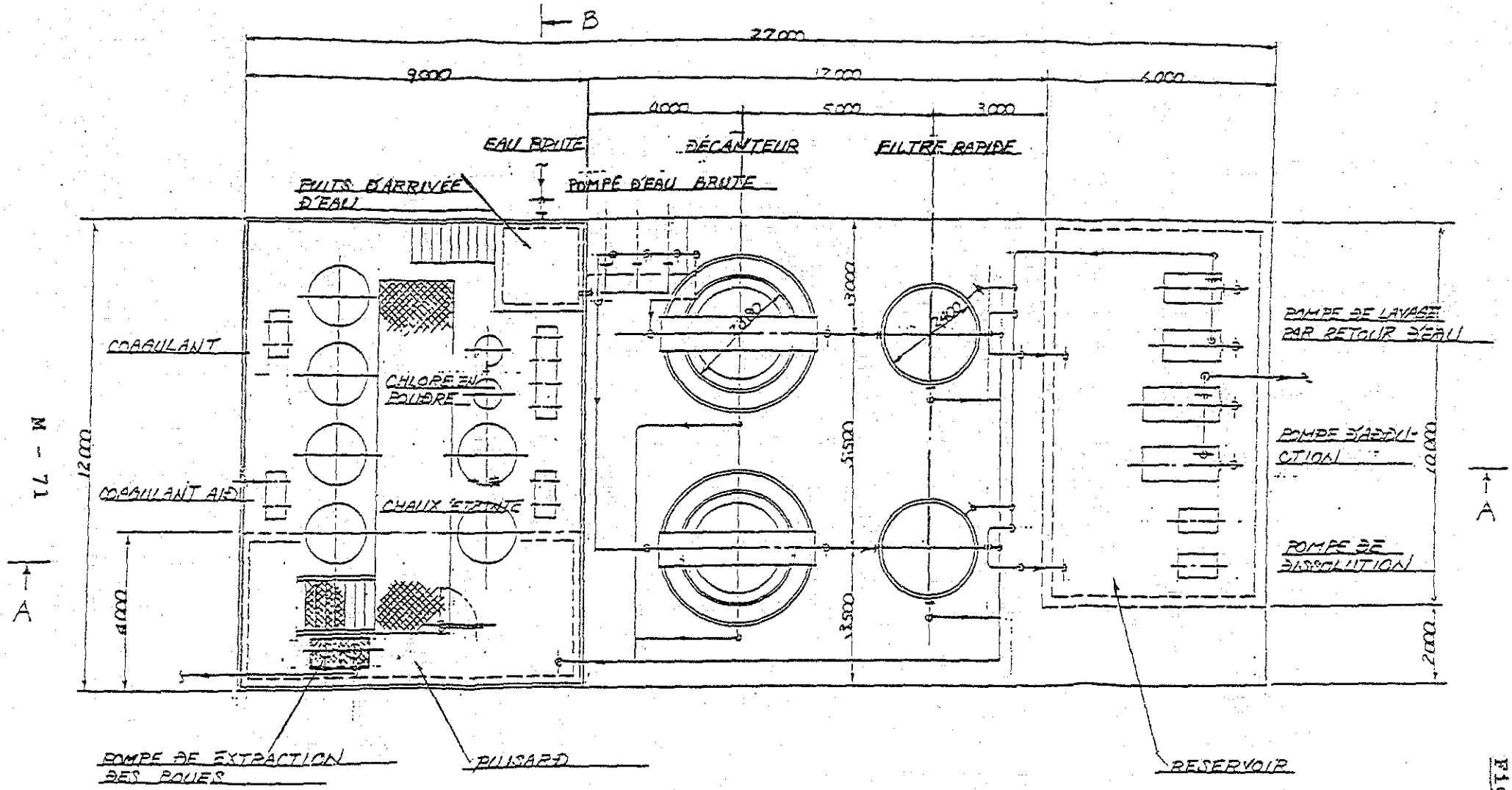
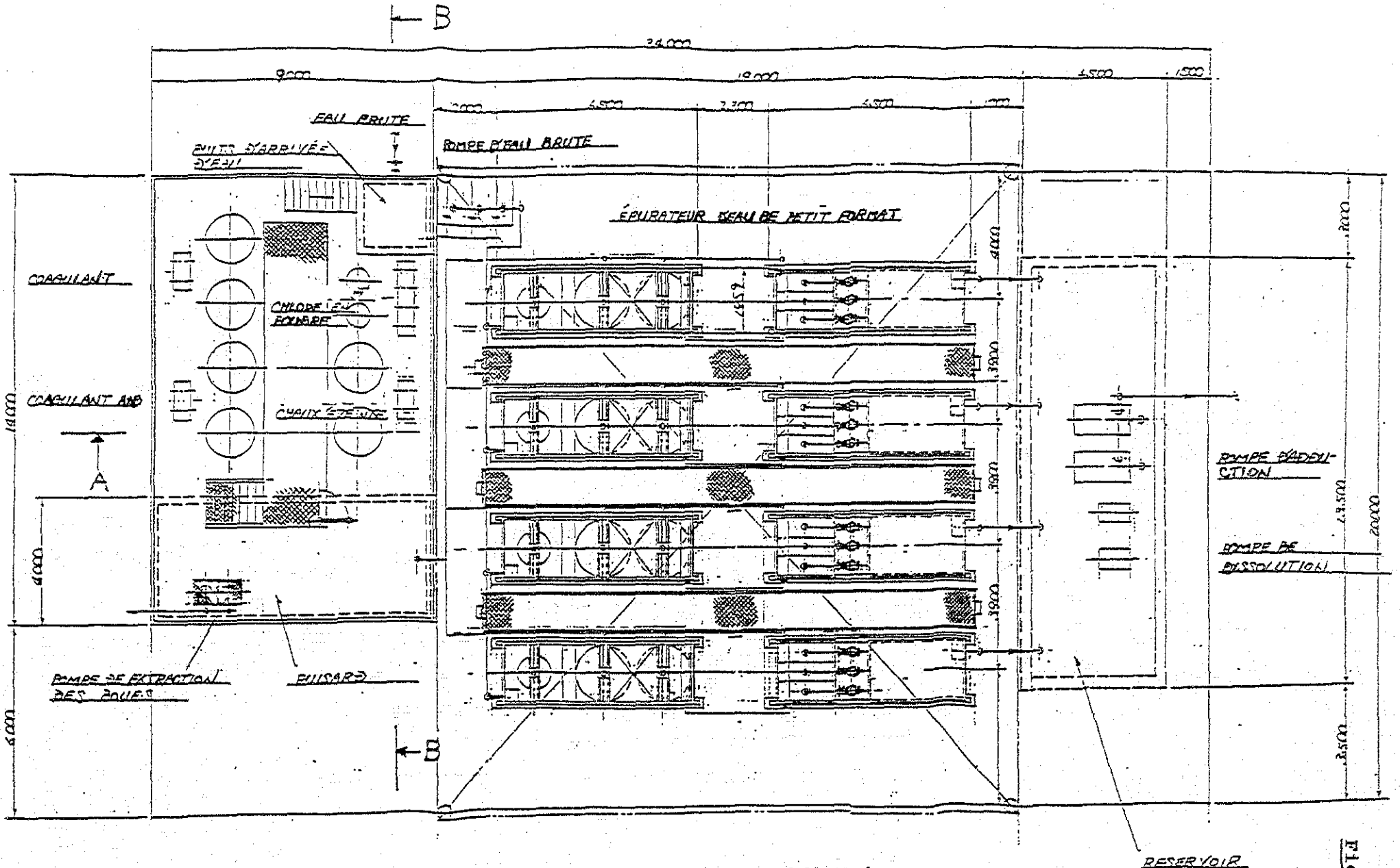


M - 71

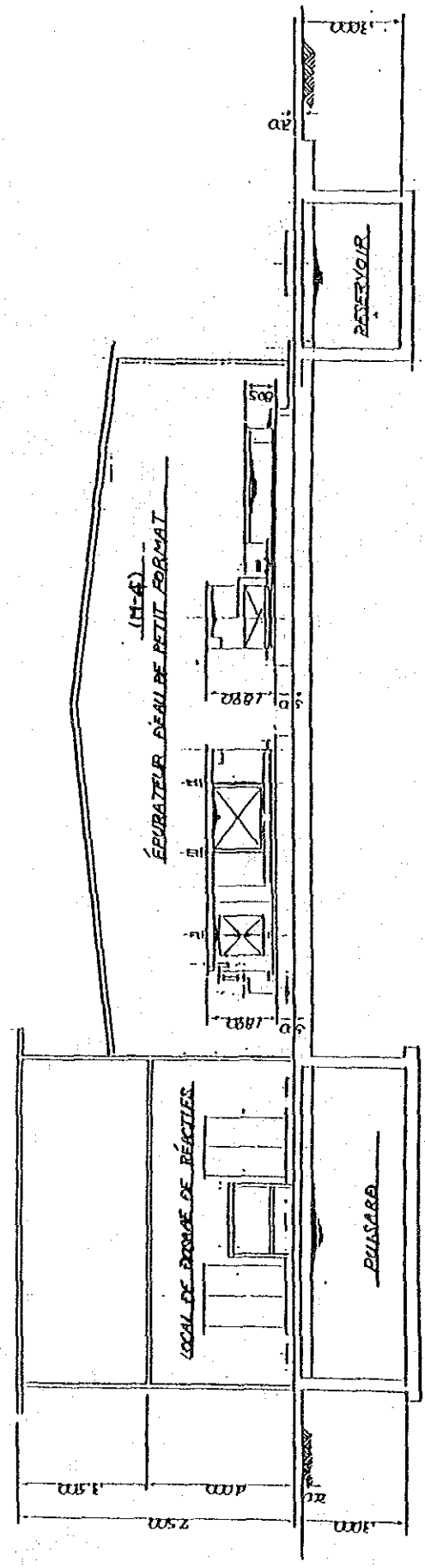
Type A : High Rate Coagulosedimentation Basin with Gravity Rapid Sand Filter-2

