And, the other weighted average amounts of payment for water by paid samples only were estimated as UShs. 62, UShs. 111, UShs. 86 in Districts of Kiboga, Mpigi and Mubende respectively. It means that, when existing unpaid samples would be necessary to pay for water, they also should pay these amounts for water per 20 litre jerrycan.

And, when it will become necessary to pay to take water, the result of the Inventory Survey says that people will pay sums of UShs. 35 in Kiboga District, UShs. 50 in Mpigi District and UShs. 45 in Mubende District. The weighted average of the amount of willingness to pay would come to UShs. 45 per 20 litre-jerrycan. These amounts of willingness to pay are rather low comparing with actual average weighted amounts by existing paid samples, but it means that those amounts are affordable for them.

Furthermore, the actual paid amounts for water vendor per 20 litre jerrycan were calculated as UShs. 180 in Kiboga District, UShs. 150 in Mpigi District and UShs. 140 in Mubende District in weighted average. These amounts are actually what they paid for water vendor for supplementing shortage of water.

An average used volume of water per day was ccalculated as about 80 litres (4 jerrycans) per household which means 18 litres per person as shown in Table (A) of APPENDIX D-23. If they will pay a sum of UShs. 19 per jerrycan or a sum of UShs. 45 per jerrycan, total amount of water carge would come to around UShs.2,550 per household per month, or UShs. 7,650 per household per annum, or UShs. 5,770 per household per month or UShs. 69,240 per household per annum in existing-paid-amount basis and in willingness-to-pay basis, respectively.

4.5.3. Income Distribution

(1) Income Distribution in Overview

Following Table shows income level of people living in the Project area based on income distribution resulted from the Inventory Survey for communities this time as shown in APPENDIX D-24.

Table 4.5.3. Income Level of Average HH by Population Size in the Project Area

(As of 1995, unit : UShs)

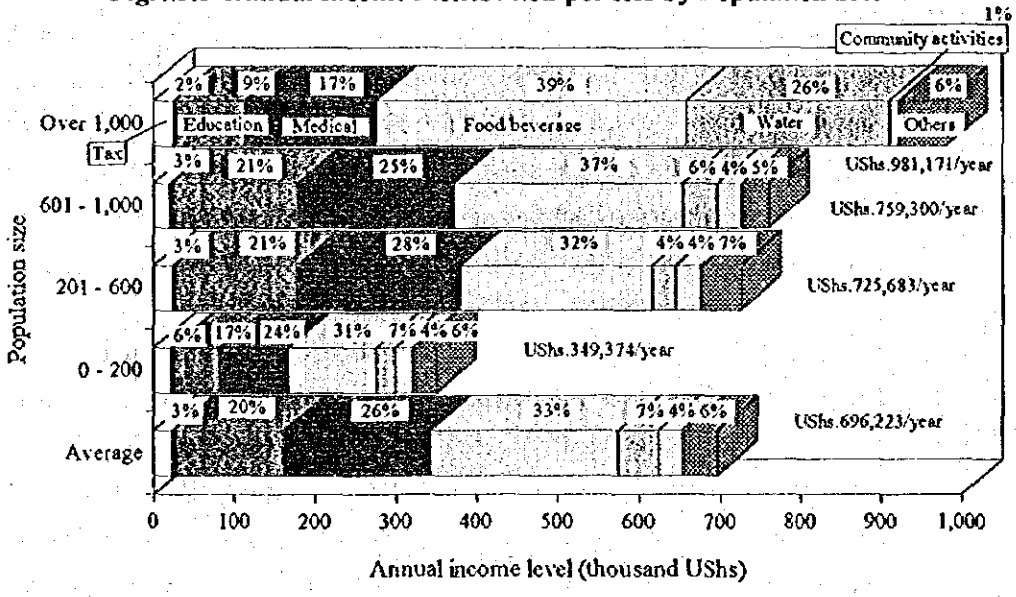
Population size	District							
	Average		Mpigi		Mubende		Kiboga	
	Annual	Monthly	Annual	Monthly	Annual	Monthly	Annual	Monthly
Average	696,223	58,019	874,957	72,913	627,913	52,326	585,798	48,816
200 & under	349,374	29,114	373,513	31,126	342,400	28,533	332,208	27,684
Between 201 - 600	725,683	60,474	968,655	80,721	621,442	51,787	586,953	48,913
Between 601 - 1,000	759,300	63,275	771,567	64,297	560,571	46,714	945,763	78,814
Over 1,000	981,171	81764	976,350	81,363	1,500,563	125,047	466,600	38,883

Source : Result of Inventory Survey for Communities made by JICA, 1995.

When the population size is small, the economic activities are also becoming not so much active, and people's income will also become lower than that in a community of large scale population size. The figures indicating in the above Table show typical patterns of relationships between population size and income level.

When the income level is different, expenditure scale will also be differed. However, proportion of each expenditure item is usually not so much different. An average expenditure pattern of people in the Project area is shown below.

Fig.4.5.1 Annual Income Distribution per HH by Population Size



In Uganda, males and females who are already becoming 18 years old and over should pay a kind of basic property tax (called as "the Graduated Tax" in the country) usually at least an amount of UShs.10,000 per annum (usually this is assessed by chief of sub-county in rural area based on the Governmental regulation, maximum amount :UShs.80,000) even if they have no any properties, but house wives do not necessary to pay any tax. So the amounts of tax paid by an average household are almost the same amount in communities categorized by population size as indicated in the above Figure. Therefore, the proportion of tax payment amount to the total expenditures becomes higher in a household of low income level than in that of high income level.

The average amount of tax paid is UShs.23,000 per year according to the result of the Inventory Survey. It means that there are around 2.3 persons of tax payer per household in the Project area in average.

