norton	Norton	Low Density	21,540	13	1,369
		Medium Density	24,750	12	
		High Density	72,000	11	
		Total	118,290	-	
Ruwa	Ruwa	Low Density	11,328	13	1,033
		Medium Density	11,970	12	
		High Density	67,500	11	
		Total	90,798	-	

(cont'd)

Table 12.2.3.17 (9) Domestic Sewage Pollution Load in Scenario-1

(Year 2015)

Authority	Sewage Works	Land Use	T-P		
			Pupulation (persons)	Unit Load (g/capita/day)	Pollution Load (kg/day)
Harare	Crowborough	Low Density	52,296	1.40	1,405
		Medium Density	86,940	1.30	
		High Density	972,600	1.20	
		Low/Medium Density	25,007	1.35	
		Medium/High Density	12,742	1.25	
		High Density High Income	1,620	1.30	
		Total	1,151,205	-	
	Firle	Low Density	45,684	1.40	1,242
		Medium Density	59,040	1.30	
		High Density	846,800	1.20	
		Low/Medium Density	4,286	1.35	
		Medium/High Density	52,451	1.25	
		High Density High Income	10,620	1.30	
		Total	1,018,881	-	
	Marlborough	Low Density	13,284	1.40	19
	Donnybrook	High Density	153,000	1.20	184
Harare Expansion	Harare South	Low Density	3,960	1.40	632
		Medium Density	20,610	1.30	
		High Density	499,600	1.20	
		Total	524,170	-	
	Harare East	Epworth (High Density)	101,126	1.20	121
Chitungwiza	Zengeza	Low Density	2,568	1.40	692
		Medium Density	37,170	1.30	
		High Density	533,400	1.20	
		Total	573,138	-	
Norton	Norton	Low Density	21,540	1.40	149
		Medium Density	24,750	1.30	
		High Density	72,000	1.20	
		Total	118,290	-	
Ruwa	Ruwa	Low Density	11,328	1.40	112
		Medium Density	11,970	1.30	
		High Density	67,500	1.20	
		Total	90,798	-	

Table 12.2.3.18 Domestic Sewage Pollution Load in Scenario-2

Sewage Works	Population (persons)	Unit Domestic Pollution Load BOD (g/capita/day)	T-N (g/capita/day)	T-P (g/capita/day)	Domestic Pollution Load BOD (kg/day)	T-N (kg/day)	T-P (kg/day)
Year 2000							
Crowborough	513,799	45	11.3	1.23	23,121	5,806	632
Firle	781,060	45	11.3	1.23	35,148	8,826	961
Marlborough	4,819	50	13.0	1.32	241	63	6
Donnybrook	97,950	44	11.0	1.20	4,310	1,077	118
Harare South	14,633	45	11.3	1.23	658	165	18
Harare East	76,028	44	11.0	1.20	3,345	836	91
Zengeza	537,824	44	11.0	1.20	23,664	5,916	645
Norton	24,770	44	11.2	1.22	1,090	277	30
Ruwa	1,757	45	11.2	1.21	79	20	2
Year 2005							
Crowborough	591,309	45	11.2	1.22	26,609	6,623	721
Firle	898,888	45	11.2	1.22	40,450	10,068	1,097
Marlborough	5,546	50	13.0	1.32	277	72	7
Donnybrook	112,726	44	11.0	1.20	4,960	1,240	135
Harare South	16,841	44	11.2	1.22	741	189	21
Harare East	83,982	44	11.0	1.20	3,695	924	101
Zengeza	668,304	44	11.0	1.20	29,405	7,351	802
Norton	27,362	45	11.4	1.23	1,231	312	34
Ruwa	1,940	45	11.3	1.23	87	22	2
Year 2015							
Crowborough	765,459	45	11.2	1.22	34,446	8,573	934
Firle	1,163,625	45	11.2	1.22	52,363	13,033	1,420
Marlborough	7,179	50	13.0	1.43	359	93	10
Donnybrook	145,926	44	11.0	1.20	6,421	1,605	175
Harare South	21,801	44	11.1	1.21	959	242	26
Harare East	101,126	44	11.0	1.20	4,450	1,112	121
Zengeza	962,456	44	11.1	1.21	42,348	10,683	1,165
Norton	32,947	46	11.6	1.26	1,516	382	42
Ruwa	2,336	45	11.4	1.23	105	27	3