Fig. M.3

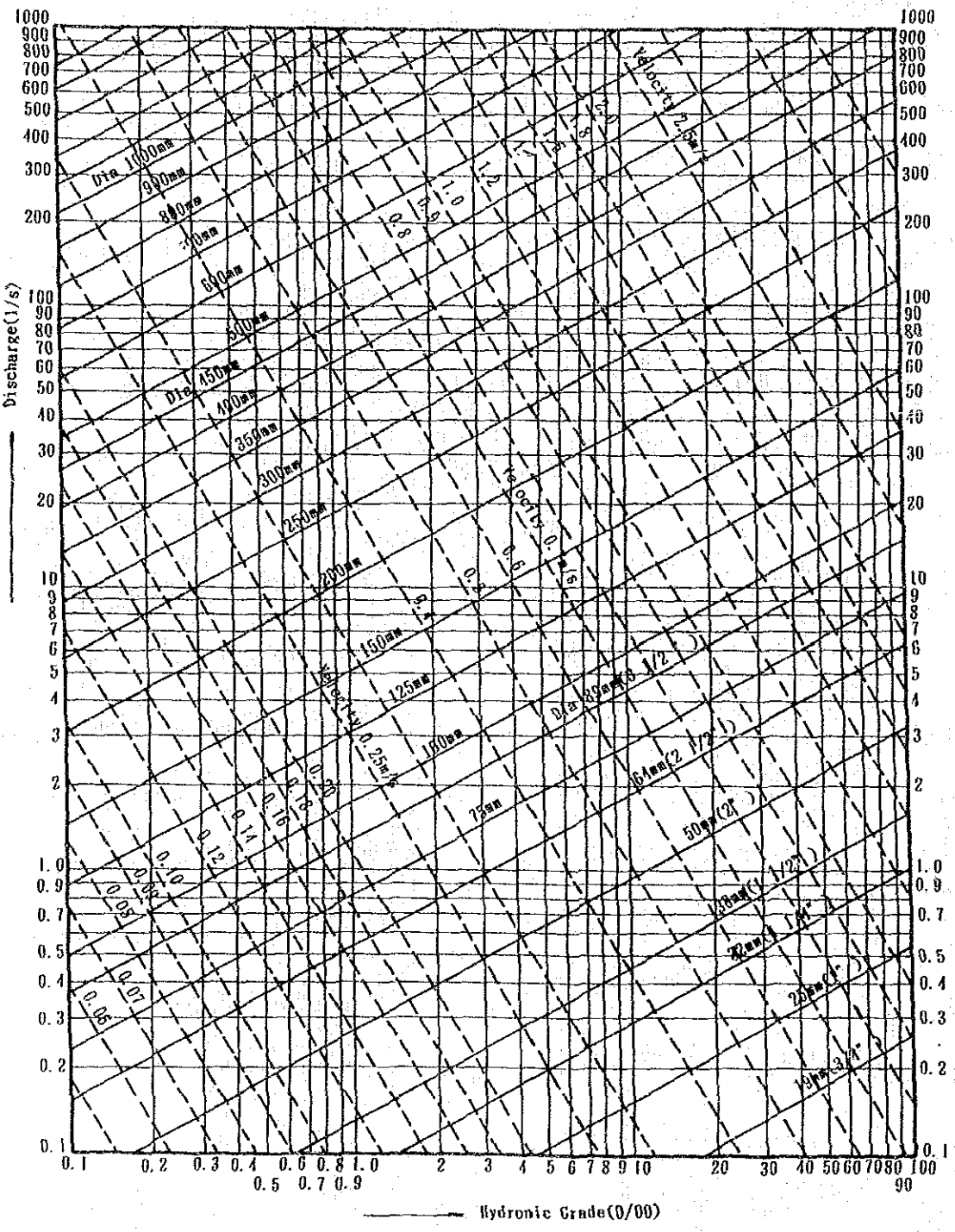


Type B : Portable-type Purifier-1

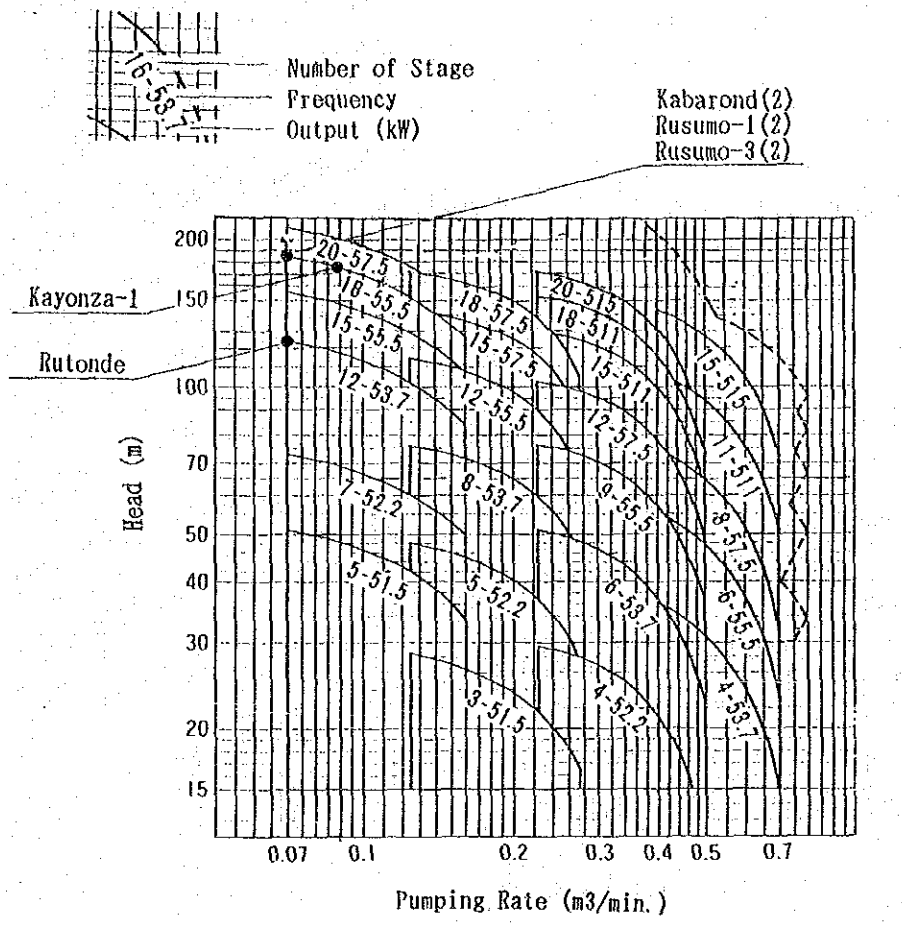
Fig. M.4



Type B : Portable-type Purifier-2



Hezen Williams Formula Figure(C=110)


Number of Stage
Frequency
Output (kW)
Kabarond(2)
Rusumo-1(2)
Rusumo-3(2)
Kayonza-1
Rutonde
Head (m)
Pumping Rate (m3/min.)

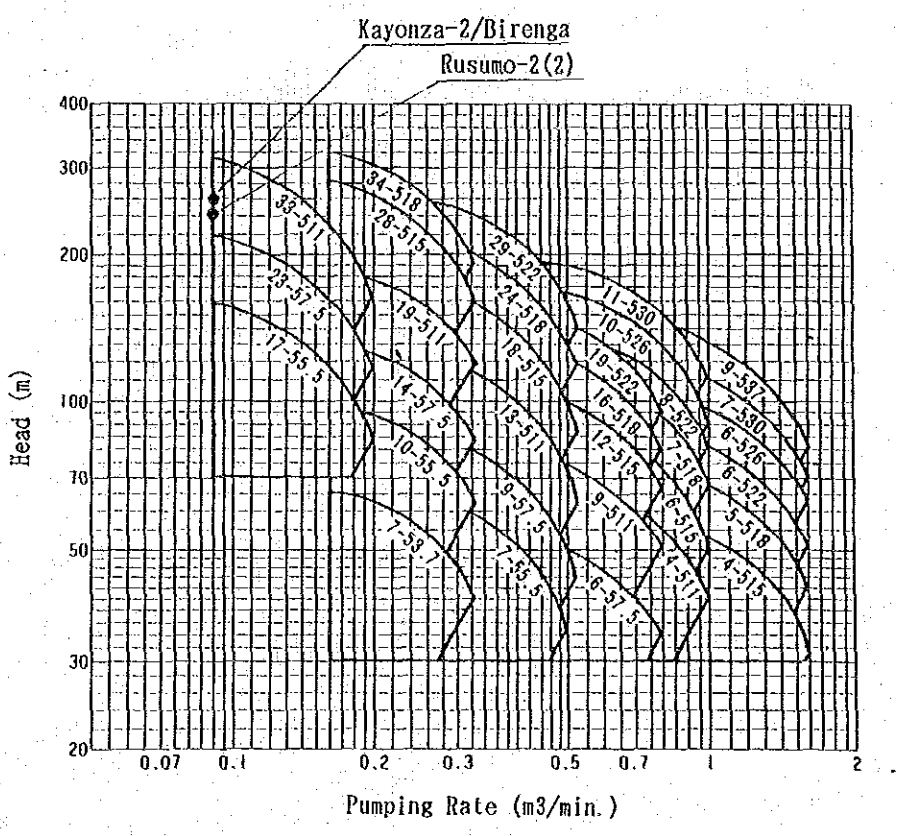
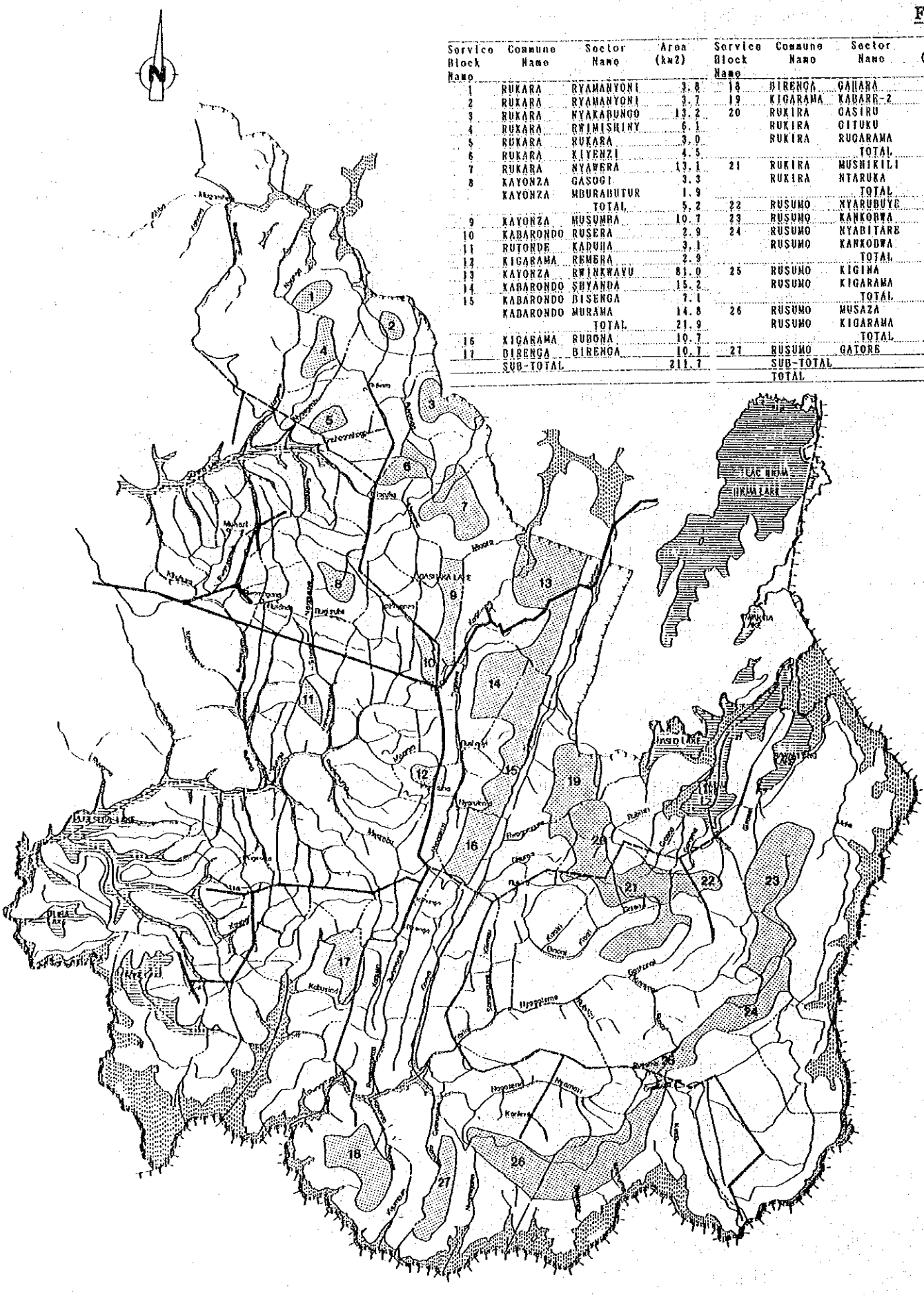

Kayonza-2/Birenga
Rusumo-2(2)
Head (m)
Pumping Rate (m3/min.)

