M3.2 Consciousness toward Sewerage System

M3.2.1 Method of Questionnaire Survey

A sample questionnaire survey was carried out to throw light on people's consciousness toward water pollution such as the water smell, the contraction of diseases, the expectation of water quality improvement and the conditions of water supply services in Nakuru municipality. Beside that, the sample questionnaire survey to tourists for Lake Nakuru National Park also was conducted to clarify their consciousness toward lake water pollution. The respective questionnaire forms were attached in Table M-12 and M-13, respectively. Samples were selected at random from residents in the municipality and tourist in Lake Nakuru National Park. Interviewees of the survey visited the sample houses or the tourist spots in the park with questionnaire forms and asked them about questions on the questionnaire. The survey was conducted for four days from 6th to 9th of September, 1993.

M3.2.2 Consciousness of Residents

(1) Distribution of respondents

The survey got efficient replies from 410 respondents. The distribution of the respondents was listed in Table M-14. The income level classification was demarcated by a staff of NMC. The income levels by zone were not official but classified based on a generally accepted idea of the people in Nakuru. The efficient number of replies by income level was as follows: 1) 65 in high income zones; 2) 90 in middle income zones; 3) 102 in low income zones; and 4) 153 in surrounding area of Lake Nakuru.

Overall average family size was 5.2 persons. That was distributed in the respective income classes as follows: 5.8 in high income family, 5.6 in middle, 4.3 in low and 5.3 in surrounding area. Monthly household income was KShs.7,241 on average. That was distributed as follows: KShs.16,738 in high income family, KShs.6,690 in middle, KShs.5,020 in low and KShs.6,329 in surrounding area. The relation between household income and family size is shown in Table M-15.

(2) Consciousness of sewage treatment

387 or 94% of the total respondents were aware that sewage treatment in the municipality is important, as shown in Table M-16. Major reasons for the importance are 1) to free from obnoxious odour, 2) to sustain safe potable water and 3) not breeding mosquitoes and germs. Following them, the next two reasons were listed as reasons of the importance: 4) to support wildlife of waterfowls such as flamingo and pelican and 5) for safe agricultural crop production. This order is based on the weighted values as depicted in the table.

Table M-12 Qestionnaire for Restident

A. Face Items

1. Your Number of Section Area: (_____)
2. Your Age: (_____ years old)
3. Your Occupation (Choose major income source):
   1) Agriculture 2) Livestock 3) Fishery 4) Forestry
   5) Private Employee 6) Government Employee
   7) Private Owner or Self-employed
   (1) Factory (2) Construction (3) Electricity/Water/Gas Service
   (4) Retail Shop (5) Restaurant/Hotel (6) Transport Company
   (7) Bank (8) Trader of Real Estate
   8) Other (_____)
4. Your Education:
   1) No Schooling 2) Primary School 3) Secondary School 4) Vocational
   5) College or University 6) Others (_____)
5. Number of Household Members: (_____ persons)
6. Monthly Household Income (KShs):
   1) Less than 1,000 2) 1,001 - 2,000 3) 2,001 - 3,000 4) 3,001 - 4,000
   5) 4,001 - 5,000 6) 5,001 - 6,000 7) 6,001 - 7,000 8) 7,001 - 10,000
   9) 10,001-20,000 10) 20,001-50,000 11) Over 50,000

B. Questions

1. Importance of Sewerage System
   1) Do you think purification of sewage is important for Nakuru Municipality?
      a) Yes b) No
   2) If "Yes", please choose three items in the following reasons that you agree for the importance, and write the order among the three.
      ( ) 1) To free from obnoxious odour
      ( ) 2) Not breeding mosquitoes and germs
      ( ) 3) For safe agricultural crop production
      ( ) 4) To sustain safe potable water
      ( ) 5) To sustain sufficient industrial water
      ( ) 6) To support wildlife of waterfowls such as flamingo and pelican
      ( ) 7) To support wildlife of animal species
      ( ) 8) To raise value of housing lot
      ( ) 9) Others (_____)

2. Payment for Potable Water
   How much does your family consume potable water monthly? How much does your family pay for water consumed monthly? Please fill out the following table.

Water Source	Consumption (m^3/month)	Water Charge (KShs./month)
a) Piped System		
b) Communal Tap		
c) Public Well		
d) Private Well		
e) Purchase through bottles		
f) Other Source ( )		

3. Contraction of Diseases

Have you and/or your family ever suffer from any diseases related to water pollution for the recent five years? Choose diseases from below and fill out other items.

Disease	Number of Patients	Medication Period (days)		Cost (KShs)
		Outside Hospital	In Hospital	
a) Cholera [KIPINDUPINDU]				
b) Typhoid [HOMA YA MATUMBO]				
c) Paratyphoid				
d) Ineffective hepatitis				
e) Diarrhoeal diseases [KUHARA]				
f) Bacillary dysentery [KUHARA DAMU]				
g) Trachoma				
h) Conjunctivitis				
i) Scabies [UDERE]				
j) Yaws				
k) Leprosy [UKOMA]				
l) Bilharzia (Schistosomiasis)				
m) Tuberculosis [KIFUA KIKUU]				
n) Malaria				
o) Dengue haemohagic fever				
p) Others( )				

4. Price of Land

4.1 What is the purchase price of housing lot per square metre around your house?
(KShs_____/m²)

4.2 The rehabilitation and expansion of sewerage treatment facilities is expected to contribute to the rise in the purchase price of housing lot. Once the works is completed, do you think the price of land will be increased?
a) Yes b) No

4.3 If the answer is "yes", to what extent will the purchase price of housing lot will rise according to your estimation? (_____%)

5. Willingness to Pay

The government will have to invest and spend some amount of money in order to free from water contamination through the rehabilitation and expansion of sewerage treatment facilities. In case that you have to pay for keeping better water environment as a tax, what will be the maximum amount you are willing to pay per month? Check the nearest one.

1) Nothing 2) KShs10.00 3) KShs20.00 4) KShs30.00
5) KShs40.00 6) KShs50.00 7) KShs70.00 8) KShs100.00
9) Others (KShs_____)

Table M-13 Questionnaire for Tourist

A. Face Items

1. Your Nationality: (_____)
2. Your Age: (_____ years old)
3. Your Sex: 1) Male 2) Female
4. Purpose of Visit:
   1) Holiday 2) Business 3) Official 4) Others (_____
5. Marriage Status: 1) Single 2) Married

B. Questions

1. How many times have you come to Lake Nakuru National Park for the last five years including this visit? (_____ times)

2. How many times are you likely to visit Lake Nakuru National Park in the next five years ?
   (_____ times)

3. What are important tourism attractions of Lake Nakuru National Park for you? Choose three items that you agree as the tourism attractions, and write the order among the three.
   ( ) 1) Wildlife of waterfowls such as flamingo and pelican
   ( ) 2) Wildlife of animal species
   ( ) 3) Clean, clear and beautiful lake
   ( ) 4) Great crater
   ( ) 5) Green and peaceful rural scenery
   ( ) 6) Mild temperature
   ( ) 7) Smiling and friendly people
   ( ) 8) Accommodations (hotels, cottages, etc.)
   ( ) 9) Souvenir
   ( ) 10) Food (fish ,fruit, etc.)
   ( ) 11) Night life
   ( ) 12) Others (_____)

4. What do you notice the present water conditions of Lake Nakuru National Park are ?
   1) Clean, clear and in good conditions
   2) Not so clean and clear in some locations
   3) Garbage is noticeable
   4) Lots of weeds are noticeable under the water
   5) Filthy and stinking

5. Suppose the wildlife in Lake Nakuru National Park gets lost because of worse water conditions, do you want to visit Lake Nakuru National Park again as a tourist ?
   1) Yes 2) No

6. Regarding this tour/trip you are attending now:
   1) Total length of this tour/trip: (_____days)
   2) Total amount for this tour/trip: (Approximately KShs_____)
   3) How many days do you stay in Lake Nakuru National Park? (_____days)

Table M-14 Distribution of Interviewees in Residential Area

	Item	High Income Area	Middle Income Area	Low Income Area	Surrounding Area	Total
1.	Total Number	65	90	102	153	410
2.	Age					
	1) 20's	13	20	55	50	138
	2) 30's	22	29	29	45	125
	3) 40's	20	23	17	29	89
	4) 50's	10	15	1	16	42
	5) 60's	0	3	0	13	16
	6) No Answer	3	7	1	2	13
3.	Occupation					
	1) Agriculture	3	1	0	20	24
	2) Livestock	2	0	0	12	14
	3) Private Employee	7	20	15	19	61
	4) Government Employee	32	28	30	34	124
	5) Private Owner	10	29	39	39	117
	a. Factory	2	0	1	3	6
	b. Construction	2	3	1	6	12
	c. Retail Shop	0	3	16	10	29
	d. Restaurant	1	2	2	4	9
	e. Transport	1	2	2	2	7
	f. Bank	2	3	1	0	6
	g. Real Estate	0	3	0	3	6
	6) Others	10	6	18	27	61
	7) No Answer	1	6	0	2	9
4.	Education					
	1) No Schooling	2	2	0	10	14
	2) Primary School	2	3	18	46	69
	3) Secondary School	17	24	59	67	167
	4) Vocational School	3	0	1	6	10
	5) College/University	39	51	22	17	129
	6) Others	0	0	1	1	2
	7) No Answer	2	10	1	6	19
5.	Numver of Household Member					
	1) One Person	1	2	10	10	23
	2) Two Persons	4	4	10	9	27
	3) Three Persons	2	9	23	27	61
	4) Four Persons	8	16	18	15	57
	5) Five Persons	12	12	8	19	51
	6) Six Persons	17	11	15	18	61
	7) More Than 7 Persons	20	31	16	52	119
	8) No Answer	1	5	2	3	11
	Average Family Size	5.8	5.6	4.3	5.3	5.2
6.	Monthly Household Income (KShs.)					
	1) Less than 1,000	1	2	10	10	23
	2) 1,001 -2,000	2	4	10	9	25
	3) 2,001 -3,000	1	9	23	27	60
	4) 3,001 -4,000	1	16	18	15	50
	5) 4,001 -5,000	5	12	8	19	44
	6) 5,001 -6,000	4	11	15	18	48
	7) 6,001 -7,000	3	16	6	19	44
	8) 7,001 -10,000	7	8	4	11	30
	9) 10,001 -20,000	9	3	2	10	24
	10) 20,001 -50,000	6	2	4	4	16
	11) Over 50,000	3	1	0	1	5
	12) No Answer	23	5	2	3	33
	Average HH Income	16,738	6,690	5,020	6,329	7,241