Table 12.2.3.19 Unit Domestic Sewage Pollution Load in Scenario-2

Sewage Works	Population in Scenario-1 (persons)	Pollution Load in Scenario-1			Unit Domestic Pollution Load		
		BOD (kg/day)	T-N (kg/day)	T-P (kg/day)	BOD (g/capita/day)	T-N (g/capita/day)	T-P (g/capita/day)
Year 2000							
Crowborough	512,196	22,961	5,776	629	45	11.3	1.23
Firle	724,473	32,451	8,151	888	45	11.3	1.23
Marlborough	4,536	227	59	6	50	13.0	1.32
Donnybrook	105,800	4,655	1,164	127	44	11.0	1.20
Harare South	93,970	4,220	1,062	116	45	11.3	1.23
Harare East	76,028	3,345	836	91	44	11.0	1.20
Zengeza	439,475	19,382	4,849	529	44	11.0	1.20
Norton	50,754	2,257	566	62	44	11.2	1.22
Ruwa	49,488	2,208	555	60	45	11.2	1.21
Year 2005							
Crowborough	1,016,349	45,361	11,392	1,241	45	11.2	1.22
Firle	929,725	41,506	10,417	1,135	45	11.2	1.22
Marlborough	4,536	227	59	6	50	13.0	1.32
Donnybrook	105,800	4,655	1,164	127	44	11.0	1.20
Harare South	181,570	8,075	2,026	221	44	11.2	1.22
Harare East	83,983	3,695	924	101	44	11.0	1.20
Zengeza	439,475	19,382	4,849	529	44	11.0	1.20
Norton	62,358	2,811	708	77	45	11.4	1.23
Ruwa	70,638	3,178	800	87	45	11.3	1.23
Year 2015							
Crowborough	1,151,205	51,383	12,900	1,405	45	11.2	1.22
Firle	1,018,881	45,440	11,401	1,242	45	11.2	1.22
Marlborough	13,284	664	173	19	50	13.0	1.43
Donnybrook	153,000	6,732	1,683	184	44	11.0	1.20
Harare South	524,170	23,149	5,794	632	44	11.1	1.21
Harare East	101,126	4,450	1,112	121	44	11.0	1.20
Zengeza	573,138	25,345	6,347	692	44	11.1	1.21
Norton	118,290	5,408	1,369	149	46	11.6	1.26
Ruwa	90,798	4,099	1,033	112	45	11.4	1.23

Table 12.2.3.20 Industrial Wastewater Pollution Load

Authority	Sub-Basin	Item	Wastewater Pollution Load (kg/day)		
			2000	2005	2015
Harare	Marimba River Sub-Basin (Crowborough)	BOD	12,826	12,826	12,826
		COD	35,721	35,721	35,721
		SS	8,520	8,520	8,520
		T-N	389	389	389
		T-P	121	121	121
	Mukuvisi River Sub-Basin (Firle)	BOD	42,715	42,715	47,026
		COD	118,956	118,956	130,949
		SS	28,376	28,376	31,243
		T-N	1,301	1,301	1,432
		T-P	404	404	445
Harare Expansion	Ruwa River Sub-Basin (Harare East)	BOD	0	0	28,877
		COD	0	0	80,420
		SS	0	0	19,182
		T-N	0	0	880
		T-P	0	0	274
	Manyame River Sub-Basin (Harare South)	BOD	1,725	44,516	44,516
		COD	4,804	123,960	123,960
		SS	1,147	29,573	29,573
		T-N	52	1,355	1,355
		T-P	16	421	421
Chitungwiza	Nyatsime River Sub-Basin (Zengeza)	BOD	1,412	1,641	14,956
		COD	3,364	3,909	35,607
		SS	708	822	7,489
		T-N	51	59	535
		T-P	21	25	218
Norton	Lake Manyame Sub-Basin (Norton)	BOD	1,406	5,891	35,349
		COD	5,176	23,940	147,158
		SS	820	2,049	10,123
		T-N	83	188	872
		T-P	13	31	143
Ruwa	Ruwa River Sub-Basin (Ruwa)	BOD	1,907	2,543	3,322
		COD	6,806	9,077	11,858
		SS	6,103	8,136	10,631
		T-N	336	450	588
		T-P	42	56	74
Total Pollution Load		BOD	61,991	110,132	186,872
		COD	174,827	315,563	565,673
		SS	45,674	77,476	116,761
		T-N	2,212	3,742	6,051
		T-P	617	1,058	1,696

Table 12.2.3.21 (1) Commercial Wastewater Pollution Load in Scenario-1

(Year 2000)

Sewage Works	Domestic Quantity (m^3/day)	Commercial Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Sewage Quality of Domestic (mg/l)	Commercial Pollution Load (kg/day)
BOD					
Crowborough	50,871	12,057	22,961	451	5,442
Firle	70,518	48,227	32,451	460	22,193
Zengeza	29,903	1,495	19,382	648	969
Norton	4,213	211	2,257	536	113
Ruwa	4,413	221	2,208	500	111
T-N					
Crowborough	50,871	12,057	5,776	114	1,369
Firle	70,518	48,227	8,151	116	5,574
Zengeza	29,903	1,495	4,849	162	242
Norton	4,213	211	566	134	28
Ruwa	4,413	221	555	126	28
T-P					
Crowborough	50,871	12,057	629	12	149
Firle	70,518	48,227	888	13	607
Zengeza	29,903	1,495	529	18	26
Norton	4,213	211	62	15	3
Ruwa	4,413	221	60	14	3.00

(Year 2005)