Fig. M.8

Service Block Nano	Commune Name	Sector Name	Area (km2)
1	RUKARA	RYAMANYONI	3.8
2	RUKARA	RYAMANYONI	3.7
3	RUKARA	NYAKABUNGO	13.2
4	RUKARA	RWIMISHINY	6.1
5	RUKARA	RUKARA	3.0
6	RUKARA	KIYENZI	4.5
7	RUKARA	NYAMBRA	13.1
8	KAYONZA	GASOGI	3.3
	KAYONZA	MBURABUTUR	1.9
		TOTAL	5.2
9	KAYONZA	MUSUMBA	10.7
10	KABARONDO	RUSERA	2.9
11	RUTONDE	KADUHA	3.1
12	KIGARAMA	REMERA	2.9
13	KAYONZA	RWINKWAVU	81.0
14	KABARONDO	SHYANDA	15.2
15	KABARONDO	BISENGA	7.1
	KADARONDO	MURAMA	14.8
		TOTAL	21.9
16	KIGARAMA	RUBONA	10.7
17	BIRENGA	BIRENGA	10.7
	SUB-TOTAL		211.7

Service Block Nano	Commune Name	Sector Name	Area (km2)
18	BIRENGA	GAHARA	15.6
19	KIGARAMA	KABARE-2	16.6
20	RUKIRA	GASIRU	7.4
	RUKIRA	GITUKU	2.5
	RUKIRA	RUGARAMA	11.1
		TOTAL	21.0
21	RUKIRA	MUSHIKILI	11.3
	RUKIRA	NTARUKA	8.8
		TOTAL	20.1
22	RUSUMO	NYARUBUYE	23.0
23	RUSUMO	KANKOBWA	45.7
24	RUSUMO	NYABITARE	16.2
	RUSUMO	KANKOBWA	10.0
		TOTAL	26.2
25	RUSUMO	KIGINA	5.7
	RUSUMO	KIGARAMA	10.0
		TOTAL	15.7
26	RUSUMO	MUSAZA	18.1
	RUSUMO	KIGARAMA	22.2
		TOTAL	40.3
27	RUSUMO	GATORE	11.6
	SUB-TOTAL		235.8
	TOTAL		447.5



APPENDIX N

ENVIRONMENTAL EXAMINATION AND RECOMMENDATION

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ENVIRONMENTAL EXAMINATION AND RECOMMENDATION

1. GENERAL

The objective of the Project is to provide all residents of Kibungo Prefecture with safe, stable domestic water in an effort to improve their living conditions.

The Project Area covers a large area (2,667 km2) that includes lakes Muhazi, Mugesera, Sake, Nasho, and Ihema all of which have intricate shorelines. The Area is bounded on the east by the Akagera National Park, a savanna natural conservation area.

Four types of water supply systems are proposed to be installed by the Project: groundwater use with handpumps; groundwater use with a pipeline water distribution system: lake water use with a pipeline water distribution system; rainwater use with roof catchment system.

It is believed that the implementation of the Project will have various effect on the natural, social and economic environment in the Project Area.

Thus, the Area's present environmental conditions, and the effects Project implementation will have on the environment were qualitatively clarified by using available data and information.

For the actual implementation of the Project, detailed environmental studies shall be made. And, prior to Project implementation, appropriate measures shall be taken correct any problems that might adversely effect the environment. It will be necessary to prevent the implementation of the Project from causing environmental destruction; the Project should be in harmony with the environment.

2. PRESENT ENVIRONMENTAL CONDITIONS

2.1 NATURAL ENVIRONMENT

Approximately 433,000 people are dispersed throughout the Project Area. Most of the arable land in the Area has already been cultivated. The administrative district offices are promoting reforestation projects for soil conservation and lumber supply purposes.

The surface water in the Project Area tends to form dead water marshes. Almost all of the water is contaminated by domestic sewerage and agricultural waste.

Akagera National Park is the only uncontaminated area in the Project Area where the natural environment is well preserved. The Park, with its precious resources of wildlife and plants, is a tourist attraction.

As a result of the water balance simulation, the hydrologic cycle in the Project Area was estimated as being 550 mm of annual evapotanspiration, 130 mm of direct runoff, and 160 mm of indirect runoff through groundwater recharging out of the approximately 900 mm of annual rainfall.

Judging from the Area's topographic and geologic conditions, it is believed that the groundwater flows in relatively shallow strata with the exception of some crushed zones.

Spring distribution, yield amounts, and water qualities are greatly affected by precipitation, and surface water qualities and conditions in the Area.

2.2 SOCIAL ENVIRONMENT

Approximately 430,000 people live in the Study Area. They are mainly concentrated in such places in the northwestern region as Muhazi and Rutonde, in Mugesera and Sake in the western region, and along the national roads further north of Kibungo city. The population density in the Study Area is more than 100/km2.

In general, sparsely populated regions have low levels of public service facilities, such as infrastructure and medical facilities.

The Area economy is mainly supported by the trading of agricultural products and daily necessity items. But, most of the markets are still at primitive levels.

3. EFFECTS OF PROJECT IMPLEMENTATION ON THE ENVIRONMENT

3.1 PRELIMINARY EXAMINATION

The preliminary environmental examination is analyzed for potential adverse impact.

The Project has been proposed based upon favorable social/house-economic indicators. The underlying intent is to improve residents living conditions and to create additional job time in economic activities by water use convenience improvement. The activities of the Project carries the promise of great near term benefit but also rise environmental questions.

The environmental questions of project activities are outlined as follows:

Surface-Water and Groundwater Resources Development

- Potential related to waterborne disease
- Potential for surface-water/groundwater development that could affect sensitive water balance in the Area
- Potential for natural resources degradation by the construction works
- Relationship to other potential users

Water Distribution Development

- Potential related to waterborne disease
- Potential for natural resources degradation by the construction works of water supply system
- Potential for waste water contamination
- Alternation of social activities patterns

The preliminary environmental examination on above activities and questions related to the Project concludes that:

> The project's environmental impact, especially given the "without-project" alternative, is highly beneficial on account of positive determination for the sanitary conditions and water use convenience improvement of the Area.
>
> Stress of hydrologic environment by development is considered to be negative impact. But the required water quantities of the Project is approx. 1/1,000 of total water cycle within the Study Area. The negative threshold therefore is warranted based on proper project design recommended through water balance simulation of the Study.

As for construction, it appears that facilities of water intake(including wells), treatment plant, reservoir tank and pipeline will only take place in the project site. There may be no significant adverse impact except small natural resources degradation such as forest clearing, land clearing, which indicate negative impacts. This aspect should be further evaluated when the site will be more clearly established.

The environmental questions on potential for waste water contamination are considered, indicating negative impacts.

The sub-activities related to planning/design, training and institutional support are accorded exclusion categories.

The qualitative examination results of Project implementation effects on the environment are shown in Table N.1.

3.2 EVALUATION

As the Project's large-scale construction work will be conducted within a limited area while other work will be conducted along existing roads, it is believed that negative environmental effects will be slight. However, in areas close to existing surface water, appropriate means shall be taken to prevent the natural resources degradation such as outflow of muddy water during the construction period.

Other possible negative effects would include the increase of water pollution and water source pollution due to the increased amount of domestic water consumption once the Project was completed. Thus, appropriate measures, including resident education and the promotion of public health related knowledge, shall be taken in an effort to prevent pollution problems.

In spite of the mentioned negative effects, it is believed, that, from an overall point of view, the implementation of the Project will have a number of significant positive factors that will bring about improvements to the living environment of the residents and will active area economy.

4. ENVIRONMENT PRESERVATION MEASURES

It is conceivable that Project implementation may have an impact on Area environment. The policy describing the measures to be taken to prevent particularly important adverse impacts are outlined below.

4.1 WATER QUALITY AND WATER SOURCE PRESERVATION

(1) Measures Against Domestic Waste

Because of the population increase and the improvement of water supply facilities in the Area, pollution loads will surely increase as a result of increased amounts of domestic waste material.

Untreated sewage, the lack of knowledge concerning water environment and water quality, and the lack of public interest and awareness, are problems that will be encountered. Thus, appropriate measures should be take to confront these problems. Consideration should be given to the installation, at some future date, of an improved tilet and a septic tank at each house or several houses, and an oxidation pond to each secteur by taking into account population distribution and secteur size.

(2) Water Source Preservation

In general, environmental deterioration due to disorderly land development tends to occur in areas where land management plans are inappropriate.

For the sake of water source preservation, soil erosion control, and the prevention of environmental destruction, the promotion of reforestation projects and the setting up of land conservation areas are highly recommended.

(3) Environment Education

To preserve the environment and keep it in good condition, emphasis should be placed on social education and the promotion of knowledge concerning environmental aspects.

It would be most effective to utilize mass media and obtain the cooperation of non-governmental organizations and religious groups to conduct the social education and promotional activities. Additionally, the mobilization of local human resources, such as teachers, councilmen, and members of commerce groups, and the participation of various organizations would be extremely important factors for undertaking these activities.

Groups of people who receive their water from the same water supply system should be mobilized and trained in environmental matters. Also, facility maintenance activities should be promoted at community levels.

(4) **Improvement of Social System**

For the functional conservation of the environment, prompt implementation of measures suitable for local conditions is essential. Thus, from a long-term viewpoint, the following environment administration and social systems should be established:

i) To establish an environment and sanitation management office or department within prefectural and commune units.

ii) To decide upon basic land management policies and the boundaries of the Government's responsibilities, prefectures and communes to be provided with environment management should be clarified.

iii) To increase the number of management personnel and train them to properly carry out the established environmental policies.

iv) To adopt a favorable tax system to promote such development projects that concern environment conservation and to increase the budgetary funds for carrying out environment administration work.

EXAMINATION OF ENVIRONMENTAL IMPACT OF THE PROJECT

Environmental Parameter	Water Supply Dev. Construction Period	After Development
1 Physical & Chemical Effects:		
a. Land		
Landform	-	x
Soil	x	x
b. Water		
Surface Water Quality	--	-
Surface Water Quantity	x	x
Groundwater(quantlity	-	-
c. Climate	x	x
2 Ecological Effects:		
a. Terrestrial Species		
Vegetation	-	-
Wildlife	--	-
b. Aquatic Species		
Fish	--	-
Plankton & Benthos	--	-
3 Socio-economic Effects:		
a. Demography		
population	x	++
Employment	++	+
Health & Sanitary	x	++
Life Style	x	++
b. Landuse		
Cropping	x	+
Residential	+	+
Industry & Commercial	+	+
Wetland	x	x
c. Infrastructure		
Major Structure	+	+
Utility Facility	+	++
Transportation	+	x
4 Aethetic effects:		
a. Scenic View & Vistas	-	x
b. Park & Reserves	-	x

[+]: Positive Impact, [-]: Negative Impact, [x]: No Impact
++, -- : high Impact
+ , - : Negligible Impact

APPENDIX-O

IDENTIFICATION OF POSSIBLE PROJECT

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IDENTIFICATION OF POSSIBLE PROJECT

1. GENERAL

Although the Government of Rwanda has a basic policy that aims at complete supply of drinking water for all of the people within this century, it seems difficult, in view of the financial conditions to complete all projects of the Basic Plan by the year 2000.

Even if sufficient funding for the Basic Plan is raised, it would not be feasible from the viewpoint of the Governmental policy to invest it during an 8 year period only on the Kibungo Prefecture's water supply project.

Thus, in view of the country's overall water supply improvement plan, it is considered to be more realistic to select the higher priority projects that are proposed in the Basic Plan and implement them according to their order of priority.

2. FINANCIAL LIMITATION FOR PROJECT IMPLEMENTATION

2.1 REASONABLE PROJECT COST

In general, if the construction costs of water supply projects in a developing country have to be compensated by fees collected from water recipients, clean water will never be supplied to the residents, due to their low incomes, and inability to pay. Therefore, the construction costs would be borne either by the Government or by financial aid provided from developed countries.