The most typical school systems in Uganda are 7 years for primary school, six years for secondary school and university. The secondary schools are divided into 2 systems, such as six years system's one and four years system's one. When someone graduated from the four year's secondary school want to enter into university, they should pass through two years advanced school (or high school). University has usually three-year system, but there are also two years system depending on courses as college.

There are several public schools for all kind of school systems in Uganda subsidized by the Government, but there are very few. Therefore, parents who want to make enter their children into schools should select private schools. Fees for private schools are usually higher than the public schools. Usually around UShs.30,000 per term are necessary to pay in cheaper case of a primary school, so it becomes UShs.120,000 per year. On the other hand, public primary school fees are around UShs.50,000 per year but depending it on situation.

Considering their income level, these school fees pressured people's livelihood. In the Project area, about UShs 140,000 per year are used for school fees in average as f 1995.

Medical examination fees and treatment fees are very high in Uganda. Furthermore, disease infection rate is also very high in the country. Therefore, a medical fee also pressed upon people's livelihood. They spend about UShs.180,000 per year for the medical fees in the Project area in average, and this amount is almost 26 % to the total expenditures.

Prices of foodstuff, if the people want to buy them from shops or markets, are expensive too even if in the rural area considering their income level. Some samples are shown in Table below:

Table 4.5.4. Prices of Daily Foodstuff in the Project Area

(As of 1995, unit : UShs/kg)

Food-stuff	Cas-sava	Yams	Irish pota-toes	Maize	Beans	Soya beans	Mato-ke ba-nanas	Sweet bana-nas	Cab-bages	Onion	Toma-toes	Pine-apple	Ground nuts	Cattle meat	Pork	Chick-en
Price	200 - 1,000	250 - 500	250 - 350	100 - 150	200 - 400	300 - 600	2,000 - 3,500	150 - 250	200 - 400	250 - 350	300 - 500	400 - 700	800 - 1,000	2,000 - 3,000	1,000 - 1,500	2,000 - 3,000

Source : Resulted from field survey by JICA Expert, January 1996.

(Note 1) Price for matoke bananas (plantains) is not for 1 kg, but for 1 bunch (about 15 kg).

(Note 2) Price for pineapple is not for 1 kg, but for 1 piece (about 2 kg).

Prices usually range depending upon regional situation and seasons as indicated in the above Table. It seems that the prices are very high considering their income level, and that they can not buy these foodstuffs for their meals for every day. Therefore, they usually take beans or matoke bananas which are harvested from their own field.

Even though, they should buy some foodstuffs at minimum level. The average amount of expenditure for foodstuff is UShs.230,000 per year in the Project area with 33 % of share rate to the total expenditure. It may say that their meals are very inferior, so that they have very poor resistance to diseases. It causes a high disease infection rate, and diseases need high medical fees as mentioned above. And, medical fees lie heavy on expenditures for foodstuff. This is a vicious circle.

(2) Expenditures for Water

As a result of the Inventory Survey for Communities this time, a situation shown in following Table was cleared:

Table 4.5.5. Annual Average HH Expenditures for Water in the Project Area

(As of 1995, unit : UShs)

Category	Categories in population size				
	Average	200 & under	201 - 600	601 - 1,000	Over 1,000
Amount paid	49,755	24,025	29,369	44,017	254,828

Source : Result of Inventory Survey for Communities made by JICA, 1995.

Even in communities in population size of 200 and under, an average HH actually pays a sum of UShs.2,000 per month in average according to the above Table (UShs.24,025/12

months=UShs.2,002/month). And this amount is equivalent to 7 % of the total expenditures as indicated in the aforementioned Fig.4.5.1.

By the same manner, UShs.2,450 per month, UShs.3,670 per month and UShs.21,240 per month may be calculated for communities in population size of 201 - 600, 601 - 1,000 and over 1,000 respectively.

On the other hand, the result of the Inventory Survey for Households shows the following figures :

Table 4.5.6. Average HH Expenditures for Water Based on Actual Use

(As of 1995)

Item	Unit	District			
		Average	Mpigi	Mubende	Kiboga
Paid amount/20 ltrs jerry can	UShs.	-	31	11	10
No. of 20 ltrs jerrycan used/day	cans/d	-	4.5	4.3	3.6
Daily expenditure for water	UShs/d	-	140	47	36
Monthly expenditure for water	UShs/m	2,547	4,185	1,419	1,080

Source : Result of Inventory Survey for Households made by JICA, 1995.

As the same way, people's willingness to pay for water and actual paid amount for water vendor are also resulted from the Inventory Survey for Households as shown in the following Tables:

Table 4.5.7. People's Willingness to Pay for Water in the Project Area

(As of 1995)

Item	Unit	District			
		Average	Mpigi	Mubende	Kiboga
Amount of willingness to pay	UShs/can	-	50	45	35
No. of 20 ltrs jerrycan used/day	cans/d	-	4.5	4.3	3.6
Daily willingness to pay	UShs/d	-	225	194	126
Monthly willingness to pay	UShs/m	5,770	6,750	5,805	3,780

Source : Result of Inventory Survey for Households made by JICA, 1995.

Table 4.5.8. Actual Paid Amount for Water Vendor in the Project Area

(As of 1995)

Item	Unit	District			
		Average	Mpigi	Mubende	Kiboga
Actual amount paid to vendor	UShs/can	-	149	144	180
No. of 20 ltrs jerrycan used/day	cans/d	-	4.5	4.3	3.6
Daily expenditure for water	UShs/d	-	671	619	648
Monthly expenditure for water	UShs/m	19,377	20,115	18,576	19,440

Source : Result of Inventory Survey for Households made by JICA, 1995.