Table M-15 Relation Between Household Income and Family Size

Household Income (KShs./month)	Family Size (Persons)								Total
	One	Two	Three	Four	Five	Six	More Than Seven	No Answer	
1. Less Than 1,000	10	3	11	2	4	3	11	1	45
2. 1,001 - 2,000	6	8	13	3	8	7	10	1	56
3. 2,001 - 3,000	4	5	12	9	5	8	18	2	63
4. 3,001 - 4,000	0	2	3	9	2	6	12	1	35
5. 4,001 - 5,000	0	0	3	4	4	6	9	0	26
6. 5,001 - 6,000	0	0	2	2	4	3	8	1	20
7. 6,001 - 7,000	0	0	1	3	1	5	4	2	16
8. 7,001 - 10,000	0	2	0	9	3	3	7	0	24
9. 10,001 - 20,000	0	2	5	7	1	6	8	0	29
10. 20,001 - 50,000	0	0	1	0	2	5	8	0	16
11. More Than 50,000	0	0	0	0	0	1	3	0	4
12. No Answer	3	5	10	9	17	8	21	3	76
Total	23	27	61	57	51	61	119	11	410

Table M-16 Reasons of Importance of Sewage Treatment

I. People's Consciousness of Sewage Treatment in Nakuru Municipality

Efficient Sample Number:	410	(100%)
1. Important:	387	(94%)
2. Not Important :	23	(6%)

II. Reasons of Importance of Sewage Treatment

Reason of Importance *1	Number of Interviewees			Simple Total	Assessed Value *2
	First Ranked	Second Ranked	Third Ranked		
1. Reason 1	135	69	46	250	589
2. Reason 2	63	109	50	222	457
3. Reason 3	38	58	40	136	270
4. Reason 4	103	59	54	216	481
5. Reason 5	7	13	31	51	78
6. Reason 6	28	44	79	151	251
7. Reason 7	1	11	24	36	49
8. Reason 8	9	13	40	62	93
9. Reason 9	1	4	11	16	22
Total	385	380	375	1,140	2,290

Remark: *1 Reasons are listed as follows:

1) To free from obnoxious odour
2) Not breeding mosquitoes and germs
3) For safe agricultural crop production
4) To sustain safe potable water
5) To sustain sufficient industrial water
6) To support wildlife of waterfowls such as flamingo and pelican
7) To support wildlife of aimal species
8) To raise value of housing lot
9) Others

*2 Assessed the number of inverviewees as follow wighting value:
3 points to the first rank; 2 points to the second rank; and 1 point to the third rank

(3) Water sources and consumption

Regarding water sources for daily life such as drinking, cooking, washing and cleaning, 157 households or 60% of the efficient respondents (259 households) rely on the municipal piped water supply system. 34% is getting water for the daily life from communal public taps, as shown in Table M-17. Other 6% is still not to rely on the municipal water supply system and get water from private wells or other sources.

According to the respondents, every household consumed water about 6.2 m^3 per month on average, as shown in the table. Its monthly charge amounted at KShs.277 on average. Accordingly, its average unit rate of water worked out around KShs.44 per m^3.

(4) Contraction of diseases

Table M-18 shows the number of patients who suffered from waterborne diseases during the recent five years. Among the diseases, the people were the most susceptible to malaria according to the table. Succeeding to 1) malaria, the following waterborne diseases were epidemic in the municipality in order of the number of patients: 2) typhoid; 3) diarrhoeal diseases, 4) scabies; 5) trachoma; and 6) cholera. For the respective diseases, the patients spent the following amount of money for medical care: 1) KShs.1,741 for malaria on average, 2) KShs.4,031 for typhoid, 3) KShs.1490 for diarrhoeal diseases, 4) KShs.720 for scabies, 5) KShs.1,267 for trachoma and 6) KShs.3,540 for cholera.

(5) Effects on price of land due to sewage treatment service

Focusing on socio-economic impacts owing to sewage treatment services in the municipality, one observed that price of land in the target areas would be expected to increase by a certain percentage because of improvement of living circumstances. In fact, 74% of the efficient respondents agreed this phenomena in the area, as shown in Table M-19. The respondents expected the price of land to increase by 26% more than the present value on average. Incidentally, the present value of land was estimated at KShs.217 thousand per plot on average.

(6) Household income and willingness-to-pay for sewage treatment services

Willingness-to-pay for sewage treatment services was KShs.35.10 per month on average (Table M-20) or approximately 0.5% of the total household income. It was distributed as follows: in high income areas, KShs.37.00/month on average or 0.22% of income; in middle income areas, KShs.40.10/month or 0.60%; in low income areas, KShs.25.50/month or 0.51%; and in surrounding areas, KShs.38.10/month or 0.60%.

Table M-17 Consumption and Payment for Potable Water

Water Source	Water Consumption			Monthly Water Charge		
	Efficient Number	Total Volume (m^3/month)	Average Volume (m^3/month)	Efficient Number	Total Volume (Shs.)	Average Volume (Shs.)
a. Piped System	157	978	6.23	201	55,694	277
b. Communal Tap	88	407	4.63	30	10,080	336
c. Public Well	-	-	-	-	-	-
d. Private Well	7	43	6.14	-	-	-
e. Puchase through Bottle	4	17	4.25	7	12,380	1,769
f. Other Sources	3	7	2.33	1	180	180
Total	259	1,452	5.61	239	78,334	328

Table M-18 Contraction of Diseases Related to Water Pollution

Disease	Number of Patients		Medication Period (days)				Cost (Shs.)		
			Out-patient		In-patient				
	Number of Cases	Total Number	Number of Cases	Total Days	Number of Cases	Total Days	Number of Cases	Total Amount	Average Amount
1. Cholera	5	6	1	5	2	11	5	17,700	3,540
2. Typhoid	90	138	58	701	37	285	81	326,495	4,031
3. Paratyphoid	3	4	0	0	2	18	3	4,280	1,427
4. Hepatitis	2	3	2	14	1	6	1	2,000	2,000
5. Diarrhoeal	31	58	19	88	10	35	25	37,260	1,490
6. Dysentery	1	1	0	0	0	0	1	3,000	3,000
7. Trachoma	7	10	2	29	0	0	6	7,600	1,267
8. Conjunctivitis	4	5	2	37	0	0	2	3,400	1,700
9. Scabies	7	13	5	40	0	0	5	3,600	720
10. Yaws	1	1	1	30	0	0	1	2,000	2,000
11. Leprosy	0	0	0	0	0	0	0	0	0
12. Bilharzia	0	0	0	0	0	0	0	0	0
13. Tuberculosis	3	3	0	0	1	10	3	16,000	5,333
14. Malaria	98	271	49	399	13	68	79	137,575	1,741
15. Dengue	2	2	0	0	1	4	2	3,400	1,700
16. Other	1	7	0	0	0	0	1	2,000	2,000

Table M-19 Price of Land Served by Sewerage System

1.	Price of Land			
	a.	Number of Efficient Samples:		59
	b.	Average Value of Housing Lot (Shs./plot):		217,000
2.	Possibility of Land Price Increase Due to Rehabilitation and Expansion of Sewerage System			
	a.	Number of Efficient Samples:	410	100%
		1) Yes	302	74%
		2) No	108	26%
3.	Percentage of Price Increase Due to Rehabilitation and Expansion of Sewerage System			
	a.	Number of Samples:	410	100%
	b.	Percentage of Price Increase		
		1) Less than 10%	199	49%
		2) 10 - 20%	70	17%
		3) 20 - 30%	76	19%
		4) 30 - 50%	34	8%
		5) 50 - 100%	24	6%
		6) More than 100%	7	2%
		7) No answer	170	41%
		Average Percentage of Price Increase	26%	

Table M-20 Willingness-to-Pay for Sewage Treatment

Item	High Income Area	Middle Income Area	Low Income Area	Surrounding Area	Total
1. Willingness-to-Pay					
1) Nothing	12	5	18	24	59
2) KShs10	10	10	28	29	77
3) KShs20	8	18	17	24	67
4) KShs30	8	8	11	20	47
5) KShs40	5	7	4	3	19
6) KShs50	11	22	9	15	57
7) KShs70	1	5	2	4	12
8) KShs100	4	7	3	11	25
9) Others	1	1	10	14	26
10) No Answer	5	7	0	9	21
Total	65	90	102	153	410
2. Average Amount of the above 9) Others*1					
Amount (KShs./month)	500	200	151	187	198
3. Average Amount of the above 1) to 9)					
Amount (KShs./month)	37.0	40.1	25.5	38.1	35.1

Remark: *1 Unreasonable answers were deleted from the analysis.