According to the Evaluation Report for the Third National Development Plan (MINIPLAN), the investment amount for the field of rural water supply during the plan period was as shown in the following table. The annual increase rate of the investment amount was 16 percent.

(unit : million FRW)

	1982	1983	1984	1985	1986	Total
Invested Amount	341.5	256.3	554.0	339.2	664.6	2,155.6
Price Index	110.9	127.8	134.7	135.1	128.3	
Real Value	284.8	200.5	411.3	251.1	518.0	1,665.7
Annual Increase Rate			20.2%		12.2%	16.1%

Note: Price index for 1980 was 100

Based on the 1986 investment amount of 664.6 million FRW and by assuming an annual increase rate of investment after that year as being 10 percent, the total investment amount for the Rural Water Supply Project in the Eastern Region during Phase III Project period (1992 - 2000) is estimated to be around 16,000 million FRW as shown in the following table.

(Unit : million FRW)

Year	Base Cost	Growth Index	Investment Amount	Accumulated Investment Amount
1986	664.6	1.000		
1992		1.772	1,177.7	1,177.7
1993		1.949	1,295.3	2,473.0
1994		2.144	1,424.9	3,897.9
1995		2.358	1,567.1	5,465.0
1996		2.594	1,724.0	7,189.0
1997		2.853	1,896.1	9,085.1
1998		3.138	2,085.5	11,170.6
1999		3.452	2,294.2	13,464.8
2000		3.797	2,523.5	15,988.3

In view of Rwanda's financial situation, the upper limit of the investment for the Rural Water Supply Project (Phase III) in the Eastern Region was calculated by taking into consideration the delay of the rural water supply development in Kibungo Prefecture. The investment amount for the entire country's rural water supply during the Phase III Project period obtained in the above table (16,000 million FRW) was divided: Project Area in population to the area population in need of water supply -- the resultant investment amount is 2,900 million FRW.

Upper limit of Investment Amount for the Phase III Project
= 16,000 million FRW x 17.9% = 2,864 million FRW
= 2,900 million FRW

Name of Prefecture	Population	Water Supply Rate(%)	No Water Supply Rate(%)	Number of People to provided with New Water Supply Facilities
Butare	746,600	78	22	164,300 (13.1%)
Byumba	590,200	79	21	123,900 (9.9%)
Cyangugu	407,200	73	27	109,900 (8.8%)
Gikongoro	460,000	83	17	78,200 (6.2%)
Gisenyi	584,000	77	23	134,300 (10.7%)
Gitarama	731,300	76	24	175,500 (14.0%)
Kibungo	416,200	46	54	224,700 (17.9%)
Kibuye	372,700	78	22	82,000 (6.5%)
Ruhengeri	667,000	76	24	160,000 (12.8%)
Total	4,975,200			1,252,800 (100 %)

Notes: 1) Population figures are based on MINAGRI's Data
2) Water supply rates are based on MINITRAPEE's Data
3) Kigali Prefecture, where urbanization has progressed considerably, was excluded from the investment area for rural water supplies.

2.2 MAXIMUM COST FOR EACH PROJECT

The Phase III Project will consist of many independent projects. Thus, by assuming the case that each of the independent projects may be implemented as a slight project, the reasonable maximum cost of a single project is to be established.

Major water supply projects in Rwanda are implemented by financial aid from advanced countries and international organizations. The costs of recently completed water supply projects are shown in DATA BOOK of Volume V.

Except for the project in Kigali, the cost of each project was less than US$5 million. Of all the rural water supply projects, the largest was the Phase I Project implemented with grant aid cooperation from the Government of Japan -- the cost was US$4.14 million.

Based on the above viewpoint, the reasonable maximum cost of a single project is thought to be US$4 million.

3. IDENTIFICATION OF THE POSSIBLE PROJECT

3.1 BASIC CONCEPT FOR THE PROJECT SELECTION

In general, a priority project is selected based on the following concept:

"I": In view of basic human needs, priority would be given to the development of the following areas:

- An area where the water source of the existing water supply facility is contaminated and the occurrence rate of disease related to the drinking water is very high.
- An area where residents have to rely on a traditional type of water source because of poverty.
- An area where rural development is still in a primitive stage.

"II": In view of the independent management capabilities of the residents, priority would be given to the development of the following areas:

- An area where the residents have a good understanding of the private and public water supply projects.
- An area where residents have a willingness to participate in project implementation and management work.
- An area where project facility operation and maintenance work would be easy and the costs low.

"III": Priority would be given to a project that is economical and realistic.

- A project not having a high cost and one where grant aid from an international organization or foreign government may be expected.
- An area where the infrastructure, such as power supply lines and roads are relatively well-developed and where it would be easy to carry out project construction.
- A project whose per capita capital cost and facility operation and maintenance cost are low.

For the water supply systems proposed in the basic plan of the Phase III Project, it would be difficult to adopt the same service level and the same water fee rate due to differences of water sources and area conditions. Therefore, when selecting a possible water supply project, it is necessary to examine the service level and water fee rate by placing emphasis on the above mentioned priority levels of "I", "II" and "III". The basic concept

for project selection is as follows:

System 1 and 2 :	Power cost is required and, as a result, the per household operation and maintenance cost will become high. Thus, the residents' awareness of the water supply system and their financial capability to pay the water fees would be a very important factor. For system selection, emphasis would be placed on "II" and, particular, "III".
System 3 and 4 :	The initial costs and the operation and maintenance costs for these systems are lower than for Systems 1 and 2. Thus, for system selection, emphasis would be placed on "I" and "II".

3.2 PROJECT PRIORITY

(1) Basis and Procedures

High priority projects were selected from those proposed in the Basic Plan for the Phase III Project. Then, by taking the economy of these projects and the country's technical level into consideration, the projects thought possible to be implemented by the year 2000 were selected.

For selection, the following items were examined for each water supply service block:

- The natural conditions of the area:
  Water qualities, amount of available water, effects on construction work.
- Present water supply conditions:
  Type of existing water sources, spring distribution pattern, existing water supply systems' water supply rates.
- Social conditions:
  Existing health and hygiene related facilities, such as hospitals and health centers, and the area's development potential.
- Economy and ease of operations and maintenance:
  Per capita construction cost, operation and maintenance cost, and operation and maintenance organization.

Each item was classified into three levels: easy to difficult; high demand to very little demand; advantageous to disadvantageous.

Evaluation items and standards are shown in Table 7.4 of Volume II. Each service block's evaluation is clarified in Tables O.1 and O.2. The operation and maintenance cost is shown as a result of the cost estimate in Appendix Q. The evaluation of other items is included in the results of the geological surveys and questionnaire surveys.

For the examination of project priority, the above items were examined. In particular, a heavy weight was placed on the per household operation and maintenance cost.

(2) Priority of Projects in Systems 1 and 2 Areas

In the Basic Plan for the Phase III Project, a total of 10 projects are proposed for System 1 and System 2 areas: 2 projects in System 1 areas; 8 projects in System 2 areas. These projects are classified into the following three categories according to their priority level:

A: Very high priority project that is desired to be implemented as soon as possible.

- Kayonza-1 (System 2)
- Kayonza-2 (System 2)
- Kabarondo (System 2)

B: High priority project that is desired to be implemented after "A".

- Muhazi (System 1)
- Sake (System 1)

C: A project requiring the installation of generator units. Facility operation and maintenance costs will be high, and it is desirable to implement the project after completing the electrical facility development.

- Rutonde (System 2)
- Birenga (System 2)
- Rusumo-1 (System 2)
- Rusumo-2 (System 2)
- Rusumo-3 (System 2)

(3) Priority Projects in System 3 Areas

The priority projects in System 3 areas are classified into the same three categories as for the Systems 1 and 2 areas. The categories are as follows:

A: Very high priority project that is desired to be implemented as soon as possible.

B: High priority project that is desired to be implemented after "A".

C: Project for which construction would possibly present some difficulties.

Priority	Number of Wells
A	75
B	153
C	249
Total	477

3.3 POSSIBLE PROJECTS

The possible projects were selected by taking into account the upper limit of their total construction costs from the priority projects examined in Section 3.2. The selected blocks are outlined in the following Table:

System	Project/ Area Name	Area (km2)	Served Population	Note
1	MUHAZI	39.9	21,944	Priority B
	SAKE	54.1	33,865	" B
	sub-total	**94.0**	**55,809**	
2	KAYONZA-1	12.9	4,374	Priority A
	KAYONZA-2	8.2	3,508	" A
	KABARONDO	15.7	5,956	" A
	sub-total	**36.8**	**13,838**	
3	Well of Priority A	168.9	37,868	75 wells
	Well of Priority B	359.6	65,026	153 wells
	sub-total	**528.5**	**102,894**	**228 wells**
	Total	**659.3**	**172,894**	

SELECTION OF PRIORITY BLOCK FOR SYSTEM 1 and 2

Commune	Name of Service Block	Secteure	Natural and Construction Conditions					Needs of Safe Water (Existing Water Supply Conditions)				Social Conditions				Economy and O/M Conditions					Rank of Priority
			① Quality of Water Source	② Quantity of Water Source	③ Electri-fication	④ Access	Over-all Eva.	⑤ Existing Water Source	⑥ Density of Spring	⑦ Service Percentage of Safe Water	Over-all Eva.	⑧ Scale of Benefici-ries	⑨ Hospital Health Center	⑩ Develop-ment Potential	Over-all Eva.	⑪ Initial Cost per Capita	⑫ O/M Cost per Family	⑬ Participa tion of Local People	⑭ O/M Organi-zation	Over-all Eva.	
System-1	MUHAZI		◎	◎	◎	◎	A	◎	◎	◎	A	◎	◎	◎	A	○	○	◎	◎	B	B
	SAKE		○	○	○	○	B	◎	◎	◎	A	◎	◎	◎	A	○	○	◎	◎	B	B
System-2	KAYONZA-1	Kyonza	◎	○	○	◎	A	◎	◎	◎	A	○	△	◎	B	○	◎	◎	◎	A	A
	KAYONZA-2	Nyamirama Syogo	◎	◎	◎	△	A	◎	◎	◎	A	○	△	◎	B	○	◎	◎	◎	A	A
	RUTONDE	Rweru	◎	◎	△	△	C	○	○	◎	B	○	△	△	C	◎	△	◎	◎	C	C
	KABARONDO	Nkamba Ruramira Ruyonza	◎	◎	○	△	B	○	○	○	B	◎	△	○	B	◎	◎	◎	◎	A	A
	BIRENGA	Ndamira	◎	◎	△	◎	B	○	○	◎	B	○	△	○	B	○	△	◎	◎	C	C
	RUSUMO-1	Gatore Kirehe	◎	◎	△	△	C	◎	◎	△	B	◎	○	◎	A	◎	△	◎	○	C	C
	RUSUMO-2	Nyarubuye	◎	◎	△	△	C	◎	◎	○	A	◎	◎	◎	A	○	△	◎	○	C	C
	RUSUMO-3	Nyamugali	◎	◎	△	○	B	◎	◎	◎	A	◎	△	△	C	○	△	◎	○	C	C

Table O.1

SELECTION OF PRIORITY BLOCK FOR SYSTEM 3 (1/2)