Apparently there seems to be some relationships between both expenditures of households categorized in population size and, resulted from actual water use, of their willingness to pay and of their actual paid amount for water vendor as shown in the following Table:

Table 4.5.9. Comparison of Amount To Pay or To Be Paid for Water Resulted from the Inventory Survey for Communities and for Households

(As of 1995, unit : UShs/month)

Amounts to pay for water resulted from the Inventory Survey for communities in population size		Amounts to pay or to be paid for water resulted from the Inventory Survey for Households	
Communities categorized by population size	Actual paid amount for water in average of 3 Districts	Kind of amounts to pay or to be paid	Amount to pay or to be paid for water in average of 3 Districts
200 and under	2,002	Actual paid amount for water from existing water source	2,547
201 - 600	2,450	Amount of willingness to pay for water	5,770
601 - 1,000	3,670		
Over 1,000	21,240	Actual paid amount for water vendor	19,377

The relationships between expenditures spent by average households categorized by population size resulted from the Inventory Survey for Communities and amount to pay or of willingness to pay of average household resulted from the Inventory Survey for Households may be considered as follows:

Relationship between Average HH Expenditure for Water in Communities of Population Size under 200 and Amount to Pay of Average HH Resulted from Actual Water Use

The amount of UShs.2,002 is resulted from the Inventory Survey for Communities, and UShs.2,547 is from that for Households. There is no such significant difference between both amounts. It means that the households in every community want to collect cheaper water and usually they do so as a whole. This is to say that a payment level of around UShs.2,000 per month is an actual level as a result of the Inventory Survey for Households.

On the other hand, the number of communities under 200 in population size shared only 9 % to the total communities in the Project area, but they are not in such economic active environment. Therefore, it seems that the said figures of UShs.2,002 were reflected the

most typical human behavior as a result of the Inventory Survey for Communities. In some of these small scale communities, they usually pay for water as fees for operation and maintenance of their water facilities by fixed rate but not all.

Relationship between Average HH Expenditure for Water in Communities of Population Size between 201 and 1,000 and Amount of Willingness to Pay

The amounts of UShs.2,450 per month and UShs.3,670 per month come from the Inventory Survey for Communities, and the amount of UShs.5,770 per month is calculated from the amount per 20 ltrs jerry can as willingness to pay and the number of 20 ltrs jerry can be used per day they answered for questionnaire for the Inventory Survey for Households. The former ones are lower than the amount of willingness to pay but higher than those in the communities under 200 in population size.

It seems that the said amount of willingness to pay, UShs.5,770, was their true will. However, most of them establish their own water users committees, and has respective payment regulations in large population communities. Usually they settled water charges as a fee for operation and maintenance of their water facilities, and the said water users committees collect water charges per 20 ltrs jerry can per water collecting time by fixed rate. Therefore, the payment amount for water becomes automatically higher than that in monthly fixed rate system in small population communities. This fixed rate per 20 ltrs jerrycan is almost the same amount of their willingness to pay as UShs.50 per 20 ltrs jerry can in Mpigi, UShs.45 in Mubende and UShs.35 in Kiboga.

The amount of UShs.5,770 is in the case that whole water collectors pay the same rate in the whole communities. But besides the water facilities to be necessary to maintain using money, there are several water sources as protected spring, unprotected spring, water hole and so on. So they usually use these water sources during a season of abundant supply of water as rainy season. This behavior is also supported by the result of the Inventory Survey for Households.

The reason why that the amounts of UShs.2,450 per month and UShs.3,670 are lower than the amount of their willingness to pay, UShs.5,770/month, even if the willingness to pay is

almost the same amount due to their existing regulation, is therefore reflected the above mentioned human behavior in the Project area.

The number of communities with population size of 201 to 600 is almost 63 % to the total communities sampled, and that with population size between 601 to 1,000 is 21 % according the said result. So 84 % of communities belong to this group.

Relationship between Average HH Expenditure for Water in Communities of Population Size More Than 1,000 and Actual Paid Amount to Water Vendor

About 7 % of communities have population more than 1,000 in accordance with the result of the Inventory Survey for Communities, and 23 % of households to the total households answered to questionnaire who pay to water vendor to buy water in the Inventory Survey for Households seem to belong to such population size communities. Most of these communities are trading centre or the same scale town. Therefore, the communities have active economic activities, and such shoppers or traders as water vendors are also active for their business.

It is not clear that people who pay the amount of UShs.21,240 per month for water have actually paid for water vendors or not. But, it is sure that there are some people who can pay such amount, and some of them must pay to water vendors. This is supported by the said result in the Inventory Survey for Households that they have actually paid to water vendor as the amount of UShs.19,377 in average.

This is to say that there should be some people who have a capacity to pay around UShs.20,000 per month to buy water.

4.6. Project Evaluation

4.6.1. Financial and Economic Evaluation

(1) General

The project evaluation is conducted from the financial and economic points of view for the whole objective communities in 3 Districts.

The financial aspect is evaluated by means of a Financial Internal Rate of Return (FIRR), by providing operation and maintenance fees for water facilities as to be collected from water users as financial revenue based on the technical criteria mentioned in previous sub-clause.

On the other hand, the economic evaluation is also carried out by means of an Economic Internal Rate of Return (EIRR), by using the estimated economic cost and benefit of the Project.

In accordance with the design criteria, the target year of services population is set as 2005. So the full benefits of both the financial and economic ones will be appeared as of 2005. The benefits accrued from the period after completion of the works to 2004 and those for the period from 2005 to the end of project life will be different from each other.

The project life is taken as 30 years after completion of the construction works. The Project benefits (both the financial and economic benefits), together with operation and maintenance costs (OM costs), are assumed to occur every year during the period of the Project life. But replacement cost is set at as 7 years each after completion of the construction works.

(2) Methodology of Financial Evaluation

(a) Project Cost

The construction cost consists of local currency portion and foreign currency portion, and is estimated on preliminary design. The annual price escalation assumed to be a rate of 10 % for the operation and maintenance cost for the period of the Project life.