Table M-21 Relation Between Household Income and Willingness-to-Pay

Willionngness-to-Pay (KShs./month)	Household Income (KShs./Month)												
	Less Than 1,000	1,001 - 2,000	2,001 - 3,000	3,001 - 4,000	4,001 - 5,000	5,001 - 6,000	6,001 - 7,000	7,001 - 10,000	10,001 - 20,000	20,001 - 50,000	More Than 50,000	No Answer	Total
1. Nothing	6	10	12	5	2	1	2	6	2	0	2	11	59
2. KShs.10	13	15	14	5	0	4	2	2	6	3	0	13	77
3. KShs.20	7	7	13	11	4	5	1	4	5	3	1	6	67
4. KShs.30	3	5	7	5	4	4	4	1	4	2	0	8	47
5. KShs.40	0	1	2	2	2	2	1	1	1	0	1	6	19
6. KShs.50	4	9	3	2	5	3	3	8	4	3	0	13	57
7. KShs.70	1	0	1	1	2	1	0	1	0	1	0	4	12
8. KShs.100	1	3	5	2	2	0	1	1	1	3	0	6	25
9. Others	6	3	5	2	4	0	2	0	3	0	0	1	26
10. No Answer	4	3	1	0	1	0	0	0	3	1	0	8	21
Total	45	56	63	35	26	20	16	24	29	16	4	76	410

Lenear Regression Analysis

(1) Efficient sample number: 317

(2) Mean of Willingness-to-Pay (y): Shs.36.42 *1

(3) Mean of Household Income ($\bar{x}$) : Shs.6,429

(4) Correlation Coefficient [$y = a + b (x - \bar{x})$]

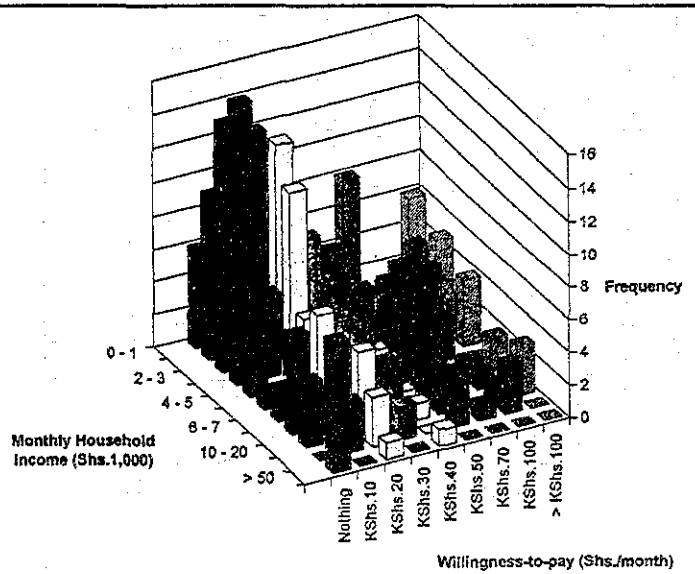
	Estimate	95% Confidence Interval		
a:	36.423	30.549	-	42.296
b:	0.000064	-0.000051	-	0.000064

(5) Regression Equation: $y = 36.01 + 0.000064x$

where, y: Willingness-to-pay (Shs./month); and

x: Monthly Household Income (Shs.)

Remark: *1 Difference of the average figure (Shs.35.10) in Table M-20 is casused by efficient sample number.



The relation between household income and willingness-to-pay was tabulated in Table M-21. The number of efficient answers were 317. Then, the average household income of the effective answers was KShs.6,429/month and the average of willingness-to-pay was KShs.36.42/month. The regression equation derived from the above data was:

$$y = 36.01 + 0.000064x$$

where, x : monthly household income (KShs./month)
y : willingness-to-pay for purification of rivers (KShs./month)

Incidentally, the correlation coefficient of these two factors was 0.012. Then, the regression estimate of willingness-to-pay were KShs.37.08 for high income level, KShs.36.44 for middle income level, KShs.36.33 for low income level and KShs.36.42 for surrounding family, respectively.

M3.2.3 Consciousness of Tourists

(1) Distribution of tourist

301 tourists in Lake Nakuru National Park responded to this survey. Their nationality was counted up to 19 nations, as seen in Table M-22. Of the total number, 50 tourists or 17% were Kenyan and others were foreigners from 18 countries. The top three countries regarding the number of tourist were Germany, UK and France. 61% of them was male and 46% was single. Regarding their purposes of visit, 84% of them stayed there on holiday tours. Only 2% was on business. In terms of average times of visit to Nakuru, Kenyan tourists visited there more than 33 times on average for the last five years, as shown in Table M-23. Foreign tourist, however, less than 2 times on average. They also expected to visit Nakuru more frequently than before for the coming five years, as shown in the same table. Kenyan people would like to visit more than 39 times, and foreign tourists expected to visit almost 6 time.

(2) Tourism attraction of Nakuru

As the most attractive reason of Lake Nakuru, 231 tourists or 77% of the total 301 respondents took up to conserve 1) "wildlife of waterfowls such as flamingo and pelican", as shown in Table M-24. Succeeding that, other major reasons for the tourism attraction were 2) also to conserve "wildlife of animal species", and 3) to sustain "clean, clear and beautiful lake". These reasons were attributable to Lake Nakuru. The following three reasons were listed as attraction reasons of Nakuru municipality: 4) "green and peaceful rural scenery", 5) "smiling and friendly people" and 6) "mild temperature". This order is based on the weighted values as depicted in the table.

Table M-22 Distribution of Tourist by Nationality

	Nationality	Total	Sex		Average	Purpose of Visit				Marriage Status	
		Number	Male	Female	Age(years)	Holiday	Business	Official	Other	Single	Married
1.	Kenyan	50	36	12	29	11	4	5	27	24	22
2.	Algerian	1	1	0	38	1	0	0	0	0	1
3.	American	24	14	10	55	23	0	0	1	5	19
4.	Australian	11	5	6	44	10	0	0	1	6	5
5.	Belgian	10	8	2	34	10	0	0	0	9	1
6.	British	34	16	18	44	34	0	0	0	13	19
7.	Canadian	6	3	2	56	5	0	1	0	1	5
8.	Dutch	19	10	8	39	19	0	0	0	9	9
9.	French	32	17	15	35	30	0	0	2	14	17
10.	German	36	27	9	42	34	1	0	1	18	18
11.	Israeli	17	8	9	29	16	0	0	1	6	10
12.	Italian	10	6	4	40	9	0	0	1	3	7
13.	Korean	2	2	0	40	1	1	0	0	1	1
14.	New Zealand	6	4	2	32	6	0	0	0	4	2
15.	Norwegian	6	4	2	27	6	0	0	0	4	2
16.	Polish	1	1	0	26	1	0	0	0	1	0
17.	Spanish	33	16	17	36	32	0	0	1	21	11
18.	Swedish	2	2	0	61	2	0	0	0	0	2
19.	Swiss	1	1	0	51	0	1	0	0	0	1
	Total	301	181	116	38	250	7	6	35	139	152

Remark: Excluding the number of "No Answer"

Table M-23 Visit Times to Lake Nakuru National Park

Item	Total	Kenyan Tourist	Foreign Tourist
I. Visit Times for the Last Five Years			
1. One	209	6	203
2. Two	46	17	29
3. Three	10	1	9
4. Four	2	0	2
5. Five	5	2	3
6. Six to Ten	5	4	1
7. 11 to 20	3	1	2
8. More than 21	15	14	1
Total	295	45	250
Average Times	6.6	33.1	1.8
No Answer	6	5	1
II. Visit Times for the Coming Five Years			
1. One	58	1	57
2. Two	49	8	41
3. Three	15	5	10
4. Four	7	3	4
5. Five	9	4	5
6. More than Six	20	15	5
Total	158	36	122
Average Times	13.5	39.5	5.8
No Answer	143	14	129

Table M-24 Reasons of Tourism Attraction of Lake Nakuru National Park

Reason of Importance *1	Number of Interviewees			Simple Total	Assessed Value *2
	First Ranked	Second Ranked	Third Ranked		
1. Reason 1	231	42	20	293	797
2. Reason 2	46	192	37	275	559
3. Reason 3	19	38	129	186	262
4. Reason 4	1	1	9	11	14
5. Reason 5	2	8	42	52	64
6. Reason 6	1	7	13	21	30
7. Reason 7	1	6	23	30	38
8. Reason 8	0	2	12	14	16
9. Reason 9	0	0	0	0	0
10. Reason 10	0	0	0	0	0
11. Reason 11	0	0	0	0	0
12. Reason 12	0	0	0	0	0
Total	301	296	285	882	1,780

Remark: *1 Reasons are listed as follows:

1) Wildlife of waterfowls such as flamingo and pelican
2) Wildlife of animal species
3) Clean, clear and beautiful lake
4) Great crater
5) Green and peaceful rural scenery
6) Mild temperature
7) Smiling and friendly people
8) Accommodations (hotels, cottages, etc.)
9) Souvenir
10) Food (fish, fruit, etc.)
11) Night life
12) Others

*2 Assessed the number of inverviewees as follow wighting value:
3 points to the first rank; 2 points to the second rank; and 1 point to the third rank

Table M-25 People's Consciousness Regarding Present Water Conditions of Laku Nakuru

Item	Total	Kenyan Tourist	Foreign Tourist
I. Tourist's Consciousness of Present Water Conditions of Lake Nakuru			
1. Clean, clear and in good Conditions	99	6	93
2. Not so clean and clear in some locations	155	34	121
3. Garbage is noticeable	20	2	18
4. Lots of weeds are noticeable under the water	3	0	3
5. Filthy and stinking	12	6	6
6. No Answer	12	2	10
Total	301	50	251
II. Tourist's Intention to Visit Lake Nakuru without Wildlife			
1. Yes	24	2	22
2. No	272	47	225
3. No Answer	5	1	4
Total	301	50	251