Commune	Secteure	Potential Class and No. of Well	Natural Conditions					Needs of Safe Water (Existing Water Supply Conditions)				Social Conditions			Economic and O/M Conditions					Rank of Priority
			Ground Water																	
			① Quality	② Quantity	③ Drilling Condition	④ Access	Over-all Eva.	⑤ Existing Water Source	⑥ Density of Spring	⑦ Service Percentage of Safe Water	Over-all Eva.	⑧ Hospital Health Center	⑨ Develop-ment Potential	Over-all Eva.	⑩ Initial Cost per Capita	⑪ O/M Cost per Family	⑫ Participation of Local People	⑬ O/M Organi-zation	Over-all Eva.	
RUKARA	GAHINI	Sa - 12	◎	◎	◎	△	C	◎	◎	△	C	◎	◎	A	○	○	◎	◎	B	C
	KIYENGI	Sa - 6	◎	◎	◎	△	C	◎	◎	◎	A	△	○	B	◎	◎	◎	◎	A	C
	NYAKABUNGO	Sa - 5	◎	◎	◎	○	A	○	◎	◎	B	△	△	C	◎	◎	○	◎	A	B
	NYWERA	Sa - 8	◎	◎	◎	○	A	○	◎	◎	B	△	○	B	◎	◎	◎	◎	A	A
	RUKARA	Sb - 12	○	◎	○	◎	B	○	◎	○	B	◎	◎	A	○	◎	◎	◎	A	A
	RWIMISHINYA	Sa - 6	◎	◎	◎	◎	A	○	◎	◎	B	△	△	C	◎	◎	◎	◎	A	B
	RYAMANYONI	Sd - 14	◎	△	○	◎	C	○	◎	◎	B	△	○	B	△	△	◎	◎	C	C
MUGESERA	CTIZIHARA	Sd - 8	◎	△	○	◎	C	○	◎	◎	B	△	△	C	○	◎	○	◎	B	C
	GATARE	Sd - 9	◎	△	○	◎	C	◎	◎	◎	A	△	△	C	○	◎	◎	○	B	C
	KAGASHI	Sd - 11	◎	△	○	○	C	◎	◎	◎	A	△	△	C	○	◎	◎	○	B	C
	KAREMBO	Sa - 1	◎	◎	◎	△	C	○	△	△	C	△	◎	A	○	◎	○	◎	A	C
	KIBARE	Sd - 10	◎	△	○	○	C	○	△	◎	B	△	○	B	○	◎	○	◎	B	C
	KIBIUZI-1	Sb - 9	○	◎	○	◎	B	○	○	◎	B	△	△	C	○	◎	○	◎	B	C
	KIRAMBO	Sd - 7	◎	△	○	○	C	◎	△	◎	C	△	○	B	○	◎	○	◎	A	C
	KUKABUYE	Sa - 5	◎	◎	◎	◎	A	○	○	◎	B	△	◎	A	◎	◎	○	◎	A	A
	MATONGO	Sd - 7	◎	△	○	◎	C	◎	◎	◎	A	△	○	B	○	◎	◎	◎	A	B
	NGARA	Sa - 7	◎	◎	○	○	A	○	◎	◎	B	△	○	B	◎	◎	○	◎	A	A
	NYANGE	Sd - 8	◎	△	○	○	C	◎	◎	◎	A	○	○	A	○	○	◎	◎	B	B
	SANGAZA	Sd - 9	◎	△	○	◎	C	◎	◎	◎	A	△	○	B	○	◎	◎	◎	A	B
	SHYWA	Sd - 8	◎	△	○	○	C	○	△	○	C	△	△	C	○	◎	○	◎	B	C
	ZAZA	Sd - 13	◎	△	○	◎	C	○	△	◎	C	◎	◎	A	△	△	◎	◎	C	C
SAKE	MBUYE	Sb - 4	○	◎	○	○	B	◎	◎	△	C	△	○	B	○	◎	◎	◎	A	C
	MURWA	Sd - 13	◎	△	○	○	C	◎	○	◎	A	◎	◎	A	○	◎	◎	◎	A	B
	RUKUMBERI	Sd - 13	◎	△	○	○	C	◎	○	◎	A	△	○	B	○	◎	◎	◎	A	B
	SHOLI	Sd - 12	◎	△	○	◎	C	◎	◎	◎	A	△	△	C	○	◎	◎	◎	A	B
KAYONZA	GASOGI	Sb - 5	○	◎	○	△	C	○	◎	◎	B	△	△	C	○	◎	○	○	B	C
	MBURABUTUR	Sb - 3	○	◎	○	△	B	○	◎	◎	B	△	△	C	◎	◎	○	○	B	C
	MUSUMBA	Sa - 3	◎	◎	◎	△	C	○	◎	◎	B	△	○	B	◎	◎	○	○	B	C
	NYAMIRAMA	Sa - 4	◎	◎	◎	△	C	○	◎	◎	B	△	◎	A	◎	◎	○	○	B	B
	RUTARE	Sb - 6	○	◎	○	◎	B	○	◎	◎	B	△	△	C	○	◎	○	○	B	C
	RWINKWAVU	Sa - 2	◎	◎	◎	◎	A	○	◎	◎	B	◎	◎	A	△	△	○	○	C	B
	SHYOGO	Sb - 3	○	◎	○	○	B	◎	◎	◎	A	△	◎	A	○	◎	○	○	B	A
RUTONDE	KADUHA	Sa - 3	◎	◎	◎	○	A	◎	△	○	C	△	△	C	○	◎	◎	◎	A	B
	RUTONDE	Sa - 6	◎	◎	◎	◎	A	◎	○	○	B	△	◎	A	◎	◎	◎	◎	A	A
	RWERU	Sb - 2	○	◎	○	◎	B	◎	○	◎	B	△	△	C	○	◎	◎	◎	A	C
	SOVU	Sb - 6	○	◎	○	◎	B	◎	△	○	C	△	△	C	○	◎	◎	◎	A	C

(continue)

Table O.2 (1)

SELECTION OF PRIORITY BlOCK FOR SYSTEM 3 (2/2)

Commune	Secteure	Potential Class and No. of Well	Natural Conditions					Needs of Safe Water (Existing Water Supply Conditions)				Social Conditions			Economic and O/M Conditions					Rank of Priority
			Ground Water																	
			① Quality	② Quantity	③ Drilling Condition	④ Access	Over-all Eva.	⑤ Existing Water Source	⑥ Density of Spring	⑦ Service Percentage of Safe Water	Over-all Eva.	⑧ Hospital Health Center	⑨ Develop-ment Potential	Over-all Eva.	⑩ Initial Cost per Capita	⑪ O/M Cost per Family	⑫ Participation of Local People	⑬ O/M Organi-zation	Over-all Eva.	
KABARONDO	BISENGA	Sa - 4	◎	◎	◎	△	C	◎	◎	◎	A	△	○	B	◎	◎	◎	○	A	B
	MURAMA	Sa - 2	◎	◎	◎	○	A	◎	◎	◎	A	△	○	B	◎	◎	◎	○	A	A
	NKAMBA	Sa - 2	◎	◎	◎	◎	A	○	○	○	B	△	◎	A	◎	◎	○	○	B	A
	RURAMIRA	Sb - 4	○	◎	○	△	C	○	○	◎	B	△	◎	A	○	◎	○	○	B	C
	RUSERA	Sa - 4	◎	◎	◎	△	C	○	○	◎	B	△	○	B	○	◎	○	○	B	C
	RUYONZA	Sa - 2	◎	◎	◎	△	C	○	○	○	B	△	△	C	○	◎	○	○	B	C
	SHYANDA	Sb - 2	○	◎	○	○	B	◎	◎	○	B	△	△	C	○	◎	◎	○	B	C
KIGARAMA	GASETSA	Sa - 3	◎	◎	◎	△	C	◎	◎	△	C	△	△	C	△	△	○	○	C	C
	GASHANDA	Sa - 5	◎	◎	◎	○	A	◎	○	○	B	△	○	B	◎	○	○	◎	A	A
	KABARE-1	Sa - 4	◎	◎	◎	△	C	○	◎	○	B	◎	◎	A	○	○	○	◎	B	C
	KABARE-2	Sa - 10	◎	◎	◎	◎	A	○	◎	◎	A	△	○	B	○	○	◎	○	B	A
	KABERANGWE	Sb - 3	○	◎	○	○	B	◎	◎	△	C	△	△	C	○	○	○	○	B	C
	KANSANA	Sa - 5	◎	◎	◎	△	C	○	○	◎	B	△	○	B	◎	○	○	○	B	C
	REMERA	Sb - 4	○	◎	○	△	C	◎	◎	◎	A	△	◎	A	○	○	○	○	B	B
	RUBONA	Sb - 11	○	◎	○	△	C	◎	◎	◎	A	△	△	C	◎	◎	○	○	B	C
	RURENGE	Sa - 4	◎	◎	◎	△	C	◎	◎	△	C	△	△	C	◎	◎	○	○	A	C
	VUMWE	Sa - 8	◎	◎	◎	△	C	◎	◎	◎	A	△	△	C	◎	◎	○	○	B	C
RUKIRA	GASIRU	Sd - 4	◎	△	○	◎	C	○	◎	○	B	○	○	A	○	◎	○	○	B	B
	GITWE	Sc - 4	◎	○	△	◎	B	○	◎	△	C	△	◎	A	○	◎	○	○	B	C
	MUSHIKILI	Sc - 4	◎	○	△	△	C	○	◎	○	B	△	△	C	○	△	○	○	C	C
	NTARUKA	Sc - 1	◎	○	△	◎	B	○	◎	△	C	△	△	C	△	◎	○	○	C	C
	RUGARAMA	Sc - 3	◎	◎	△	△	C	○	◎	◎	B	△	△	C	◎	◎	○	○	B	C
BIRENGA	BARE	Sa - 3	◎	◎	◎	◎	A	○	○	△	C	○	◎	A	○	○	◎	◎	B	B
	BIRENGA	Sa - 3	◎	◎	◎	△	C	○	◎	○	B	△	○	B	○	◎	◎	○	A	C
	GAHARA	Sb - 7	○	◎	○	△	C	○	◎	○	B	○	◎	A	○	◎	○	○	B	C
	GAHULIRE	Sa - 3	◎	◎	◎	○	A	○	◎	△	C	△	△	C	○	◎	○	○	A	B
	GASHONGORA	Sa - 4	◎	◎	○	○	A	◎	○	△	C	△	△	C	○	◎	○	○	B	C
	KIBAYA	Sb - 6	○	◎	◎	△	C	◎	○	△	C	△	△	C	○	◎	○	○	B	C
	KIBIMBA	Sa - 3	◎	◎	◎	△	C	○	○	△	B	△	△	C	○	◎	○	○	B	C
	SAKARA	Sa - 4	◎	◎	◎	○	A	○	○	△	C	△	◎	A	◎	◎	○	○	B	B
RUSUMO	GATORE	Sc - 6	◎	◎	△	◎	B	◎	◎	○	B	△	○	B	○	△	◎	○	B	C
	KANKOBWA	Sa - 30	◎	◎	◎	○	A	◎	◎	○	B	△	△	C	△	◎	○	○	B	B
	KIGARAMA	Sa - 6	◎	◎	◎	◎	A	◎	◎	○	B	◎	△	B	◎	◎	○	○	B	B
	KIGINA	Sa - 11	◎	◎	◎	○	A	◎	◎	○	B	◎	◎	A	◎	◎	○	○	A	A
	KIREHE	Sa - 4	◎	◎	◎	○	A	○	◎	○	B	○	◎	A	◎	◎	○	○	A	A
	MUSAZA	Sc - 11	◎	◎	△	◎	B	○	◎	○	B	△	○	B	◎	◎	○	○	A	B
	NYABITARE	Sc - 9	◎	◎	△	△	C	○	◎	◎	B	△	△	C	○	○	○	○	B	C
	NYAMUGALI	Sd - 5	◎	△	○	△	C	○	◎	◎	A	△	◎	B	○	◎	○	○	B	C
	NYARUBUYE	Sc - 7	◎	◎	△	△	C	○	◎	◎	B	△	○	A	○	◎	○	○	B	C