(b) Project Revenue

The operation and maintenance fees for water facilities are given as the project revenue as mentioned above. In this case, a fixed annual equal fee is applied for service households based on the monthly equal payment base considering the family size of each District. Average family size is 4.39 persons per household resulted from 4.02 persons in Mpigi, 4.87 in Mubende and 4.48 in Kiboga.

Average actual payment amount for operation and maintenance of existing water facilities studied in previous section is ranged from UShs. 2,002 to UShs. 2,547 per HH resulted

from the Inventory Survey for both Communities and Households in the minimum community categorized by population size. The fixed monthly equal payment amount is fixed as UShs, 2,000 based on this situation considering the technical criteria for financial evaluation of the Project.

A bad debt is presumed to be 10 % of the payment amount to be collected as the operation and maintenance fees for the newly installed facilities expected in each year.

(3) ***Methodology of Economic Evaluation***

(a) Economic Cost

The econonic cost of the Project is converted from the financial cost under the some conditions and assumptions mentioned hereunder.

Transfer payments such as taxes and duties are assumed to be 15 % of market prices of commodities and services procured locally, and to be exempted from duties for those procured from abroad.

Standard conversion factor (SCF) to be applied for local commodities and services is assumed to be approximately 92.673 %, based on export and import statistics in recent years. For estimation of the SCF, a following equation is applied:

$$SCF = (I + E)/((I + Ic) + (E - Et + Ss)) * 100 \quad \text{.....Formula - 1}$$

Where, SCF : The Standard Conversion Factor, I : Import amount, E : Export amount, Ic : Import customs, Et : Export taxes, and Ss : Subsidies.

The elements for estimation of the said SCF are given as following table:

Table 4.6.1. Estimation of Standard Conversion Factor

(US$ million)

Year	Import amount	Export amount	Import customs	Export taxes	subsidies
1987	598.3	333.6	1.9	5.3	0.0
1988	658.2	266.3	7.8	5.4	0.0
1989	740.0	277.7	25.1	13.4	0.0
1990	617.6	177.8	49.6	12.7	0.0
1991	474.8	173.7	76.6	2.0	0.0
1992	513.3	151.2	125.3	0.0	0.0
1993	597.1	196.7	152.4	0.0	0.0
1994	880.6	433.5	189.5	28.8	0.0
Total	5,079.9	2,010.5	628.2	67.6	0.0
				SCF =92.673 %	

Source : Quarterly Economic Report, January-March 1995, Volume 01/1995, Research Department, Bank of Uganda.

Economic wage of unskilled laborers to be employed for the construction works is assumed to be 90 % of the actual market wage, taking of the employment opportunity of laborers in the study area.

Economic cost of land compensation is assumed to be 100 % of the financial cost, taking account of the opportunity cost of land use.

The economic cost of the Project is given in the present value (PV) at the 1996 price level and are taken no account of the price escalation during the periods of construction works and Project life.

(b) Economic Benefit

People lived in the study area mainly used unprotected springs and water holes in both wet season and dry season according to the result of Inventory Survey as shown in Table (A) of APPENDIX D-21. The water holes were used more than the unprotected spring in wet season, but this tendency reverses in dry season as shown in Illustration (B) of APPENDIX D-21. The water holes are rather shallow than the other ones, so those are easy to dry in dry season. Therefore, they would like to go springs, but protected springs are quite little, so they go to the unprotected springs more for taking water.

Usually they spend a time to go water source about 50 minutes in one way in wet season including water taking time from the source, and also 100 minutes in dry season also

including the water taking time from the source in one time as summarized below. Water taking time was about 10 minutes. So, the actual times spent to go and to come back from the water source are 80 minutes in wet season and 180 minutes in dry season.

Table 4.6.2. Average Time to Get Water

(Minutes)

Districts	Wet season	Dry season
Kiboga	44	99
Mpigi	56	96
Mubende	43	94
Average	48	96

Source:Result of Inventory Survey for Households made by JICA, 1995.

When the water source like well is located at 1.5 km in maximum from house in these villages, it will take about 30 minutes under the condition of 4 km/hour by foot in one way for taking water including water drawing time from the well whether it is in wet season or not.

Therefore, if the wells are constructed as water sources with the condition mentioned above, they can save the time spent to take water about 40 minutes in wet season and 140 minutes in dry season.

On the other hand, as shown in APPENDIX D-22, child share rates to the total water collector were 23.5 % in Kiboga District, 25.6 % in Mpigi District, 26.7 % in Mubende District. The average child share rate may be calculated at 25 % which means that about a quarter of total water collector is child. When they could save the time spent mentioned above, almost all these children could have a time for receiving education.

And about 60 to 70 % of total water collectors were female according to the said Table. When they could save the time spent for taking water, they could attend more to social activities or their daily works in their houses or out-door works like agriculture. To engage in productive works is quite important not only for individual but also for social economy.

Furthermore, the result of the Inventory Survey says that times per day to take water were 2.5 times to 2.8 times in average in the study area too (refer to Table(A) of APPENDIX D-23). It means that the said time spent would become 75 minutes to 85 minute in wet season, and 350 minutes to 390 minutes in dry season. Especially, in dry season, the lost

time was almost the same with working hour in a day in ordinary office workers or employees. This should be quite big loss.

Whether male or female, to save the time is very important in the economical viewpoint. That is to say, it can produce an opportunity to engage in more productive works or business. If there is no work to do or no opportunity to engage in more economical activities at the present time, the Government should guide, train and educate these people by giving knowledge to look for the way of self-supporting themselves. For this, the Government should promote another type of action plan like industrialization, agricultural development and so on.

The economic benefit is mainly estimated based on a concept of time saving for fetching water from the water sources, and in addition a reduction in expenditures for medical fees is estimated as part of the benefit. The benefit is given as a difference between both conditions of with and without the Project, under the conditions and assumptions stated hereunder.

The economic benefit during the construction period starting from 1997 to 2000 (totally 4 years including detail design period) is estimated proportionally based on construction schedule for water supply facilities considering number of service households in those periods. And the benefit after completion of the works to the target year of 2005 is estimated based on the number of service households in those periods.