Table M-26 Itinerary and Budget of Tour

Item	Total	Kenyan Tourist	Foreign Tourist
I. Length of Tour			
1. Total Length of Tour			
a. One Day	21	4	17
b. Two to Five Days	32	16	16
c. Six to Ten Days	95	22	73
d. 11 to 15 Days	58	3	55
e. 16 to 30 Days	83	1	82
f. More than 31 Days	4	2	2
g. No Answer	8	2	6
Total	301	50	251
Average Length (Days)	13.3	14.5	13.0
2. Total Length in Lake Nakuru Naional Park			
a. One Day	131	15	116
b. Two Days	84	11	73
c. Three Days	21	2	19
d. Four Days	9	0	9
e. Five Days	6	2	4
f. More than Five Days	41	19	22
g. No Answer	9	1	8
Total	301	50	251
Average Length (Days)	2.6	4.8	2.1
II. Total Budget of Tour			
a. Less than Shs.5,000	12	2	10
b. Shs.5001 to 10,000	27	10	17
c. Shs.10,001 to 20,000	12	3	9
d. Shs.20,001 to 50,000	55	21	34
e. Shs.50,001 to 100,000	41	0	41
f. Shs.100,001 to 200,000	47	1	46
g. Shs.200,001 to 500,000	22	0	22
h. More than Shs.500,000	1	0	1
i. No Answer	84	13	71
Total	301	50	251
Average Expense (Shs.)*1	90,491	34,438	102,013

Remark: *1 Lenear Regression Analysis

		Kenyan Tourist	Foreign Tourist
(1)	Efficient sample number:	37	176
	Selected the samples who replied both total length and total expenses.		
(2)	Mean of Total Length (Days):	9.1	13.1
(3)	Mean of Total budget (Shs.):	34,438	103,768
(4)	Regression Equation:	y=18,366+985x	y=94,923+674x
	where, y: Total Budget (Shs.) and x: Total Length (Days)		

155 tourists or 52% of the total tourists noticed that the water of the lake is "not so clean and clear in some location", as shown in Table M-25. On the other hand, 99 tourists or 33% said that the water is kept to be "clean, clear and in good condition". However, 272 tourists or more than 90% of the total tourist answered that they would not visit Lake Nakuru National Park again, if the wildlife get lost because of worse water conditions.

(3) Itinerary and budget of tour

Itinerary and budget of the tours were tabulated in Table M-26. Average length and budget of the tours for both Kenyan and foreign tourists were summarized as follows:

Item	Kenyan Tourists	Foreign Tourists
Total length of tour	14.5 days	13.0 days
Total length in Lake Nakuru	4.8 days	2.1 days
Total budget of tour	KShs.34,400	KShs.102,000

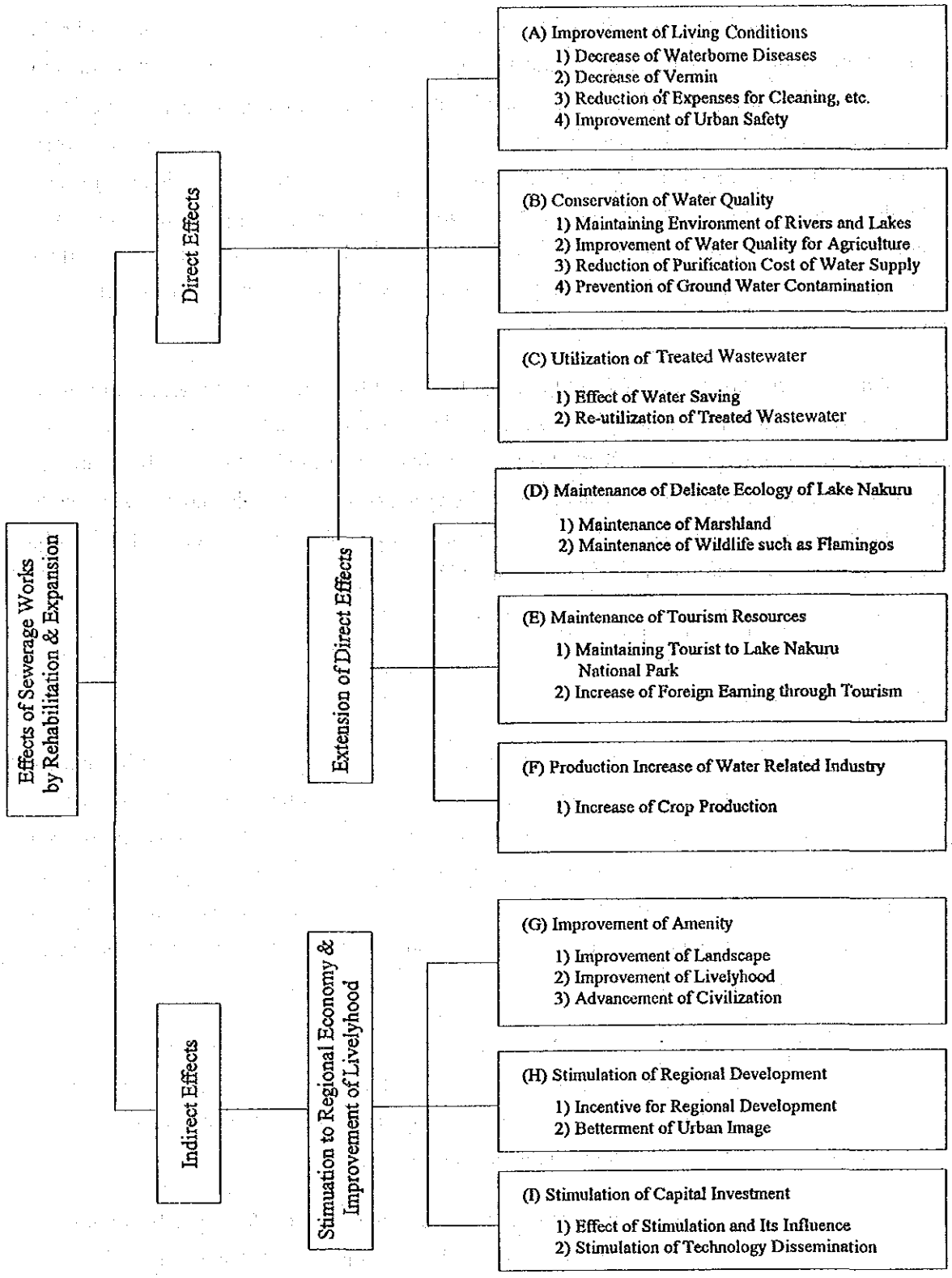
Kenyan tourists spent 4.8 days on average or one-third of the total length of the tour in Lake Nakuru, but foreign tourists spent only 2.1 days on average or 16% of the total length. Since foreign tourists declared that their budget included the traffic cost to Kenya, the actual expenditure for domestic tour in Kenya might be much smaller than the above total budget.

M3.3 Economic Benefit

M3.3.1 Structure of Economic Benefit

The direct objective of this current study is to verify the feasibility of rehabilitation and expansion of sewage works of Nakuru Municipality. This sewage works aim not only to conserve sanitary condition of the municipal area but also to maintain very delicate ecology of Lake Nakuru. Because, Nakuru Municipality is focused as the major source of pollution load for Lake Nakuru. Lake Nakuru is famous for millions of flamingos and for one of conservation areas registered under the Ramsar Convention. At the same time, Lake Nakuru is one of the most important tourist spots in Kenya. Accordingly, it is also important from the economic point of view for Kenya to keep the natural environment of Lake Nakuru.

Fig. M-1



THE REPUBLIC OF KENYA	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT	TITLE
MINISTRY OF LOCAL GOVERNMENT	JAPAN INTERNATIONAL COOPERATION AGENCY	Benefit Structure of Sewerage Works

Fig. M-1 illustrates structure of benefit which accrues from the sewage works in Nakuru Municipality, taking the above project background into consideration. As discussed in the above, the direct benefit of the project is made up of two major components, 1) benefit on people in the municipality and 2) benefit for Lake Nakuru. The respective benefits are broken down three sub-components as shown in the figure. Besides these direct benefits, the project brings about indirect benefits as indicated in the figure. These are 1) to improve amenity in the municipality, 2) to induce another regional development activity through the project implementation and 3) to stimulate the regional economy through capital investment of the project.

Among these direct and indirect benefits, the direct benefit would rather be chosen in this economic evaluation. The indirect benefits are discussed in the following chapter as socio-economic impacts of the project. Among direct benefits, the following two benefits could be selected as tangible benefits: 1) benefit on direct beneficiaries, i.e., people and establishments such as factories, stores and other facilities covered by sewage treatment services and 2) benefit on conservation of tourism resources, i.e., nature of Lake Nakuru.

M3.3.2 Benefit of Direct Beneficiary

(1) Residents

Basic idea of economic benefits for sewage treatment services is based on willingness-to-pay of the beneficiaries in the target areas. The willingness-to-pay for services is considered to reflect their desire regarding environmental living conditions. It also is a convincing factor to convert their desire to monetary terms. As analyzed in the previous section, the willingness-to-pay is estimated in accordance with household income. Then, economic benefit is estimated on the basis of the following procedures and preconditions:

(a) The total population in the areas served by sewage treatment works is projected at 123,460 in 1996, after the completion of the project. It corresponds to 23,742 households, because the family size is calculated at 5.2, according to the questionnaire survey.

(b) The willingness-to-pay was estimated KShs.36.42 per household in financial terms on average in 1993 as shown in Table M-21.

(c) An average household income was KShs.6,429 per annum in financial terms, according to the questionnaire survey. This household income in the future was assumed to link with the growth of GDP per capita in

Kenya, which is shown in Table M-27. The procedure of projection was as follows:

(i) Until the year 2000, the projection of GDP is based on the target growth of the long-range national economic development plan, which is stated in the Sessional Paper No.1 in 1986 (Ref.M21). In the Paper, the economic development policy and strategies are proposed over all economic sectors up to the target year 2000. The target growth of national economy is summarized in Table M-28.

(ii) The GDP growth rate beyond 2000 is assumed to be 4% per annum in conformity with this tentative projection of Long-Range Planning Unit in MOPND in the light of economic successiveness.

(d) An economic benefit in the future was estimated through applying the equation mentioned in the previous section and household income calculated by the above assumption.