Table O.2 (2)

TOTAL AND PER CAPITA COSTS OF SYSTEM-3 CONSTRUCTION (1/2)

Commune Name	Secteur Name	Population 2000	Water Demand (m3/day)	No. of Well	Construction Cost (RWF)	Cost/Capita (RWF)	Cost/Capita (US$)
RUKARA	GAHINI	3,827	111.4	12	55,466,400	14,493	113.2
	KIYENZI	3,511	56.8	6	27,733,200	7,899	61.7
	NYAKABUNGO	2,345	38.1	5	23,110,000	9,855	77.0
	NYAWERA	4,024	62.6	8	36,977,600	9,189	71.8
	RUKARA	6,677	119.9	12	79,202,400	11,862	92.7
	RWIMISHINYA	3,594	58.0	6	27,733,200	7,717	60.3
	RYAMANYONI	3,450	60.2	14	78,570,800	22,774	177.9
	TOTAL	27,428	507.0	63	328,793,600	11,988	93.7
MUGESERA	CYIZIHIRA	4,199	63.1	8	44,897,600	10,692	83.5
	GATARE	4,311	69.6	9	50,509,800	11,716	91.5
	KAGASHI	5,137	81.3	11	61,734,200	12,018	93.9
	KAREMBO	614	9.4	1	4,622,200	7,528	58.8
	KIBARE	4,892	75.8	10	56,122,000	11,472	89.6
	KIBILIZI-1,2	5,169	83.2	9	59,401,800	11,492	89.8
	KIRAMBO	3,584	53.9	7	39,285,400	10,961	85.6
	KUKABUYE	2,936	45.2	5	23,111,000	7,872	61.5
	MATONGO	3,726	56.0	7	39,285,400	10,544	82.4
	NGARA	3,944	62.0	7	32,355,400	8,204	64.1
	NYANGE	3,105	57.8	8	44,897,600	14,460	113.0
	SANGAZA	4,190	67.6	9	50,509,800	12,055	94.2
	SHYWA	3,931	62.4	8	44,897,600	11,421	89.2
	ZAZA	2,064	99.6	13	72,958,600	35,348	276.2
	TOTAL	51,802	886.9	112	624,588,400	12,057	94.2
SAKE	MBUYE	2,010	31.0	4	26,400,800	13,135	102.6
	MURWA	5,666	100.3	13	72,958,600	12,877	100.6
	RUKUMBERI	6,058	99.5	13	72,958,600	12,043	94.1
	SHOLI	5,521	89.3	12	67,346,400	12,198	95.3
	TOTAL	19,255	320.1	42	239,664,400	12,447	97.2
KAYONZA	GASOGI	2,617	41.5	5	33,001,000	12,610	98.5
	MBURABUTURO	1,932	29.1	3	19,800,600	10,249	80.1
	MUSUMBA	1,471	24.2	3	13,866,600	9,427	73.6
	NYAMIRAMA	3,285	53.8	6	27,733,200	8,442	66.0
	RUTARE	3,267	51.6	6	39,601,200	12,122	94.7
	RWINKWAVU	448	9.1	2	9,244,400	20,635	161.2
	SHYOGO	1,403	22.7	3	19,800,600	14,113	110.3
	TOTAL	14,423	232.0	28	163,047,600	11,305	88.3
RUTONDE	KADUHA	1,339	20.3	3	13,866,600	10,356	80.9
	RUTONDE	3,326	54.6	6	27,733,200	8,338	65.1
	RWERU	930	14.0	2	13,200,400	14,194	110.9
	SOVU	3,244	52.0	6	39,601,200	12,208	95.4
	TOTAL	8,839	140.9	17	94,401,400	10,680	83.4
KABARONDO	BISENGA	2,223	36.5	4	18,488,800	8,317	65.0
	MURAMA	941	15.0	2	9,244,400	9,824	76.8
	NKAMBA	934	14.1	2	9,244,400	9,898	77.3
	RURAMIRA	1,914	32.5	4	26,400,800	13,794	107.8
	RUSERA	2,159	32.5	4	18,488,800	8,564	66.9
	RUYONZA	1,115	16.7	2	9,244,400	8,291	64.8
	SHYANDA	887	14.2	2	13,200,400	14,882	116.3
	TOTAL	10,173	161.5	20	104,312,000	10,254	80.1

(continue)

TOTAL AND PER CAPITA COSTS OF SYSTEM-3 CONSTRUCTION (2/2)

Commune Name	Secteur Name	Population 2000	Water Demand (m3/day)	No. of Well	Construction Cost (RWF)	Cost/Capita (RWF)	Cost/Capita (US$)
KIGARAMA	GASETSA	696	12.3	3	13,866,600	19,923	155.7
	GASHANDA	2,326	41.4	5	23,111,000	9,936	77.6
	KABARE-1	1,507	38.6	4	18,488,800	12,269	95.8
	KABARE-2	3,370	61.1	10	46,222,000	13,716	107.2
	KABERANGWE	1,714	28.9	3	19,800,600	11,552	90.3
	KANSANA	2,395	43.2	5	23,111,000	9,650	75.4
	REMERA	1,748	31.8	4	26,400,800	15,103	118.0
	RUBONA	6,110	107.7	11	72,602,200	11,883	92.8
	RURENGE	1,924	33.3	4	18,488,800	9,610	75.1
	VUMWE	4,441	72.1	8	36,977,600	8,326	65.1
	TOTAL	26,231	470.4	57	299,069,400	11,401	89.1
RUKIRA	GASIRU	1,733	27.4	4	22,448,800	12,954	101.2
	GITWE	2,056	34.2	4	22,448,800	10,919	85.3
	MUSHIKILI	1,786	28.1	4	22,448,800	12,569	98.2
	NTARUKA	224	3.9	1	5,612,200	25,054	195.7
	RUGARAMA	1,883	29.6	3	16,836,600	8,941	69.9
	TOTAL	7,682	123.2	16	89,795,200	11,689	91.3
BIRENGA	BARE	1,237	21.9	3	13,866,600	11,210	87.6
	BIRENGA	1,351	23.6	3	13,866,600	10,264	80.2
	GAHARA	3,709	62.6	7	46,201,400	12,457	97.3
	GAHULIRE	1,512	24.5	3	13,866,600	9,171	71.6
	GASHONGORA	2,231	35.4	4	18,488,800	8,287	64.7
	KIBAYA	3,570	58.8	6	39,601,200	11,093	86.7
	KIBIMBA	1,522	26.9	3	13,866,600	9,111	71.2
	SAKARA	2,110	33.9	4	18,488,800	8,762	68.5
	TOTAL	17,242	287.6	33	178,246,600	10,338	80.8
RUSUMO	GATORE	3,285	54.2	6	33,673,200	10,251	80.1
	KANKOBWA	4,847	79.5	30	138,666,000	28,609	223.5
	KIGARAMA	3,361	53.4	6	27,733,200	8,251	64.5
	KIGINA	5,838	102.9	11	50,844,200	8,709	68.0
	KIREHE	2,149	36.6	4	18,488,800	8,603	67.2
	MUSAZA	6,978	108.0	11	61,734,200	8,847	69.1
	NYABITARE	5,177	82.6	9	50,509,800	9,757	76.2
	NYAMUGALI	1,679	28.2	5	28,061,000	16,713	130.6
	NYARUBUYE	3,455	59.9	7	39,285,400	11,371	88.8
	TOTAL	36,769	605.3	89	448,995,800	12,211	95.4
TOTAL		219,844	3735	477	2,570,914,400	11,694	91.4

TOTAL AND PER CAPITA COSTS OF SYSTEM-1, 2 CONSTRUCTION

Block Name	Population 2000	Water Demand (m3/day)	Construction Cost (RWF)	Cost/Capita (RWF)	Cost/Capita (US$)
SYSTEM-1					
1. MUHAZI	21,944	518.2	404,875,000	18,450	144.1
2. SAKE	33,865	774.9	441,716,000	13,043	101.9
TOTAL	55,859	1293.1	846,591,000	(15,156)	(118.4)
SYSTEM-2					
1. KAYONZA-1	4,374	100.4	76,806,000	17,560	137.2
2. KAYONZA-2	3,508	80.3	53,985,000	15,389	120.2
3. RUTONDE	3,720	80.7	35,374,000	9,509	74.3
4. KABARONDO	5,956	133.3	69,881,000	11,733	91.7
5. BIRENGA	3,588	77.8	53,163,000	14,817	115.8
6. RUSUMO-1	7,300	171.2	81,459,000	11,159	87.2
7. RUSUMO-2	8,292	199.0	107,811,000	13,002	101.6
8. RUSUMO-3	7,278	170.5	104,750,000	14,393	112.4
TOTAL	44,016	1,013	583,229,000	(13,250)	(103.5)

APPENDIX P

IMPLEMENTATION AND MANAGEMENT

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IMPLEMENTATION AND OPERATION/MAINTENANCE

1. PROJECT OPERATION AND ORGANIZATION

1.1 EXECUTING AGENCY

(1) Proposed Organization

The Directorate General of Water(DGW), The Ministry of Public Works, Energy and Water(MINITRAPPE), will be the executing agency for implementation of the project, coordinating the activities of all government agencies and regional administrative organizations concerned with the project implementation.

For the smooth and effective execution of The Project, it is proposed that Implementation Office(the RWI/ER Office) of Rural Water Supply Project in Eastern Region(RWSP/ER) will be established under the administration of the DGW, MINITRAPEE through Rural Water Supply Department(RWSD). The RWI/ER Office will be headed by a project manager appointed by DGW(see Fig. P.1).

The organization and activities should be detailed through implementation planning and D/D stages.

(2) Organization Structures and Personnels

For execution of the construction works, RWI/ER Office will have three(3) divisions at full development stage as Fig. P.2 and will be established for execution of following necessary works:

- Survey and study for physical(water resource hydrogeology etc.) and socio-economic conditions
- Observation of hydrology and meteorology
- Engineering of water supply facilities
- Water supply facilities construction

Stuff

The works and administrations of the Project operation are the major parts of the Rural Water Supply Development in Eastern Region of Rwanda.

RWI/ER office therefore, is to be conducted the necessary works by following staff proposed:

- Officer in Charge	1	Overall supervision and management
- Civil/Water supply Engineer	1	Engineering and supervision of civil works
- Facilities Engineer	1	Engineering and supervision
- Asst. Engineer	2	For well construction and water supply facilities
- Secretary	1	
- Driver	2	

Officer in charge and civil/water supply engineer will be appointed from DGW, MINITRAPEE and facility engineer should be recommended to be appointed from ELECTROGAZ.

1.2 FINANCING

The foreign currency portion and some parts of local currency of the Project will be financed by the international financing institutions. While, 40 to 60 % of the local currency portion will be appropriated by the Rwanda Government.

Furthermore, it is recommended that a few portions of local currency should be covered by construction works of the beneficiaries' service without pay. The portions for the service activities are estimated in Appendix Q and outlined as below:

System 1	:	18 % of L/C(10 % of total cost)
System 2	:	12 % of L/C(7 % of total cost)
System 3	:	7 % of L/C(3 % of total cost)

1.3 IMPLEMENTATION SCHEDULE FOR THE BASIC PLAN

Since GOR has a basic policy which aims at complete supply of drinking water for all of the people within this century, the implementation schedule of the Basic Plan will be made to complete all project components by the year 2000.

The implementation schedule is formulated on a target of completion within nine (9) years between 1992 and 2000; the first year for mainly preparatory work and four (4) Packages; Package A of 1993 to 1994, Package B of 1995 to 1996, Package C of 1997 to 1998 and Package D of 1999 to 2000, are proposed on account of the large project scale, long project period and smooth/effective execution.