At present, the majority of inhabitants in the Project area are using water of very few boreholes, dam, protected spring, unprotecting spring, well with pump, well without pump, water hole, gravity feed, and rain water harvest feed and the distance is very far which includes 5 km more in maximum from their house. They spend water fetching time at 77 minutes per day in wet season and 268 to 292 minutes per day in dry season in weighted average in 3 Districts in the Project area without time spent at water sources.

And they have a high share rate of infection of water related diseases to the total diseases due to poor quality of water as mentioned in previous section. They usually spend expenditures at amount of UShs.77,600 per year caused by water related disease. But this amount should be converted based on the rate of diseases by (1) water borne, (2) water washed, (3) water based and (4) water related vector borne.

Any way, this situation is the condition of without the Project.

After completion of the Project, it is expected that they will get their domestic water from water supply facilities as borehole or other water facilities which will be more convenience distance of maximum 1.5 km from their house with assumed time spent of 100 minutes, and will get more clean water so that expenditures of water related diseases will be reduced. This situation is the condition of with the Project.

For the Project evaluation, economic benefit of the Project is given as an economic difference between both conditions of with and without the Project.

It is assumed that the time saved to fetch water will produce an increase in working time, and that the economic benefit will come to UShs.56 per hour in 1995/6 on the basis of a lowest class labourer wage of UShs.34,210/month in U8 class based on the newest "Circular Standing Instruction No. of 1995", a work time of 8 hours/day and the employment opportunity rate of 90 %.

As mentioned in previous sub-clause, people living in the Project area spend the medical expenditures at rounded amount of UShs.180,000 per year in average with share rate of 26 % to the total expenditures as summarized in the following Table.

Table 4.6.3. Annual Average HH Medical Expenditures in the Project Area

(As of 1995, unit : UShs)

District	Categories in population size				
	Average	200 & under	201 - 600	601 - 1,000	Over 1,000
Average	181,286	85,556	200,741	192,501	162,311
Mpigi	196,735	75,500	229,530	179,667	162,583
Mubende	147,526	87,000	156,617	140,019	163,750
Kiboga	199,596	94,167	216,075	257,818	160,600

Source : Result of Inventory Survey for Communities made by JICA, 1995.

On the other hand, major diseases may be classified as follows:

Table 4.6.4. Classification of Diseases by Causes

Water borne	Water washed	Water based	Water related vector borne	Faecal disposal related	Housing and crowding related
(1)	(2)	(3)	(4)	(5)	(6)
Gastroenteritis, diarrhoea (non bloody), diarrhoea with blood, cholera, typhoid	Trachoma, other eye infections, skin infections	Schistosomiasis, guinea worm	Malaria, onchocerciasis, trypanosomiasis	Hepatitis, hook-worms, worms, hookworm anemia	Tuberculosis, meningitis, measles, malnutrition

Source : Ministry of Health, Uganda.

Among the above mentioned diseases, those on item (1) to (4) may be said as water related diseases. For evaluating a share rate of infections of water related diseases to the total cases, a data on cases of diagnosis reported by the Ministry of Health can be applied. The data has been clarified by kind of diseases per month as of 1995. Following Table shows a summary of this data by water related ones (case 1) and by not water related ones (case 2).

Table 4.6.5. Number of Cases of Diagnosis in Uganda

(As of 1995, unit : 1,000 cases)

Cases	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Case 1	302	233	189	224	227	227	200	188	67	37	29	89	2,012
Case 2	346	278	300	308	318	317	273	236	187	50	39	37	2,689
Total	648	511	489	532	545	544	473	424	254	87	68	126	4,701

Source : OPD Report 1995 prepared by the Ministry of Health, Uganda, 1995.
(Note 1)Figures in row of Case 1 is the cases of diagnosis for water related diseases.
(Note 2)Figures in row of Case 2 is the cases of diagnosis for non-water related diseases.

On the viewpoint of the cases of diagnosis, the share rate of water related disease infection to the total cases can be calculated as 43 % based on the above Table 4.5.11. Using this rate, the medical expenditures for water related diseases may be estimated at around USh.77,600 per year in average as shown in the Table below.

Table 4.6.6. Annual Average HH Medical Expenditures for Water Related Diseases in the Project Area

(As of 1995, unit : USh)

District	Categories in population size				
	Average	200 & under	201 - 600	601 - 1,000	Over 1,000
Average	77,589	36,617	85,916	82,389	69,468
Mpigi	84,201	31,314	98,237	76,896	69,585
Mubende	63,140	37,235	67,031	59,927	70,084
Kiboga	85,426	40,303	92,479	110,345	68,736

For evaluation of the Project, impact rates by interventions will be needed to be cleared.

In estimating the reduction in medical expenditures of water related diseases, a reduction rate of medical expenditures is applied for the economic benefit according to the following data.

Table 4.6.7. Situation of Annual Incidence

(As of 1995)

Water related disease	Annual incidence	
	No. of new cases per 1,000 population per year	(%)
1. Water borne	74.05	12.38
2. Water washed	471.65	78.88
3. Water based	9.40	1.57
4. Water related vector borne	42.85	7.17
Total	597.95	100.00

Source : Ministry of Health, Uganda, 1995.

On the otherhand, an estimation of impact of selected interventions is made as follows:

Table 4.6.8. Estimation of Impact by Interventions

(As of 1995)

Water related disease	Impact rate of selected interventions			
	W/only	W+S	W+HE	W+S+HE
1. Water borne	17 %	30 %	33 %	35 %
2. Water washed	15 %	15 %	50 %	50 %
3. Water based	60 %	65 %	70 %	77 %
4. Water related vector borne	<0 %	<0 %	10 %	10 %

(Note 1) W : Improved water supply
(Note 2) S : Improved sanitation.
(Note 3) HE : Health education.
Source : Field survey by JICA Expert, 1995.