Applying these assumptions and conversion factor as mentioned in Section M3.1, the annual economic benefit for the people in Nakuru Municipality was estimated at KShs.9.35 million in 1997, KShs.9.36 million in 2000 and KShs.9.37 million in 2010. Incidentally, the sewage volume from the residents within the sewered areas was estimated at 6,955 m^3/day or 2,539 m^3/year as total dry weather flow in 1997. Then, an unit rate of sewage services was calculated at KShs.3.68 per m^3 in 1997 in economic terms.

(2) Establishments

Benefit for major urban establishments such as factories, hotels, stores and public facilities was estimated as follows.

(a) Unit rate of sewage treatment is estimated through the benefit estimation of the residents. As calculated in the above, the rate was an almost constant value of KShs.3.68 per m^3 in 1997.

(b) The sewage volume from the establishments will increase in proportion to the growth of economic activities. The economic activities of the establishments were assumed to grow at the same rate as that of GDP in Kenya, which is estimated in Table M-27.

Table M-27 Projected GDP at 1992 Constant Prices : 1992-2010

(Unit : K£ million)

Item	1992 Provisional	1995	2000	2005	2010
I. GDP at 1992 Constant Prices					
1. Non-Monetary Economy	483.35	535.9	636.5	713.6	800.0
2. Monetary Economy					
a. Agriculture	2,681.9	3,131.4	4,053.9	4,815.6	5,720.3
b. Manufacturing	1,309.9	1,627.3	2,336.2	2,975.6	3,790.1
c. Trade, Restaurants & Hotels	1,412.6	1,658.7	2,167.9	2,591.7	3,098.3
d. Government Services	1,732.1	2,028.1	2,638.1	3,143.8	3,746.4
e. Others	3,985.2	4,841.1	6,695.3	8,315.2	10,327.0
Total of Manetary Economy	11,121.8	13,286.6	17,891.4	21,841.9	26,682.1
3. GDP at Factor Cost	11,605.1	13,822.5	18,527.9	22,555.5	27,482.2
GDP Growth Rate (% p.a.)	-	6.0%	6.0%	4.0%	4.0%
II. GDP per Capita					
1. GDP per Capita (K£)	440.8	471.5	527.6	545.2	568.3
GDP per Capita (US$)*1	243.4	260.4	291.4	301.1	313.8
GDP per Capita Growth Rate (% per annum)	-	2.3%	2.3%	0.7%	0.8%
2. Projected Population (1000)	26,327.5	29,233.4	34,794.8	40,966.7	47,814.7

Source : Ref. M-03 and M-21

Remark : *1 Foreign exchange rate : KShs36.2/US$ (as of December, 1992)

Table M-28 National Socio-Economic Framework in the Year 2000

1 Target Growth of Economic Sector : 1988 - 2000

Item	Target Annual Growth % of GDP between 1988 and 2000	GDP by Industrial Origin at 1988 Constant Prices (Unit : K£ thousand)	
		1988	2000
1) Non-monetary	3.5	394.9	596.6
2) Agriculture	5.3	1,902.7	3,535.9
3) Manufacturing	7.5	797.6	1,899.6
4) Trade	5.5	715.0	1,359.3
5) Government services	5.4	994.2	1,868.8
6) Other sectors	6.7	1,748.0	3,806.3
7) GDP at factor cost	5.9	6,552.4	13,066.5

2. Population and Income per Capita

	1988	2000	
		Scenario 1*1	Scenario 2*2
10 Population (million)	22.7	34.8	38.4
2) GDP per capita at 1988 constant prices	289.2	374.6	339.5
3) 12-year increase (%) in income per capita	-	29.5	17.4
4) Average Growth of GDP per capita (% per annum)	3.3	2.2	1.3

Source : Ref. M-21

Remark : *1 Both fertility and mortality decline

*2 Fertility remains constant, but mortality continue to decline

In 1997, the sewage volume from the establishments was estimated at 9,182 m^3/day or 3,351 m^3/year as total dry weather flow. The annual economic benefit of the establishments was estimated at KShs.12.34 million in 1997, KShs.14.73 million in 2000 and KShs.21.87 million in 2010.

M3.3.3 Benefit of Tourism

The benefit of tourism is estimated as the national revenue through tourism, that is, the expenditure of tourists. The total amount of tourist's expenditure in Lake Nakuru National Park was estimated by applying the results of the questionnaire survey to tourists and statistical data presented by Kenya Wildlife Service (KWS). The tourists were divided into two categories, Kenyan and Foreigner. The expenditure of the tourists was estimated on the basis of the following assumptions.

(1) Kenyan tourist

(a) The average length of staying in Lake Nakuru was assumed at four days, referring to the results of the questionnaire survey.

(b) The average expenditure for staying in Lake Nakuru was KShs.2,300 per day. As a result, the total expenditure for one tour was KShs.9,200 on average.

(c) The number of Kenyan tourists was assumed at 20,000 persons. According to Table M-29, the number of resident visitors into Lake Nakuru National Park was approximately 78.8 thousand in 1991 and 66.3 thousand on average for the latest four years. According to the national statistics in Table M-30, those were 88.6 thousand in 1991 and 85.6 thousand on average, respectively. Since these figures are counted as the number of visitors per day and the total length of tour to Lake Nakuru was assumed at four days per tourist on average, the total number of Kenyan tourists was assumed at 20 thousand per annum. This number is assumed to grow at 0.5% per annum.

Applying these assumptions and conversion factor, the annual economic expenditure of the Kenyan tourists in Lake Nakuru National Park was estimated at KShs.166.3 million in 1997, KShs.180.6 million in 2000 and KShs.204.5 million in 2010.

(2) Foreign tourist

(a) The average length of staying in Lake Nakuru was assumed at two days, referring to the results of the questionnaire survey.

(b) The average expenditure for staying in Lake Nakuru was KShs.3,900 per day. Incidentally, according to the statistics of international earnings, an average expenditure of foreign tourist was around US$45/day, as shown in Table M-31. This amount corresponds approximately KShs.2,880/day. Although this amount is smaller than the aforesaid amount of KShs.3,900, that might be because the latter amount was the average of the entire country. Accordingly, the total expenditure in Lake Nakuru was KShs.7,800 on average.

(c) The number of foreign tourists was assumed at 40,000 persons. According to Table M-29, the number of non-resident visitors into Lake Nakuru National Park was approximately 93.4 thousand in 1991 and 82.5 thousand on average for the latest four years. According to the national statistics in Table M-30, those were 85.9 thousand in 1991 and 77.4 thousand on average, respectively. Since these figures are counted as the number of visitors per day and the total length of tour to Lake Nakuru was two days per tourist on average, the total number of foreign tourists was assumed at 40 thousand per annum. This number is also assumed to grow at 0.5% per annum.

The annual economic expenditure of the foreign tourists in Lake Nakuru National Park was estimated at KShs.268.3 million in 1997, KShs.280.6 million in 2000 and KShs.325.8 million in 2010.

The total expenditure of the tourists in Lake Nakuru was summed up as follows: KShs.434.6 million in 1997, KShs.461.2 million in 2000 and KShs.530.3 million in 2010 in economic terms. This total amount is benefit through tourism and does not accrue from the effect of sewage system. However, if the sewage system does not function to keep better environment for tourism resources in Lake Nakuru, this national revenue through tourism would be decrease in the future because of water pollution of the lake. In this study, thus, the tourism benefit for the project is assumed to be a half of the total revenue mentioned above.

Table M-29 Number of Tourists into Lake Nakuru National Park

	1988	1989	1990	1991	Average
1. Number of Tourists					
(a) Resident	43,860	70,293	72,262	78,765	66,295
- Adult	31,492	52,407	51,795	53,073	47,192
- Student	9,807	12,807	20,467	14,628	14,427
- Children	2,561	5,079	-	11,064	6,235
(b) Non-resident	56,720	90,000	89,684	93,434	82,460
- Adult	53,633	85,243	88,462	90,872	79,553
- Children	3,087	4,757	1,222	2,562	2,907
(c) Seasonal Ticket Holder	6,737	10,403	10,220	2,901	7,565
(d) Free Entrants & VIPs	2,229	2,070	2,836	2,380	2,379
Total	109,546	172,766	175,002	177,480	158,699

Source : Lake Nakuru National Park, Kenya Wildlife Service

Table M-30 Number of Visitors to Lake Nakuru National Park: 1987-1991

Item	1988	1989	1990	1991	Average	% Distribution
1. Number of Visitors to National Parks and Game Reserves (Unit: 1000)						
(1) Lake Nakuru	138.6	167.4	174.2	174.4	163.7	12.1
(2) Animal Orphanage	84.8	43.3	213.8	217.6	139.9	10.4
(3) Amboseli	137.7	140.4	237.2	189.2	176.1	13.0
(4) Nairobi	125.5	155.2	152.8	168.8	150.6	11.2
(5) Masai Mara	118.8	196.2	180.5	143.3	159.7	11.8
(6) Tsavo East	87.3	101.1	127.7	135.9	113.0	8.4
(7) Tsavo West	85.4	96.8	78.6	119.3	95.0	7.0
(8) Others	317.7	354.6	367.4	370.0	352.4	26.1
Total	1,095.8	1,255.0	1,532.2	1,518.5	1,350.4	100.0
2. Number of All Visitors to Lake Nakuru National Park (Unit: 1000)						
January	11.8	14.1	13.8	13.6	13.3	8.2
February	11.0	15.3	12.6	9.8	12.2	7.5
March	8.5	16.8	11.4	9.4	11.5	7.1
April	7.3	8.8	12.6	8.9	9.4	5.8
May	5.6	7.3	7.8	7.7	7.1	4.4
June	8.6	11.6	12.2	13.1	11.4	7.0
July	13.5	19.4	14.7	17.6	16.3	10.0
August *1	17.6	23.9	26.1	22.5	22.5	13.8
September *1	10.6	13.7	14.2	17.4	13.9	8.6
October	12.5	14.6	16.1	20.0	15.8	9.7
November	14.2	11.3	11.7	14.7	13.0	8.0
December	15.7	14.9	15.7	19.9	16.5	10.2
Total	137.0	171.6	168.7	174.5	163.0	100.0
2. Number of Non-resident (Foreign) Visitors to Lake Nakuru National Park (Unit: 1000)						
January	6.9	7.6	8.5	6.4	7.4	9.5
February	6.8	7.8	8.2	5.5	7.1	9.1
March	5.2	6.7	7.3	4.5	5.9	7.6
April	3.1	3.3	5.5	4.3	4.0	5.2
May	2.2	2.8	3.2	3.3	2.9	3.7
June	4.2	4.3	5.4	6.0	5.0	6.4
July	7.0	9.5	7.9	9.6	8.5	11.0
August	-	13.2	12.9	10.8	12.3	15.9
September	-	6.9	7.9	10.2	8.4	10.8
October	4.6	8.9	8.0	9.9	7.9	10.2
November	6.0	6.9	5.7	7.4	6.5	8.4
December	6.3	7.1	5.8	8.0	6.8	8.8
Total	52.4	85.0	86.3	85.9	77.4	106.7

Source: Ref.M-03 and Kenya Wildlife Service
Remark: *1 Number of visitors in August and September 1988 indicates adult residents only.