The implementation schedule of Basic Plan is given in Fig. P.3, and estimated population served at each package of the Project are as presented in the table below.

	Package A	Package B	Package C	Package D	Total
System 1	21,944	33,865	0	0	55,809
System 2	13,838	0	14,608	15,570	44,016
System 3	37,868	65,026	58,475	58,475	219,844
System 4	12,500	12,500	12,500	12,530	50,530
Total	64,206	103,190	81,863	120,440	369,699

1.4 IMPLEMENTATION PLAN OF THE POSSIBLE PROJECT SCHEME

It would not be realistic to complete all of the individual projects proposed in the Basic Plan for Phase III Project by the year 2000 from the viewpoint of project financing, and the operation and maintenance systems of the facilities. At this stage, stgewise development will therefore be recommended.

Thus, the implementation program of the overall project in the Basic Plan for the Phase III Project is to be conducted in the following five stages. The overall implementation program for stagewise development is planned as shown in Table P.1.

Phase III-A : Initial Phase
Phase III-B : Consolidation I Phase
Phase III-C : Review Phase
Phase III-D : Consolidation II Phase
Phase III-E : Self-help Operation Phase (Completion Stage)

During the Phase III-A and III-B periods, the Possible Project Scheme would be implemented in order of priority and communications between the government offices and the area resident would be enhanced.

During Phase III-C, evaluation of the implemented Possible Project Scheme during Phase III-A and III-B periods would be carried out. During the Phase III-D period, deferred projects of the Basic Plan after the year 2000 will be implemented. Finally, Phase III-E is the completion stage of the Phase III Project.

Therefore, the schedule of the Possible Project Scheme was based on a target of completion within nine (9) years between 1992 and 2000, as given in Fig. P.4. The first years is mainly for preparatory work and the remaining years are divided in four (4) packages. Package A from

1993 to 1994, Package B from 1995 to 1996, Package C from 1997 to 1998 and Package D from 1999 to 2000.

-Package A: System 2 (Kayonza-2 and Kabarondo Blocks)
(1993-1994) System 3 (Wells of Priority A)
-Package B: System 1 (Muhazi Block)
(1995-1996) System 2 (Kayonza-1 block)
System 3 (Wells of Priority B)
-Package C: System 3 (Wells of Priority B)
(1997-1998)
-Package D: System 1 (Sake Block)
(1999-2000) System 3 (Wells of Priority B)

The implementation components of the possible project scheme in the Area are as follows:

1) Preparatory Works

The preparatory works such as organizing of the project organization(RWIO/ER etc.), mobilization and setting up of facilities would be carried out. And it is strongly recommended to avoid unnecessary delay at this stage in order to provide the smooth implementation of such a large scale project.

2) Detailed Design/Basic Design Work

MINITRAPEE has experience in project construction for rural water supply development. Nevertheless, there is an inadequate number of experienced persons for detailed design/basic design and project supervision of large scale project, including tendering which is necessary to execute the proposed project works. Therefore, experienced foreign and local engineering team/consultants will contribute to the project implementation especially at this design stage.

3) Construction Works and Supplying Program

Construction will start as soon as possible in order to provide efficient/smooth execution.

<u>System 1(Piped System)</u>
Construction of the system will takes around 2 years and work components are intake/treatment facilities, water conveyance facilities, storage and water distribution facilities. Around 12 months is necessary to construct a system. Therefore, one site or two sites of the system will be constructed within one project package.

System 2(Small Scale Piped System)
The construction totally will takes about 4 years. Work components are well construction, water conveyance facilities, storage and water distribution facilities. Around 4 to 6 months is necessary to construct a system. Therefore, it is considered that one construction team can construct 3 systems per year.

System 3(Shallow well - Manual Pump - System)
Totally, the system will takes around 8 years; construction of 30 wells per one drilling machinery set is proposed as a annual maximum, and the work components are well digging, pump installation and related structure. It is recommended maintenance works should be conducted for a few years after the completion of well construction.

System 4(Rainwater Storage System)
Supplying and financing Program for the System will be carried out taking around 8 years. The components of the Program are supplying the catchment and storage facilities. It is proposed that 1,000 households will be involved per year at a maximum.

4) Training

Training will be commenced after obtaining the loan/grant agreement for second package(Package B). The main training term will be half a year, however, it is necessary to continue the proposed training programs through MINITRAPEE for future period.

2. OPERATION AND MAINTENANCE

2.1 PRESENT SITUATION

The existing operation and maintenance problems in the Study Area are summarized below:

- As the spare parts for the handpumps are stored in Kigali, the country's capital, the local residents cannot perform prompt maintenance and repair work.
- Many of the water supply facilities are inoperative due to mechanical failure, difficulties in obtaining fuel, or for financial reasons.
- Water fee collecting systems are not fully functioned.
- Not all water fees collected by communes are used for the operation and maintenance of the water supply facilities.

2.2 PROPOSED INSTITUTIONAL SUPPORT

(1) Proposed Measure for Improvement of O/M System

To achieve prospective water supply development, the introduction of institutional support systems will be needed first, because many institutions to operate and manage the water supply system are lacking in the Prefecture.

MINITRAPEE also proposed a policy whereby water supply recipients would pay facility operation and maintenance costs and MINITRAPEE has examined various water supply administrative structures including the promotion of a program aimed at making the residents more conscious of their water supply(see Appendix F).

Considering all these, the basis for the promotion of water supply development will be a comprehensive operation and management body, which will carry out the following activities necessary for the appropriate rural water supply development:

- General administration for rural water supply
- Providing O/M services
- Guidance and extension of O/M techniques to operator/worker at site level and general health educations
- Coordination, account and administration of water fee collection
- Purchasing O/M supplies and O/M equipments
- Storage O/M supplies and O/M equipments
- Promoting O/M groups of Sectors level
- Other relevant matters of O/M and water fee Charge

At this Study stage, O/M Unit and System Management Organization which will take full responsibility for matters relevant to the subject of O/M and water fees. The functions of the O/M Unit and Management Organization should be more comprehensive covering the activities mentioned above.

(2) Proposed Organization

Organizational Structures and Their Functions

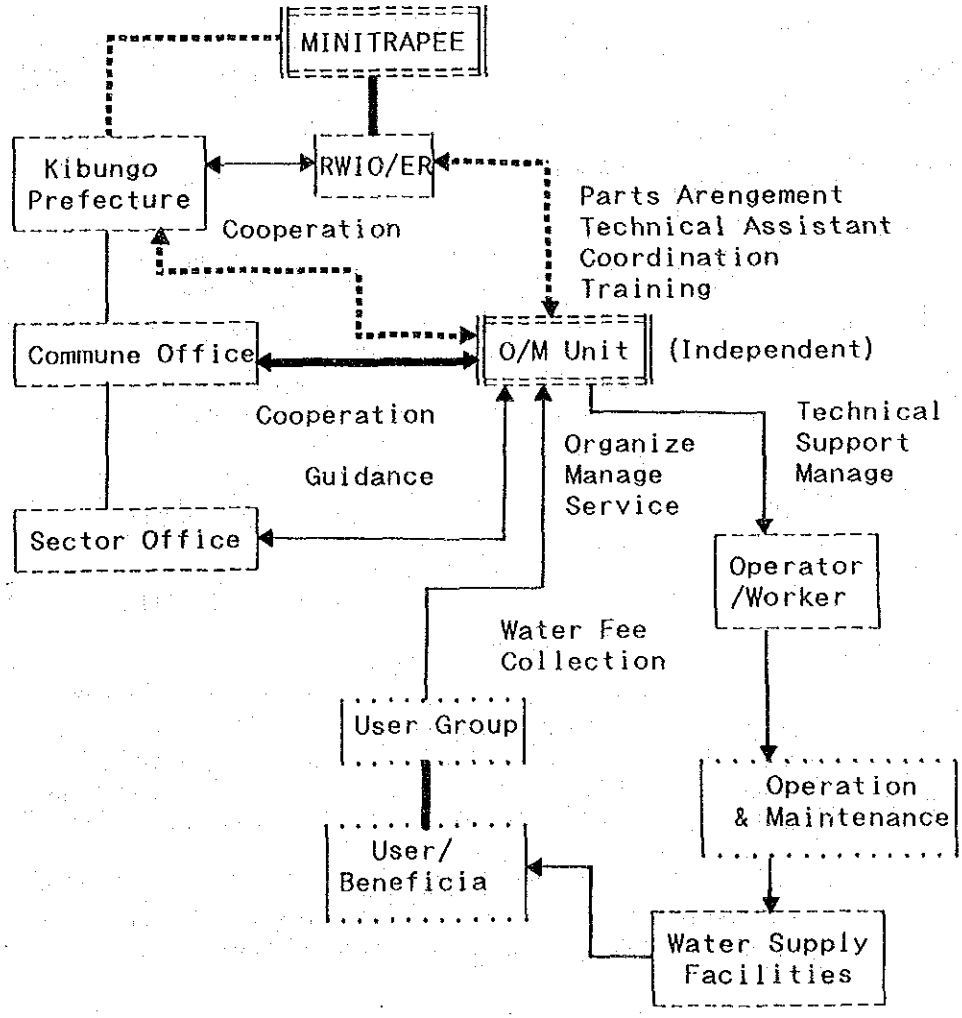
The organizational structure is proposed by referring to the MINITRAPEE's water supply facility operation and maintenance organizational structure which has a commune as its basic unit.

O/M unit is organization at same level of "Public Association for Water Supply" of MINITRAPEE which take care of their overall water supply administrative works.

The proposed O/M Unit is to be organized by representatives of the water supply recipients and commune office personnel as shown in the following figure. If the water supply recipients do not have management capabilities, it is proposed that the O/M unit should be managed mainly by commune office personnel.

It is strongly recommended that the technical management of piped system(System 1 and System 2) will be conducted by ELECTROGAZ. Individual management is required for System 4 by beneficiaries.

The structure of O/M Unit are given in Fig. P.5 and the relationship among the proposed organization will be presented as follows:



Stuff Personnel

[O/M Unit]

O/M works and administrations of water fee charge are one of the major parts of the continuous rural water supply development.

O/M Unit is therefore, to be conducted the necessary O/M works by following staff proposed:

- Head	1	Overall supervision and management
- Saving/Accounting	1	Generalists of accounting works
- O/M Management Staff	1	O/M specialist
- O/M Service Worker & Collector	2	Mechanic technician
- Administrator/Clerk	1	Generalists of administration
- Office Keeper	1	

O/M service worker shall conduct some maintenance works of piped and non-piped water supply systems including technology transfer to villagers.

[System Management Organization]

Systems 1 and 2

O/M works and some administrations of system management are required for each system of Systems 1 and 2. System management Organization is to be conducted the necessary O/M works by following staff proposed:

- Head	1	Overall supervision and management
- O/M Service Worker & Collector	1	Mechanic technician (employed by ELECTROGAZ)
- Administrator/Clerk	1	Generalists of administration
- Water Sale-person	some	Management of KIOSK(public standpipe)

It is recommended that one villager with some technical knowledge should be appointed at management organization of each piped system to maintain the water supply facilities and to collect water fees of both System 2(small scale) and System 1 as a full-time operator /worker.

The technical operator/worker of System 1 and 2 is employed by ELECTROGAZ as a site level worker and the

personnel expense of the worker should be paid to ELECTROGAZ from the System Management Organization.

The system which water selling right of each KIOSK will be provided to the Tap Manager is employed. Therefore, Tap Manager should be appointed as a pert-time worker and specific charge of supplied water at the KIOSK will be his income.

It is proposed that head and administrator of the Organization who carry out the general administration and management in shifts and without pay.

In case of non-piped water supply systems,i.e. point shallow well water supply, it is also proposed that a few designated workers maintain the facilities in shifts and without pay, since the works are simple and short.