(4) Financial Evaluation

(a) Project Cost

Construction cost of the Project estimated at the amount of US$ 12,988 thousand in total including the cost for intervention shown in Table (C) of APPENDIX D-25 is given for the whole three Districts taking no account of the annual price escalation with annual allocation of construction works (see Table (A)) and unit cost per construction works (see Table (B)).

The annual unit OM cost for the Project is indicated at the 1995 price level in the Table (E) of the said APPENDIX. During the period of Project life, the said unit OM cost for

pumps of wells:US$ 147.5 thousand, pumps for Level II Works:US$ 737.5 thousand and Diesel generator:US$ 3,070 should be considered with construction volume. The annual OM cost during the construction period is estimated considering the construction schedule as shown in Table (A) of the said APPENDIX D-25.

On the otherhand, a running cost will also necessary for Level II Works according to the Project criteria as shown in Table (F) of the said APPENDIX D-25, namely US$6,800 per annum after completion of the Level II Works.

The annual OM cost including the said running cost for Level II Works will amount at US$ 91 thousand in full amount.

Table (D) of the APPENDIX D-25 shows a replacement cost for each facility. The replacement cost for pumps for well and Level II Works will be needed in every 7 year and that for diesel generator for Level II Works will be needed in every 15 year after completion of the works. The unit amounts of replacement cost for pumps for wells, for pumps for Level II Works and for diesel generator for Level II Works will amount at US$ 2,000, US$ 10,000 and US$ 50,000 respectively. For evaluation this amounts are applied considering the each construction volume.

(b) Project Revenue

For financial evaluation, revenues for operation and maintenance from users as financial benefit are estimated in 5 cases as shown in APPENDIX D-26 and summarized below:

Table 4.6.9. Financial Revenue by Cases

(US$ 1,000)

District	Case A	Case B	Case C	Case D	Case E
Mpigi	744	1,200	275	263	351
Mubende	194	796	135	203	270
Kiboga	100	351	92	137	183
Total	1,039	2,346	402	603	804

In the above cases, the Case A is the actual paid amount case. As mentioned in previous clause of 4.5.2 in sub-chapter "4.5 Financial Management Plan", inhabitants actual paid amount for water are UShs.31 per 20 litre jerrycan in Mpigi District, UShs.11 also per 20 litre jerrycan in Mubende District and UShs.10 per 20 litre jerrycan too in Kiboga District according to the result of the Inventory Survey this time. In this case, the unit paid amount for water per 20 litre jerrycan, actual supplied volume of water per person, and actual paid

amount for water per HH per month can be calculated as an amount of UShs.19, 18 litres and UShs.2,547 respectively. The supplied water volume does not satisfy the design criteria as 20 litres per person.

The Case B is the case of people's willingness to pay basis. The amounts of willingness to pay, as UShs.50 in Mpigi, UShs.45 in Mubende and UShs.35, are also based on the result of the Inventory Survey. In this case, the unit paid amount for water per 20 litre jerrycan, actual supplied volume of water per person, and actual paid amount for water per HH per month can be calculated as an amount of UShs.45, 18 litres and UShs.5,770 respectively. Also the supplied water volume does not satisfy the design criteria as 20 litres per person because of the same data on water fetching.

The Case C is the case of 1st probable basis which is applied an amount of UShs.1,000 as the amount to be paid per HH per month for operation and maintenance. In this case, the unit amount of water to be paid per 20 litre jerrycan can be estimated at UShs.8 considering the supplied water volume of 20 litres per person based on the design criteria.

The Case D is the case of 2nd probable basis which is applied an amount of UShs.1,500 as the amount to be paid per HH per month for operation and maintenance. In this case, the unit amount of water to be paid per 20 litre jerrycan can be estimated at UShs.11 considering the supplied water volume of 20 litres per person based on the design criteria.

The Case E is the case of 3rd probable basis which is applied an amount of UShs.2,000 as the amount to be paid per HH per month for operation and maintenance. In this case, the unit amount of water to be paid per 20 litre jerrycan can be estimated at UShs.15 considering the supplied water volume of 20 litres per person based on the design criteria.

(c) Cost Revenue Analysis

The FIRR is estimated under the conditions and assumptions stated in methodology mentioned above, and the result is shown in APPENDIX D-27 and summarized below:

Table 4.6.10. Financial Internal Rate of Return

(%)

Case	FIRR
Case A	4.73
Case B	15.52
Case C	-4.70
Case D	-0.61
Case E	2.14

In Case A, the FIRR would come to rather high rate, but supplied water volume is not satisfied that of the design criteria. In Case B, it would be highest one, but not only that the supplied water volume is not satisfied but also that it does not seem to be able to pay the amount of UShs. 5,770 monthly by each household even if they have willingness to pay considering their income level as mentioned in previous sub-clause. In Case C and D, the FIRR would come to negative rates, so this case may not applicable for project formation.

The FIRRs in Case E would come to the positive side as 2.14 % at a discount rate of 12 %. It means that the monthly equal amount to be paid by each household should be kept at least a sum of UShs.2,000, and this amount is in the safe side considering the monthly payment amount in the Case A

The Project sows to be feasible in self-supporting viewpoint in case that water users can pay the amount of UShs.2,000 per HH per month, and this amount is reasonable as mentioned above.

(5) Economic Evaluation

(a) Economic Cost

The economic cost of the Project is converted from the financial cost under the conditions and assumptions described in the previous sub clause, and the result is given in APPENDIX D-25 together with the financial cost in total. The total economic cost for the Project amounts to US$ 12,710 thousand for the construction cost and US$ 82 for the annual OM cost including the running cost for Level II Works in full amount.

The unit replacement costs for pumps for wells, pumps for Level II works and Diesel Generator for Level II Works are estimated at amounts of US$ 1,974, US$ 9,873 and US$

49,500 respectively. These amounts are applied considering the construction schedule for the evaluation.