Table M-31 International Tourism and Earnings : 1983-1992

Item	1988	1989	1990	1991	1992
1. Number of Visitors (Unit:1000)	677	667	728	682	670
2. Number of Days Stayed by Purpose of Visit (Unit:1000 days)					
Holiday	9,747	8,256	9,277	8,366	8,005
Business	856	648	770	701	711
Transit	228	178	180	198	195
Total	10,831	9,081	10,227	9,265	8,912
Average Length of Stay in Days	16.0	13.6	14.4	13.7	13.4
3. Visitor Departures by Purpose of Visit (Unit:1000)					
Holiday	522.6	548.4	598.0	559.5	546.8
Business	71.0	62.1	74.7	68.5	69.4
Transit	71.2	54.1	48.1	47.2	47.4
Other	12.1	2.8	7.5	6.3	6.0
Total *2	676.9	667.4	728.3	681.5	669.6
4. Visitor Departures by Nationality (Unit:1000)					
United Kingdom	89.7	107.4	108.8	101.9	99.8
West Germany	121.5	107.1	133.4	125.0	117.2
Switzerland	53.7	35.2	33.3	31.2	29.2
Italy	43.6	36.4	36.3	34.0	34.5
France	34.2	38.3	40.3	37.7	36.4
Unites States	69.5	85.3	43.3	40.7	39.9
Uganda	25.9	66.3	49.6	46.1	48.9
Tanzania	10.1	54.6	84.1	78.7	79.0
India	12.6	19.1	12.5	11.7	11.9
Japan	9.8	10.6	9.0	8.4	8.5
Others	206.3	151.3	170.2	159.9	158.4
Total *2	676.9	711.6	720.8	675.3	663.7
5. Tourist Receipts					
Total Earning from foreign tourism (K£ million)	349	432	533	594	713
Total current account in balance of payments (K£ million)	2,014	2,434	3,052	3,877	4,235
Percentage of tourism earning to total current account	17%	18%	17%	15%	17%
6. Average Expenditure (KShs.)					
Per visitor-day (KShs.)	645	952	1,043	1,282	1,600
Per visitor-day (US$)*4	35	44	43	46	44
Per visitor-departure (KShs.)	10,321	12,143	14,797	17,586	21,477
Per visitor-departure (US$)*4	555	562	614	626	593

Source : Ref. M-01 to M-05 and Data of Kenya Wildlife Service

Remark : *1 Credits account of total current account in balance of payments

*2 Both numbers of the total should be the same.

*3 "-" means that data are not available.

*4 Exchange Rate (KShs./US$): 18.60 (1988); 21.60 (1989); 24.08 (1990)
28.70 (1991); and 36.22 (1992)

M3.4 Economic Costs

The financial construction costs, as described in the chapter of cost estimation, consist of following items:

(1) Main construction cost;

(2) Land acquisition and compensation cost;

(3) Government administration cost;

(4) Engineering service cost;

(5) Price contingency; and

(6) Physical contingency.

Among these cost items, the price contingency was omitted from economic cost items, since the economic evaluation must be discussed in absolute terms, i.e., to the exclusion of inflation. The conversion procedure and indices from financial value to economic value were already mentioned in Section M3.1. After going through the conversion procedure to the financial costs, the respective economic costs are obtained as presented in Table M-32. They are summarized as follows:

(Unit: KShs. million)

Cost Item	1st yeat	2nd year	3rd year	Total
Foreign Portion	156	449	68	672
Local Portion	100	295	49	444
Total Equivalent	256	744	117	1,116

The O&M cost is annually required during the economic life of the project after completion of the project. The O&M cost is also given by making adjustment to economic prices. The O&M cost is estimated at KShs. 5.9 million in economic terms, as shown in Table M-32.

Table M-32 Financial Cost and Economic Cost

(Unit: million)

Item	Total			1st year		2nd year		3rd year	
	Total Equivalent (KShs.)*1	Foreign Portion (KShs.)*1	Local Portion (KShs.)	Foreign Portion (KShs.)*1	Local Portion (KShs.)	Foreign Portion (KShs.)*1	Local Portion (KShs.)	Foreign Portion (KShs.)*1	Local Portion (KShs.)
I. Financial Cost									
1. Initial Construction Works									
1) Direct Cost	1,024	513	511	102	102	359	358	51	51
a. Construction Works	867	513	355	102	71	359	249	51	35
b. Value Added Tax	156	0	156	0	31	0	109	0	16
2) Land Acquisition	1	0	1	0	1	0	0	0	0
3) Government Administration	51	0	51	0	15	0	26	0	10
4) Engineering Services	145	98	47	39	19	49	24	10	4
5) Physical Contingency	123	61	62	14	14	41	41	6	7
6) Price Contingency	84	29	54	4	6	21	39	5	9
Total	1,427	701	726	159	157	470	488	72	81
2. Operation and Maintenance Works*2	6.4	1.1	5.3	-	-	-	-	-	-
II. Economic Cost									
1. Initial Construction Works									
1) Direct Cost	832	513	319	102	64	359	224	51	32
a. Construction Works	832	513	319	102	64	359	224	51	32
b. Value Added Tax	0	0	0	0	0	0	0	0	0
2) Land Acquisition	1	0	1	0	1	0	0	0	0
3) Government Administration	46	0	46	0	14	0	23	0	9
4) Engineering Services	120	98	22	39	9	49	11	10	2
5) Physical Contingency	117	61	56	14	13	41	37	6	6
6) Price Contingency	0	0	0	0	0	0	0	0	0
Total	1,116	672	444	156	100	449	295	68	49
2. Operation and Maintenance Works	5.9	1.1	4.8	-	-	-	-	-	-

Remark: *1 Exchange Rate: KShs.1.00=¥1.75, US$1.00=KShs.62.40=¥109.50

*2 After the completion of the construction works

M3.5 Economic Evaluation

The proposed project was examined in economic efficiency through factors of Net Present Value (NPV), Benefit-Cost Ratio (B/C) and Economic Internal Rate of Return (EIRR). Table M-33 shows the stream of economic costs and benefits and the results of the examination. The project resulted in 18.6% of EIRR, exceeding the opportunity cost of capital of 10%. Thus, the proposed project is viable from economic point of view.

Yet, the quantification of tourism benefit seems to be controversial. As mentioned before, the tourism benefit for the project is assumed to be a half of the total revenue. In this section, then, the sensitivity of this benefit would be tested in the case that the benefit for the project was reduced to a quarter of the total revenue. Table M-34 shows the results of the examination. The EIRR was 10.8%. In this condition, it is still higher than 10%. Then, the project is concluded as feasible even under this condition.

In the current study, all cost items have been quantified after careful study. However, there always remains the question as to the degree of reliability of input. Thus, the sensitivity test is carried out to only the variations in the total cost. The test is made for the variation in 10% of the total cost. The results were given in Table M-35. EIRR still holds a higher rate of 17.2%. It is identified to be economically viable.

Table M-33 Economic Cost and Benefit Stream of Proposed Project

(Unit: KShs. million)

Year	Cost			Benefit			Balance
	Initial Construction Works	O&M Works	Total	Residents & Estab-lishments	Tourism	Total	
1	255.7		255.7			0.0	-255.7
2	743.7		743.7			0.0	-743.7
3	116.7		116.7			0.0	-116.7
4		5.9	5.9	21.7	217.3	239.0	233.1
5		5.9	5.9	22.4	221.6	244.1	238.2
6		5.9	5.9	23.2	226.1	249.3	243.4
7		5.9	5.9	24.1	230.6	254.7	248.8
8		5.9	5.9	24.7	233.8	258.4	252.6
9		5.9	5.9	25.3	237.0	262.3	256.4
10		5.9	5.9	25.9	240.2	266.2	260.3
11		5.9	5.9	26.6	243.5	270.1	264.2
12		5.9	5.9	27.3	246.9	274.1	268.3
13		5.9	5.9	28.0	250.4	278.4	272.6
14		5.9	5.9	28.8	254.0	282.8	276.9
15		5.9	5.9	29.6	257.7	287.2	281.4
16		5.9	5.9	30.4	261.4	291.8	285.9
17		5.9	5.9	31.2	265.1	296.4	290.5
18		5.9	5.9	31.2	265.1	296.4	290.5
19		5.9	5.9	31.2	265.1	296.4	290.5
20		5.9	5.9	31.2	265.1	296.4	290.5
21		5.9	5.9	31.2	265.1	296.4	290.5
22		5.9	5.9	31.2	265.1	296.4	290.5
23		5.9	5.9	31.2	265.1	296.4	290.5
24		5.9	5.9	31.2	265.1	296.4	290.5
25		5.9	5.9	31.2	265.1	296.4	290.5
26		5.9	5.9	31.2	265.1	296.4	290.5
27		5.9	5.9	31.2	265.1	296.4	290.5
28		5.9	5.9	31.2	265.1	296.4	290.5
29		5.9	5.9	31.2	265.1	296.4	290.5
30		5.9	5.9	31.2	265.1	296.4	290.5
31		5.9	5.9	31.2	265.1	296.4	290.5
32		5.9	5.9	31.2	265.1	296.4	290.5
33		5.9	5.9	31.2	265.1	296.4	290.5