Sewage Works	Domestic Quantity (m^3/day)	Commercial Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Sewage Quality of Domestic (mg/l)	Commercial Pollution Load (kg/day)
BOD					
Crowborough	94,451	22,917	45,361	480	11,006
Firle	86,142	91,668	41,506	482	44,169
Zengeza	30,752	1,538	19,382	630	969
Norton	7,054	353	2,811	398	141
Ruwa	7,541	377	3,178	421	159
T-N					
Crowborough	94,451	22,917	11,392	121	2,764
Firle	86,142	91,668	10,417	121	11,085
Zengeza	30,752	1,538	4,849	158	243
Norton	7,054	353	708	100	35
Ruwa	7,541	377	800	106	40
T-P					
Crowborough	94,451	22,917	1,241	13	301
Firle	86,142	91,668	1,135	13	1,208
Zengeza	30,752	1,538	529	17	26
Norton	7,054	353	77	11	4
Ruwa	7,541	377	87	12	4.35

(cont'd)

Table 12.2.3.21 (2) Commercial Wastewater Pollution Load in Scenario-I

(Year 2015)

Sewage Works	Domestic Quantity (m^3/day)	Commercial Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Sewage Quality of Domestic (mg/l)	Commercial Pollution Load (kg/day)
BOD					
Crowborough	111,514	32,697	51,383	461	15,066
Firle	96,765	130,789	45,440	470	61,417
Zengeza	45,953	2,298	25,345	552	1,267
Norton	17,023	851	5,408	318	270
Ruwa	10,807	540	4,099	379	205
T-N					
Crowborough	111,514	32,697	12,900	116	3,782
Firle	96,765	130,789	11,401	118	15,410
Zengeza	45,953	2,298	6,347	138	317
Norton	17,023	851	1,369	80	68
Ruwa	10,807	540	1,033	96	52
T-P					
Crowborough	111,514	32,697	1,405	13	412
Firle	96,765	130,789	1,242	13	1,679
Zengeza	45,953	2,298	692	15	35
Norton	17,023	851	149	9	7
Ruwa	10,807	540	112	10	5.60

Table 12.2.3.22 (1) Commercial Wastewater Pollution Load in Scenario-2

(Year 2000)

Sewage Works	Domestic Quantity (m^3/day)	Commercial Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Sewage Quality of Domestic (mg/l)	Commercial Pollution Load (kg/day)
BOD					
Crowborough	50,866	11,515	23,121	455	5,234
Firle	75,763	46,061	35,148	464	21,369
Zengeza	36,573	1,829	23,664	647	1,183
Norton	2,056	103	1,090	530	55
Ruwa	156	8	79	506	4
T-N					
Crowborough	50,866	11,515	5,806	114	1,314
Firle	75,763	46,061	8,826	116	5,366
Zengeza	36,573	1,829	5,916	162	296
Norton	2,056	103	277	135	14
Ruwa	156	8	20	128	1
T-P					
Crowborough	50,866	11,515	632	12	143
Firle	75,763	46,061	961	13	584
Zengeza	36,573	1,829	645	18	32
Norton	2,056	103	30	15	2
Ruwa	156	8	2	13	0.10

(Year 2005)

Sewage Works	Domestic Quantity (m^3/day)	Commercial Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Sewage Quality of Domestic (mg/l)	Commercial Pollution Load (kg/day)
BOD					
Crowborough	54,992	14,251	26,609	484	6,896
Firle	83,597	57,003	40,450	484	27,582
Zengeza	46,781	2,339	29,405	629	1,470
Norton	3,092	155	1,231	398	62
Ruwa	208	10	87	418	4
T-N					
Crowborough	54,992	14,251	6,623	120	1,716
Firle	83,597	57,003	10,068	120	6,865
Zengeza	46,781	2,339	7,351	157	368
Norton	3,092	155	312	101	16
Ruwa	208	10	22	106	1
T-P					
Crowborough	54,992	14,251	721	13	187
Firle	83,597	57,003	1,097	13	748
Zengeza	46,781	2,339	802	17	40
Norton	3,092	155	34	11	2
Ruwa	208	10	2	10	0.10

(cont'd)

Table 12.2.3.22 (2) Commercial Wastewater Pollution Load in Scenario-2

(Year 2015)

Sewage Works	Domestic Quantity (m^3/day)	Commercial Quantity (m^3/day)	Pollution Load of Domestic (kg/day)	Sewage Quality of Domestic (mg/l)	Commercial Pollution Load (kg/day)
BOD					
Crowborough	74,250	22,334	34,446	464	10,361
Firle	110,544	89,335	52,363	474	42,317
Zengeza	76,996	3,850	42,348	550	2,118
Norton	4,744	237	1,516	320	76
Ruwa	278	14	105	378	5
T-N					
Crowborough	74,250	22,334	8,573	115	2,579
Firle	110,544	89,335	13,033	118	10,532
Zengeza	76,996	3,850	10,683	139	534
Norton	4,744	237	382	81	19
Ruwa	278	14	27	97	1
T-P					
Crowborough	74,250	22,334	934	13	281
Firle	110,544	89,335	1,420	13	1,148
Zengeza	76,996	3,850	1,165	15	58
Norton	4,744	237	42	9	2
Ruwa	278	14	3	11	0.15