(b) Economic Benefit

The economic benefit is mainly estimated based on a concept of time saving for fetching water from the water sources, and in addition the benefit of reduction in medical expenditures is estimated by using the rates of incidence and rates of impact by improve water supply based on official medical data as mentioned in previous sub-clause and total medical expenditures per HH resulted from the Inventory Survey.

The benefit is given as a difference between both conditions of with and without the Project under the conditions and assumptions stated in previous sub clause. The economic annual benefit is estimated at US$ 1,456 thousand in full amount consisting of US$ 1,358 thousand from the time saving and US$ 98 thousand from the reduction of medical expenditures as shown in Table (A) and (B) in APPENDIX D-28.

The economic benefit is appeared after completion of construction works in full amount, and that from 1997 to 2000 is estimated proportionally based on construction schedule.

(c) Cost Benefit Analysis

A calculation of EIRR for the Project is given in APPENDIX D-29. The EIRR for the Project is estimated at 8.86 % at a discount rate of 12 % as shown in this APPENDIX.

Generally, it is suggested that a EIRR should keep 5 % for project formation in the viewpoint of basic human needs as this Project. From this viewpoint, it can be said that the said EIRR is high enough for the Project.

(d) Sensitivity Analysis of EIRR

Various conditions and assumptions have been set in the analysis based on professional experience and appropriate judgment of experts, but there always remains the question as to the degree of reliability of inputs. Therefore, a test is carried out for sensitivity of the EIRR to variations in the economic cost and benefit which have been estimated for the Project.

The sensitivity of the EIRR is tested for the 10 % and 20 % increase in the economic cost and the 10 % and 20 % decrease in the economic benefit as summarized below:

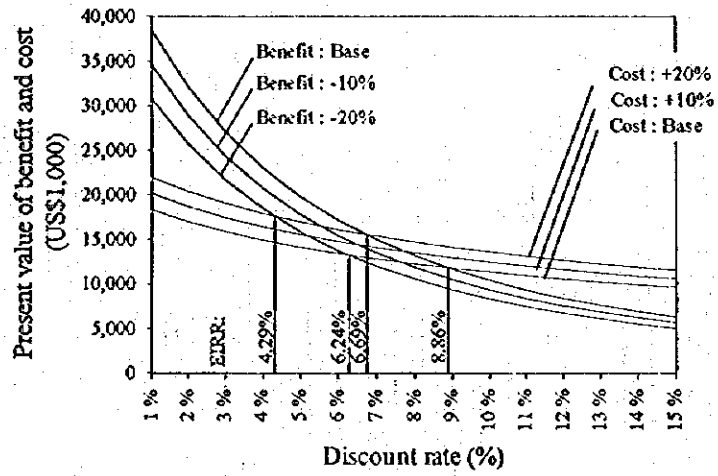
Table 4.6.11. Result of Sensitivity Analysis of EIRR for the Project

(%)

Cost	Benefit		
	Base	-10 %	-20%
Base	8.86	7.58	6.24
+10 %	7.70	6.49	5.20
+20 %	6.67	5.53	4.29

And following Figure illustrates the sensitivity analysis of EIRR for the Project graphically:

Fig. 4.6.1 Sensitivity Analysis of EIRR



Here, cost in "Base" and benefit in "Base" mean amounts of the basic estimation of the economic cost and benefit as mentioned in previous sub-clause.

As shown in the above Table and Figure, the EIRR in the case of Cost:Base and Benefit:-20 % (Case 1), in the case of Cost:+10 % and Benefit:-10 % (Case 2) and in the case of Cost:+20 % and Benefit:Base (Case 3) would come to 6.62 %, 6.49 % and 6.69 % respectively. These percentages are clearly higher position than the said minimum rate generally suggested in the viewpoint of basic human needs. Even in the most pessimistic condition which combines 20 % increase in the cost and 20 %-decrease in the benefit, the EIRR would be kept in higher position than the said minimum rate as 4.29 %. It seems

therefore that the Project maintains the socio-economic feasibility in the viewpoint of basic human needs.

4.6.2. Affordability to Pay

For making clrear affordabilities of inhabitants for the costs of operation and maintenace, and replacement, an analysis of affordability to pay was made as shown in APPENDIX D-30.

(1) Operation and Maintenance to be Paid

In the case of Level II system, the O/M cost includes the costs for operation and maintenance for pumps (US$737.5/annum per unit, 5 units in total, so US$3,687.5/annum in total amount) and diesel generator (US$3,070/annum, one unit), and annual running cost for the system (US$6,800/annum). The Level II system serves water for 3,604 persons in population which means 794 households.

In the case of borehole facilities, the O/M cost includes the cost for operation and maintenance for pums only (US$147.5/annum.unit). One unit of pump will serve water for 430 persons based on the design criteria which means 91 households in average.

Based on the above mentioned conditions, amounts to be paid for O/M cost in each case are estimated as follows:

(a) Amount to be paid for O/M cost for Level II system : UShs.1,451/month.HH
(b) Amount to be paid for O/M cost for borehole system : UShs.136/month.HH

The Level II system is planned to be constructed in one location in Kiboga District consisting of 5 communities. But borehole systems are planned to be constructed in a lot of locations including the village that has 200 persons population or below in community size. Therefor, one more estimation was made for borehole system using 150 persons as a mininum service population which means 32 household in average. The result is as follow:

(c) Amount to be paid for O/M cost for borehole system : UShs.362/month.HH
(As a case of minimum service population of 150 persons)

As indicated above, when it is necessary to bear by themselves for O/M cost only, they have enough affordability to pay in both the Level II system and borehole systems considering their actual expenditure for water from existing income as mentioned in previous clause..