EIRR 18.6%

Table M-34 Economic Cost and Benefit Stream of Proposed Project: Sensitivity Test 1

(Unit: KShs. million)

Year	Cost			Benefit			Balance
	Initial Construction Works	O&M Works	Total	Residents & Estab-lishments	Tourism	Total	
1	255.7		255.7			0.0	-255.7
2	743.7		743.7			0.0	-743.7
3	116.7		116.7			0.0	-116.7
4		5.9	5.9	21.7	108.7	130.3	124.5
5		5.9	5.9	22.4	110.8	133.3	127.4
6		5.9	5.9	23.2	113.0	136.3	130.4
7		5.9	5.9	24.1	115.3	139.4	133.5
8		5.9	5.9	24.7	116.9	141.6	135.7
9		5.9	5.9	25.3	118.5	143.8	137.9
10		5.9	5.9	25.9	120.1	146.0	140.2
11		5.9	5.9	26.6	121.8	148.4	142.5
12		5.9	5.9	27.3	123.4	150.7	144.9
13		5.9	5.9	28.0	125.2	153.2	147.4
14		5.9	5.9	28.8	127.0	155.8	149.9
15		5.9	5.9	29.6	128.8	158.4	152.5
16		5.9	5.9	30.4	130.7	161.1	155.2
17		5.9	5.9	31.2	132.6	163.8	157.9
18		5.9	5.9	31.2	132.6	163.8	157.9
19		5.9	5.9	31.2	132.6	163.8	157.9
20		5.9	5.9	31.2	132.6	163.8	157.9
21		5.9	5.9	31.2	132.6	163.8	157.9
22		5.9	5.9	31.2	132.6	163.8	157.9
23		5.9	5.9	31.2	132.6	163.8	157.9
24		5.9	5.9	31.2	132.6	163.8	157.9
25		5.9	5.9	31.2	132.6	163.8	157.9
26		5.9	5.9	31.2	132.6	163.8	157.9
27		5.9	5.9	31.2	132.6	163.8	157.9
28		5.9	5.9	31.2	132.6	163.8	157.9
29		5.9	5.9	31.2	132.6	163.8	157.9
30		5.9	5.9	31.2	132.6	163.8	157.9
31		5.9	5.9	31.2	132.6	163.8	157.9
32		5.9	5.9	31.2	132.6	163.8	157.9
33		5.9	5.9	31.2	132.6	163.8	157.9
					EIRR	10.8%	

Table M-35 Economic Cost and Benefit Stream of Proposed Project: Sensitivity Test 2

(Unit: KShs. million)

Year	Cost			Benefit			Balance
	Initial Construction Works	O&M Works	Total	Residents & Estab-lishments	Tourism	Total	
1	281.2		281.2			0.0	-281.2
2	818.1		818.1			0.0	-818.1
3	128.3		128.3			0.0	-128.3
4		5.9	5.9	21.7	217.3	239.0	233.1
5		5.9	5.9	22.4	221.6	244.1	238.2
6		5.9	5.9	23.2	226.1	249.3	243.4
7		5.9	5.9	24.1	230.6	254.7	248.8
8		5.9	5.9	24.7	233.8	258.4	252.6
9		5.9	5.9	25.3	237.0	262.3	256.4
10		5.9	5.9	25.9	240.2	266.2	260.3
11		5.9	5.9	26.6	243.5	270.1	264.2
12		5.9	5.9	27.3	246.9	274.1	268.3
13		5.9	5.9	28.0	250.4	278.4	272.6
14		5.9	5.9	28.8	254.0	282.8	276.9
15		5.9	5.9	29.6	257.7	287.2	281.4
16		5.9	5.9	30.4	261.4	291.8	285.9
17		5.9	5.9	31.2	265.1	296.4	290.5
18		5.9	5.9	31.2	265.1	296.4	290.5
19		5.9	5.9	31.2	265.1	296.4	290.5
20		5.9	5.9	31.2	265.1	296.4	290.5
21		5.9	5.9	31.2	265.1	296.4	290.5
22		5.9	5.9	31.2	265.1	296.4	290.5
23		5.9	5.9	31.2	265.1	296.4	290.5
24		5.9	5.9	31.2	265.1	296.4	290.5
25		5.9	5.9	31.2	265.1	296.4	290.5
26		5.9	5.9	31.2	265.1	296.4	290.5
27		5.9	5.9	31.2	265.1	296.4	290.5
28		5.9	5.9	31.2	265.1	296.4	290.5
29		5.9	5.9	31.2	265.1	296.4	290.5
30		5.9	5.9	31.2	265.1	296.4	290.5
31		5.9	5.9	31.2	265.1	296.4	290.5
32		5.9	5.9	31.2	265.1	296.4	290.5
33		5.9	5.9	31.2	265.1	296.4	290.5

EIRR 17.2%

M4. SOCIO-ECONOMIC IMPACTS

M4.1 Impacts on Low-income Families

As analyzed in Section M2.5.2, the water and sewage charge to middle income people is heavy burden, in the case that they receive domestic water through piped system with water meter. In particular, the charge might be very heavy burden for the people of comparatively lower income level. The undertaker should consider not only to address these people conservation of water consumption but also to take a carefully thought out measure of sewage rates for these people.

The charge to low income people seems not so heavy burden under the current water sewage rates, as far as they get water through communal water system as it is. Even under the current rate, however, about a half of families in low income class who have more than an average family member of 4.3 persons could not afford to support their lives because the charge could exceed the average rate of 1.5% of the family income, as discussed in the Section M2.5.2. On the other hand, since the sewage system is very important for keeping vulnerable environment of Lake Nakuru in good conditions, all houses and buildings in the municipality must be connected to the sewage system. In this context, a careful rate system for low income people to commune with the sewage system might be necessary to mitigate the burden of sewage charge.

M4.2 Impacts on Regional Economy

As discussed in Section M3.3, the project implementation gives economic effects to various sectors in the regions concerned indirectly. For instance, the construction of the system needs a great deal of machinery and construction materials. It also stimulate labour market and distribution industry. This indirect economic effects to regional economy is quantified through an input-output table of regional economy.

The latest input-output table was prepared in October 1979, which was based on the year reference 1976. No input-output tables were officially published afterwards. The MOPND, however, has prepared some tables as inner material. The latest series of the tables refer to the year 1986. However, these series cover the entire national economy only, and never have any regional ones. Thus, the national table can not but be applied to quantify the effects.

The input-output table was tabulated in the original reference, "Input/Output Tables for Kenya, 1986" (Ref.M12). On the basis of the input-output table in the reference, Leontief inverse matrix is calculated as shown in Table M-36. This matrix indicates induced effects of investment. Supposing KShs.1.43 billion is invested in the regional market in the construction sector, 2.18 times of investment effects or KShs.3.11 billion would be induced in the economy. Those comprise KShs.1.43 billion for the construction sector as direct effect and 1.18 times or KShs.1.68 billion through the other economic sectors as indirect effect. Thus, these components show direct and indirect positive economic effects on respective production sectors. On the contrary, if the relative sectors do not reserve production power to support the new investment, it would be feared that the investment simply rises prices of construction materials.

M4.3 Effects for Public Hygiene

There would not be the slightest doubt that sewage system has good effects to public hygiene. As discussed in Section M3.3, this effect is illustrated in Fig. M-1. The effect could be considered to be reflected in the willingness-to-pay of the beneficiaries, as economic benefit.

The sewage system is effective to reduce contraction of waterborne diseases. Table M-37 shows out-patient morbidity of major infectious waterborne diseases in Nakuru District. As shown in the table, the number of patients infected with these disease was almost a quarter of the total number of the entire cases. This rate is smaller than the nation rate of around one-third. In fact, the rate of incidence of these diseases in 1989 was smaller than the rate of the 1989 census population of 4.03%. This means that the people in Nakuru District might be in better circumstance regarding contraction of waterborne disease, as compared with the national average condition.

In keeping with the reduction of disease contraction, the sewage system is also effective to pare down the medical expenses to some extent. Table M-38 shows the municipal expenditure for medical supplies, drugs and dressing to citizens in Nakuru Municipality. In 1992, the municipality spent KShs.200 thousand or 2.8% of the municipal total expenditure. The amount also accounted for 81% of the sewerage sector's expenditure. Although this table shows only municipal expenses, the other public hospitals such as provincial district hospitals and private hospitals spend a lot of expenses for medical care of waterborne diseases. Thus, from the economic point of view, the sewage system might be fairly effective for national economy.