(2) **Replacement Cost to be Reserved**

In the case of Level II system, the replacement cost includes the costs for replacemnt of pumps (US$10,000/unit, 5 units in total, so US$50,000 in total) and diesel generator (US$50,000/unit, one unit only). Pumps will be replaced in every 7 years, and diesel generator will be replaced in every 15 years. The service population and households are as mentioned in previous sub clause.

In the case of borehole facilities, the replacement cost includes the cost for replacement of pums only (US$2,000/unit) which will also be repced in every 7 years. The service population and households are as mentioned in previous sub clause too.

Based on the above mentioned conditions, amounts to be reserved for replacement cost in each case are estimated as follows. In this case, capital recovery factors are considered based on a price escalation rate of 15 % per annum as 0.24036 for pumps and 0.17102 for diesel generator.

(a) Amount to be reserved for replacement cost for Level II system :
UShs.2,202/month.HH

(b) Amount to be reserved for replacement cost for borehole system :
UShs.445/month.HH

According to the construction plan mentioned in previous sub clause, one more estimation was made for borehole system using 150 persons as a minimum service population which means 32 household in average. The result is as follow:

(c) Amount to be reserved for replacement cost for borehole system :
UShs.362/month.HH
(As a case of minimum service population of 150 persons)

As indicated above, when it is necessary to bear by themselves for replacement cost only, they have enough affordability to pay in both the Level II system and borehole systems

considering their actual expenditure for water from existing income as mentioned in previous clause..

(3) Affordability to Pay

As mentioned in previous clause, actual paid amount and willingness to pay for water are summarized in Table below:

Table 4.6.12. Actual Paid Amounts and Willingness to Pay for Water

(As of 1995, unit : UShs/month)

Results from the Inventory Survey for Communities by size		Results from the Inventory Survey for Households	
200 and under	2,002	Actual paid amount for water from existing water source	2,547
201 - 600	2,450	Amount of willingness to pay for water	5,770
601 - 1,000	3,670		
Over 1,000	21,240	Actual paid amount for water vendor	19,377

And amount to be paid or reserved estimated above are as summarized below:

Table 4.6.13. Amount to be Paid or Reserved for O/M or Replacement Cost

(UShs/month HH)

Cost item	Level II	Borehole	
		Case A*	Case B**
O/M cost	1,451	136	362
Replacement cost	2,202	445	1,275
Total	3,653	581	1,637

(Note)

* : The case based on the design criteria.

** : The case of probable minimum community size.

Comparing the above 2 Tables, the total amount to be paid/reserved for Level II system, UShs.3,653, is within the amount of willingness to pay and almost the same amount of actual paid amount of communities which have population between 601 and 1,000. As mentioned above, Level II system is planned to be constructed in one location in Kiboga District consisting 5 communities, and these communities have population of 720 in average in the year of 2005. It means that they have enough affordability to pay for O/M and replacement costs without any burden.

The total amount to be paid/reserved for O/M and replacement costs for borehole systems in the case of probable minimum community size of 150 in population, UShs.1,637, is less than the actual paid amount, UShs.2,002, of communities with population of 200 and below. And in 2005, minimum community size will be 168 persons in population according to extrapolated population projection by based on the past population growth ratio mentioned in previous clause. It means that the actual amount to be paid/reserved for O/M and replacement costs should be lower than the said estimated amount. Therefore, they have enough affordability to pay for O/M and replacement costs without any burden in borehole systems too.

4.6.3. Socioeconomic Impacts

Besides the foregoing tangible benefit, the following effects would be expected by implementation and/or completion of the construction works of the Project:

(1) During the construction period, the employment opportunities will be created in and around the area of the target communities.

(2) Working time will be created due to time saving with the Project as mentioned in previous sub-clauses. Therefore, there will be a stimulative effect for promotion of the socioeconomic development in and around the area of the target communities in agriculture or other socioeconomic activities. It should be contribute to rural economy.

(3) As mentioned in previous sub-clause and shown in APPENDIX D-28, the inhabitants can save their times at 72 minutes (1.2 hours) in wet season and 284 minutes (4.7 hours) in dry season per day per HH both in average. And almost 25 % of existing water collectors are children. So, they can get educational opportunities or they can back to schools when the Project will be completed.

(4) As shown in APPENDIX D-22, almost of 60 % to 65 % of existing water collectors are female in the age group between 14 to 40 years old. When the Project will be completed, they will be free from a lot of heavy working time to fetch water, and they can attend more to social activities using these saved time.

(5) Due to above effects from (1) to (4), they will have a high consciousness to exertion on the rural economy and/or to importance of education for their children who will act major role in the future as the next generation.

(6) The Project will stabilize the people's livelihood in the target communities due to decrease of the cases of water related diseases by supplying of clean water.

4.6.4. Synthetic Project Evaluation

Result of the Project evaluation is summarized as follows:

(1) In case where UShs. 2,000 per HH per month is applied to collect from water users in the target communities as a water charge for operation and maintenance for the water facilities newly constructed for the financial evaluation, the FIRR for the Project would come to positive side as 2.14 % that shows to be feasible in self-supporting viewpoint.

(2) The EIRR for the Project shows 8.86 % which is a fairly high rate in the viewpoint of economic activity and basic human needs of this kind of project, i.e., the Project would be feasible socioeconomically.

(3) In conclusion, the Project as a whole is feasible in self-supporting viewpoint (under the condition of UShs. 2,000 to be collected as a water charge per HH per month for operation and maintenance for newly constructed water facilities with the Project) and socioeconomically (at the viewpoint of effective use of saved time with the Project and benefit derived from decrease of medical expenditures due to supply clean water also with the Project).

(4) Amount to be paid/reserved by themselves for O/M and replacement costs of UShs.3,653 for Level II system and UShs.1,637 for borehole systems in the case of probable minimum community size are both within their existing actual paid amount for water. It means that they have enough affordability to pay for O/M and replacement costs for newly constructed water sources.

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