Table M-36 Leontief Inverse Matrix of Domestic Intermediate Sectors : 1986

No.	Delivering Sector	Receiving Sector 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Traditional Economy	1.1200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	Agriculture	0.0249	1.0425	0.0117	0.2790	0.0673	0.0226	0.0259	0.0153	0.0103	0.0082	0.0112	0.0519	0.0109	0.0270	0.0037
3	Mining & Quarrying	0.0005	0.0006	1.0067	0.0026	0.0023	0.0031	0.0254	0.0104	0.0030	0.0052	0.0063	0.0020	0.0055	0.0020	0.0011
4	M. of Food, Beverages & Tobacco	0.0075	0.0286	0.0369	1.4787	0.0836	0.0387	0.0736	0.0508	0.0400	0.0288	0.0401	0.2593	0.0413	0.1296	0.0156
5	M. of Textile, Apparel & Leather	0.0013	0.0131	0.0352	0.0124	1.2938	0.0231	0.0065	0.0064	0.0093	0.0027	0.0050	0.0084	0.0063	0.0053	0.0011
6	M. of Wood, Paper Products & Printing	0.0343	0.0028	0.0350	0.0565	0.0343	1.3562	0.0236	0.0442	0.0261	0.0202	0.0400	0.0247	0.0208	0.0282	0.0164
7	M. of Chemicals & Petroleum Products	0.0241	0.0308	0.3134	0.1253	0.1135	0.1481	1.2300	0.4964	0.1444	0.2523	0.3008	0.0975	0.2685	0.0988	0.0545
8	M. of Non-metalic Mineral Products	0.0346	0.0006	0.0465	0.0069	0.0034	0.0047	0.0126	1.0891	0.0172	0.0078	0.0895	0.0035	0.0060	0.0042	0.0038
9	M. of Metal, Machinery & Others	0.0480	0.0177	0.1905	0.1253	0.0980	0.1598	0.1532	0.2422	1.6534	0.1441	0.2952	0.0720	0.2549	0.0774	0.0526
10	Electricity & Water Supply	0.0029	0.0055	0.0314	0.0220	0.0244	0.0163	0.0482	0.0597	0.0178	1.0858	0.0221	0.0131	0.0222	0.0147	0.0074
11	Building & Construction	0.0019	0.0020	0.0282	0.0113	0.0115	0.0148	0.0608	0.0338	0.0129	0.0161	1.0521	0.0111	0.0176	0.0276	0.0361
12	Wholesale, Retail Trade & Catering	0.0236	0.0420	0.0778	0.1373	0.1054	0.1212	0.0741	0.1080	0.1053	0.0658	0.1015	1.0543	0.0694	0.0474	0.0229
13	Transport & Communication	0.0059	0.0082	0.1243	0.0460	0.0272	0.0449	0.0336	0.0906	0.0324	0.0420	0.0473	0.0851	1.2336	0.0700	0.0378
14	Government Services	0.0004	0.0011	0.0053	0.0033	0.0020	0.0025	0.0207	0.0084	0.0025	0.0043	0.0051	0.0019	0.0047	1.0023	0.0010
15	Other Services	0.0190	0.0205	0.2638	0.1328	0.1929	0.1941	0.1996	0.2314	0.1677	0.1815	0.1640	0.2325	0.2001	0.1216	1.3722
	Total	1.3489	1.2160	2.2068	2.4395	2.0598	2.1501	1.9876	2.4867	2.2423	1.8647	2.1802	1.9173	2.1620	1.6561	1.6262

Source: Ref.M-12

Table M-37 Out-patient Morbidity of Major Infectious Waterborne Diseases: 1986-90

Item	1986	1987	1988	1989	1990
1. Nakuru District					
(1) Number of Institutions	69	80	64	64	64
(2) Major Infective Waterborne Diseases					
(a) Diarrhoeal Diseases	36,928	25,231	10,271	16,813	18,648
(b) Leprosy	20	31	0	8	1
(c) Infectious Hepatitis	6,077	63	94	94	173
(d) Bilharzia	207	42	336	203	568
(e) Eye Infections	14,679	11,990	6,189	9,700	10,285
(f) Malaria	89,332	74,036	38,229	79,845	69,763
(g) Tuberculosis	28	132	15	47	19
(3) Total of above six diseases	147,271	111,525	55,134	106,710	99,457
(4) All Other Diseases	525,532	338,800	175,853	316,211	286,504
(5) Total New Cases	672,803	450,325	230,987	422,921	385,961
2. Kenya					
(1) Number of Institutions	1,621	1,422	1,962	1,988	957
(2) Major Infective Waterborne Diseases					
(a) Diarrhoeal Diseases	1,032,422	769,813	820,096	888,694	777,116
(b) Leprosy	1,558	1,185	770	1,016	1,048
(c) Infectious Hepatitis	33,889	8,843	20,912	8,680	25,042
(d) Bilharzia	105,439	60,991	68,530	81,825	51,755
(e) Eye Infections	507,915	413,894	441,733	628,252	442,943
(f) Malaria	4,574,015	3,840,357	4,099,138	5,745,041	4,718,092
(g) Tuberculosis	6,993	5,392	9,187	7,776	6,981
(3) Total of above six diseases	6,262,231	5,100,475	5,460,366	7,361,284	6,022,977
(4) All Other Diseases	12,826,119	11,476,622	10,882,006	14,434,763	12,597,980
(5) Total New Cases	19,088,350	16,577,097	16,342,372	21,796,047	18,620,957
3. Percentage of Nakuru District to Kenya Total (%)					
(1) Number of Institutions	4.26	5.63	3.26	3.22	6.69
(2) Major Infective Waterborne Diseases					
(a) Diarrhoeal Diseases	3.58	3.28	1.25	1.89	2.40
(b) Leprosy	1.28	2.62	0.00	0.79	0.10
(c) Infectious Hepatitis	17.93	0.71	0.45	1.08	0.69
(d) Bilharzia	0.20	0.07	0.49	0.25	1.10
(e) Eye Infections	2.89	2.90	1.40	1.54	2.32
(f) Malaria	1.95	1.93	0.93	1.39	1.48
(g) Tuberculosis	0.40	2.45	0.16	0.60	0.27
(3) Total of above six diseases	2.35	2.19	1.01	1.45	1.65
(4) All Other Diseases	4.10	2.95	1.62	2.19	2.27
(5) Total New Cases	3.52	2.72	1.41	1.94	2.07
	Year 1979	-	-	Year 1989	-
(6) Ratio of Census Population	3.41	-	-	4.03	-

Source: Ref.M-14 and Health Information System, MOH

Table M-38 Number of Patients in Nakuru Municipal Area and in Provincial General Hospital, and Expenditure for Medical Services by Nakuru Municipal Council

1. Curative Services by Nakuru Municipal Council

(a) Number of Outside-Hospital Patients by Major Waterborne Disease

	1988	1989	1990	1991	1992
Clinical Malaria	4,783	10,328	9,210	3,879	3,467
Gastroenteritis	4,735	7,817	6,967	4,224	1,624
Conjuctivitis	-	3,175	2,885	1,178	448
Scabies	-	2,436	3,445	1,730	276
Dysentery	-	-	-	2	12
Hepatitis	-	-	-	1	1
Typhoid Fever	-	-	-	-	12
Total	9,518	23,756	22,507	11,014	5,840
Total Number of Out-patient	241,343	244,797	-	75,981	-

(b) Expenditure for Medical Supplies,Drugs and Dressing (K£)

	Actual 1988/89	Actual 1989/90	Actual 1990/91	Actual 1991/92	Probable 1992/93
Bondeni Clinic	14,810	17,943	11,646	7,131	34,700
Langalanga Dispensary	59,745	50,027	30,256	1,359	66,940
Maternity	14,283	15,061	1,264	8,202	3,000
Nakuru West Health Centre	31,210	15,893	12,743	5,296	35,875
Viwanda Dispensary	21,200	16,099	9,841	1,787	25,000
Lanet Clinic	29,900	32,448	14,979	4,560	34,485
Total	171,148	147,471	80,729	28,335	200,000

2. Number of In-hopital Patients by Major Waterborne Disease in Provincial General Hospital

	1988	1989	1990	1991	1992
(a) Number of Patients					
Cholera	-	-	-	-	-
Typhoid & Paratyphoid Fever	36	20	19	141	256
Amoebeasis	11	9	12	10	4
Bilharziasis (Schistosomiasis)	9	8	7	8	6
Malaria	640	846	2,346	1,240	3,548
(b) Average Length of Stay in Hospital (days)					
Typhoid & Paratyphoid Fever	7	6	6	6	7
Amoebeasis	2	3	3	2	2
Bilharziasis (Schistosomiasis)	6	6	5	5	6
Malaria	4	5	4	4	4

Source : Public Health Department, Municipal Council of Nakuru

References

No.	Title	Issued on	Issued by
M-01	Statistical Abstract 1991	May 1992	CBS
M-02	Statistical Abstract 1989	May 1990	CBS
M-03	Economic Survey 1993	May 1993	CBS
M-04	Economic Survey 1992	May 1992	CBS
M-05	Economic Survey 1991	May 1991	CBS
M-06	1993/94 Estimates, Municipal Council of Nakuru	1993	MCN
M-07	1992/93 Estimates, Municipal Council of Nakuru	1992	MCN
M-08	1991/92 Estimates, Municipal Council of Nakuru	1991	MCN
M-09	1990/91 Estimates, Municipal Council of Nakuru	1990	MCN
M-10	1989/90 Estimates, Municipal Council of Nakuru	1989	MCN
M-11	Kenya, Local Government Finance Study	April 1992	World Bank
M-12	Input-Output Tables for Kenya, 1986	July 1989	S. Damus, etc. LRPU, MOPND
M-13	Status of Water, Sewerage and Refuse Services in Local Authorities in Kenya, Volume 1 (Report) and 2 (Appendices)	Oct. 1989	MOLG, Technical Section
M-14	Health Information System, 1993 Annual Report	March 1993	MOH
M-15	Development Estimates for the Year 1993/94 Volume I and II	1993	GOK
M-16	1993/94 Estimates of Recurrent Expenditure of the Government of Kenya for the Year ending 30th June, 1994 Vol.I	1993	GOK
M-17	Development Estimates for the Year 1992/93 Volume I	1992	GOK
M-18	1992/93 Estimates of Recurrent Expenditure of the Government of Kenya for the Year ending 30th June, 1993 Vol.I	1992	GOK
M-19	Development Estimates for the Year 1991/92 Volume	1991	GOK
M-20	1991/92 Estimates of Recurrent Expenditure of the Government of Kenya for the Year ending 30th June, 1992 Vol.I	1991	GOK
M-21	Sessional Paper No.1 of 1986 on Economic Management for Renewed Growth, 1986	1986	GOK
M-22	Kenya, Local Government Finance Study Report No.8997-KE	April 1992	World Bank