2.3 RESPONSIBILITY OF ORIGINAL ADMINISTRATION

The original administration offices with their responsibilities to support O/M Unit are as follows:

Administration office	Responsibility
MINITRAPEE	Management Coordination Technical Advice Technical Training
ELECTROGAZ	Management Technical Advice
Kibungo Prefecture	Cooperation System/extension Health Service Supporting Service
Commune Office	Community Group Improvement Cooperation System

2.4 TRAINING

At this stage, it is strongly required, for sustainable development of "The Rural Water Supply Project in The Eastern Region(Phase III)", that training program would be considered in order to promote the O/M and water fee charge system efficiently and effectively.

The training program below as one of the whole rural

water supply program component of Kibungo Prefecture should be proposed.

- Training courses for O/M workers at site level
- Training for O/M manager and O/M service worker of O/M Unit
- Courses for accountants, administrators and collectors of O/M Unit

Also, it is recommended that specific training for instructors and National officials regarding O/M system establishment is undertaken.

The schedule of training program is tentatively proposed as in "Implementation Schedule".

In addition, it is proposed that residents promotion and education activities concerned with water supply and public health with the cooperation of recipient unions, water management committees, and the public association for water supply should be carried out as a National Program.

According to the Government policy, since it is proposed that CCDFP will be newly established in each commune, CCDFP should extend water supply knowledge to the residents and provide training for personnel in charge of accounting and technical matters.

2.5 ACTIVITIES

O/M Unit

Stuff
4 Persons(see O/M Structure)

Activities
- General administration
- Control O/M services
- Guidance and extension of O/M techniques to operator/worker at site level and general health educations
- Coordination, account and administration of water fee management
- Purchasing O/M supplies and O/M equipments
- Storage O/M supplies and O/M equipments
- Promoting O/M groups of Sectors level
- Other relevant matters of O/M and water fee charge

System Management Organization

Stuff
3 Persons(see O/M Structure)+ some Pert-time worker

Activities
- Providing O/M services(supported by ELECTROGAZ)
- Guidance and extension of O/M techniques to users group of each System and general health educations
- Coordination, account and administration of water fee collection
- Other relevant matters of O/M and water fee charge
- Water supply works

3. DETERMINATION OF OPERATION AND MAINTENANCE COST

A water fee should be collected for each water supply system. The water fee rate to cover the operation and maintenance costs will vary according to the size and service level of each water supply system.

According to the O/M cost classification of MINITRAPEE(see Section 9.2 of Appendix F), the water fee is thought to be composed of the following three levels:

-Level 1: Costs required for the management, operation, and maintenance works

-Level 2: Costs of Level 1 plus non-machinery costs

-Level 3: Costs of Level 2 plus machinery costs

MINITRAPEE's policy is to collect water fees at least for Level 1 from water supply recipients.

The system's operation and management costs consist of the operation and maintenance costs and the system management costs as follows:

	Cost for O/M Unit (FRW/M/Person)		System Management Cost(FRW/M/system)
System 1:	2.5		690,000 - 950,000
System 2:	2.5	Elec. power:	55,000 - 100,000
		Generator :	over 420,000
System 3:	2.5		1,270
System 4:	2.5		

The operation and maintenance costs for different water supply systems at Level 3(overall O/M cost) are estimated in Tables Q.10, Q.11 and Q.12 and are outlined as below:

System 1 :Level 3 185 to 203 FRW(1.4 -1.6 US$)/F
Level 2 140 to 155 FRW(1.1 -1.2 US$)/F
Level 1 125 to 140 FRW(1.0 -1.1 US$)/F

System 2 :

Electric power
Level 3 120 to 150 FRW(0.9 -1.15US$)/F

Generator
Level 3 700 to 1,335 FRW(5.5-10.4US$)/F

System 3 :Level 3 27 to 63 FRW(0.2 -0.5 US$)/F

The costs of all sub-project form less than 5 % of average income per family at farmer's level which is estimated as 1.5 US$/family, is considered to be acceptable in the household economy.

4. WATER FEE COLLECTION SYSTEM

Based on the above operation and maintenance costs, by referencing the water fee collection system concept described in MINITRAPEE's report, and by taking into account the financial capability of the residents, it is proposed that the water fee collection system adopted for the Phase III Project to be the fixed fee rate and meter rate method.

At the stage, it is recommended that the water fees at Level 2 of MINITRAPEE should be collected from the water supply recipients.

4.1 WATER FEE RATE

Based on the concept that operation and maintenance costs be basically collected from the residents, the water fee rate for each water supply system is to be established as follows:

System 1:

From the field surveys made of existing water supply systems, it was found that around 60 percent of the designed water supply capacities of those systems collecting water fees wa actually used.

Thus, for the Phase III Project, a decision was made to have about 50 % of the planned water supply amount, ie., 65 liters/household/day(2.0 m3/household/month), be subjected to the basic fixed water fee rate.

Based on the operation and maintenance cost, the standards for the water fee rates are to be as follows:

Basic Fixed Fee Rate:	100 FRW/household/month
Meter Fee Rate:	No charge up to 2.0 m3/month. 2.0 FRW/20 liters or 100 FRW/m3 in excess of 2.0 m3/month.

System 2:

Based on the same concept as System 1, it is proposed that the basic fixed fee rate plus the meter fee rate be adopted for System 2.

Based on System 2's operation and maintenance cost, the following fee collection system is to be set up:

Basic Fixed Fee:	70 FRW/household/month
Meter Fee Rate:	No charge up to 2.0 m3/month. 2.0 FRW/20 liters or 100 FRW/m3 in excess of 2.0 m3/month.

System 3:

Only the basic fixed fee rate shall be applied for System 3. Residents shall organize a water users' union for each well; each union shall collect the water fees.

As technical matters concerned with well management will be taken care of at the commune level, the collected water fees shall be managed by the operation and management Unit(O/M Unit) established in each commune.

Water fee collectors shall be elected by the residents in each Secteur or Commune.

Water fee rates will vary according to the number of wells and the population in each Secteur(see Table Q.13).

Based on System 3's operation and maintenance cost, the water fee rate will be 30 to 65 FRW(0.25-0.5 US$)/household/month.

System 4:

Basically, the water fee for System 4 should include each water supply unit's operation and maintenance cost for each household.

To maintain an adequate water supply environment, it was estimated that 5 FRW/household/month would be required. However, a decision was made to collect 15 FRW/household /month by each commune as a form of water supply administration fee that is necessary to maintain the operation and maintenance unit of the commune.

4.2 WATER SUPPLY METHOD

By taking into account the water fee collection system, the Kiosk method is thought to be most appropriate for Systems 1 and 2.

The water supply manager of the Kiosk would be a part-time employee of the System Management Organization. The manager would be paid according to the amount of water he sells. His salary is planned to be about 7 FRW per cubic meter.

5. BALANCE OF OPERATION AND MAINTENANCE COST

5.1 SUMMARY OF THE BALANCE

According to the water fee collection system, the operation/maintenance cost for System 1, 2 and 3 was estimated as shown in Appendix Q.

The financial evaluation of each System is summarized as follows:

System 1:

The operation and maintenance cost for each water supply system is as follows:

The system's annual costs of Level 2 which do not contain replace cost of machinery equipment, will be 6,863,040 FRW in Muhazi and 9,259,932 FRW in Sake, while the annual water fee revenue will be 8,452,290 FRW and 13,046,880 FRW, respectively. The positive balance will be deposited to pay for unit replacement and spare parts purchases.

The estimated repair costs for machinery parts is converted annually. But, in reality, 645,000 FRW will be needed every three years for Muhazi, and 780,000 FRW for Sake.

System 2:

The balance of water fees and the operation and maintenance cost for each water supply system which will use supplied electric power is as follows:

The highest annual operation and maintenance cost will be Rusumo-2's 21 million FRW, while its water fee revenue will be 1.5 million FRW per year.

The lowest annual operation and maintenance cost will be Kayonza-1's 850,716 FRW, while its water fee revenue will be 118,462 FRW per year. The same as for System 1, System 2 will need from 40,000 to 75,000 FRW for supplied electric power system and 75,000 to 300,000 FRW for engine generator system every three years for repair costs.

The annual O/M costs of systems with engine generated power facilities are estimated over 5.5 to 21.0 million FRW(45,000-165,000 US$).

System 3:

The water fee revenue for System 3 was estimated for each Secteur(see Table P.2).

Rukumberi Secteur of Sake Commune will need the highest water fee revenue of 424,200 FRW(3,314 US$) per year. Ntaruka Secteur in Rukira Commune will need the lowest water revenue of 22,800 FRW(178 US$) per year. It is believed that the mostly same amount of water fee revenue will be needed every year to cover the operation and maintenance cost.

The water fee revenue and the operation and maintenance cost will be balanced within each commune and the annual scale range from 45,000 to 300,000 FRW(350-2,350 US$).

5.2 FINANCIAL MANAGEMENT

Based on MINITRAPEE's proposal, CCDR of CID will be the main office for handing the financial management of Phase III Project's water supply systems.

The total water fee revenue from Phase III Project's water supply systems in Kibungo Prefecture will be 102 million FRW per year.

By assuming that 10 percent of the revenue will be needed to cover the repair costs for Systems 1 and 2 every three years. To finance the payment of such costs, 9.7 million FRW should be deposited every year in the Kibungo Prefecture.

The financial management of water supply systems in each commune should be handled by the commune's O/M Unit.

Each commune's money balance is shown in Table P.3. Sake Commune will have the largest balance. Its yearly revenue will be 13.16 million FRW per year whilst its expenditure will be 9.36 million FRW per year. Rukira Commune will have the smallest balance. Its annual revenue will be 52,000 FRW while its annual expenditures will be 39,525 FRW.

Overall Implementation Program for Basic Plan

Phase	Phase III - A	Phase III - B	Phase III - C	Phase III - D	Phase III - E
	Initial Phase	Consolidation I Phase	Review Phase	Consolidation II Phase	Self-help Operation Phase
Objective and Target	1) Government and aiding organizations will gain residents' trust. 2) Stimulate area residents' aspirations. 3) Find out problems involved in the Plan as soon as possible 4) Accumulate field personnel's know-how and skills	1) Increase the number of experienced and skillful field personnel and organise them 2) Develop standard techniques and construction methods to be used in planned projects 3) Decide facilities' and equipment's technical standards	1) Review possible projects to be implemented by the year 2000 2) Review the social and economic changes by the year 2000 3) Based on 1) and 2) above, review the Basic Plan of the Phase III Project.	1) Unlike the Initial Phase and Consolidation II Phase, establish country level development policy 2) Prepare sufficient funds, manpower, and organizations 3) Make steady progress, even at slow speed.	1) Aim at area residents' self-supporting management 2) Develop operation and maintenance organization and expand the fields in which area residents can participate
Special Attention	1) Not to make oversized 2) Select appropriate areas 3) Well understand each area's major economic and social features 4) Promote acceleration campaign 5) Use simple techniques 6) Select field personnel having well-rounded personalities 7) Select convenient areas for transportation and communications	Select appropriate special attention items specified in the left column and develop appropriate development methods	1) Review and revise the development policy and the development level to suit the economic and social conditions in the year 2000 2) Adjust each concerned project to conform to other projects	1) Close cooperation between the Government organization and the aiding organization 2) If project implementation is carried out under the area residents' petition or political pressure, the Government may lose the residents' trust.	
Implementation Schedule	Implementation Schedule of Possible Projects		Evaluation of Possible Projects and Review of the Basic Plan	Implementation of Other Projects	Establishment of Area Residents' Self-supporting Management Organization
Related Program	Residents' Promotion Education Program				
	Training Program for Water Supply Technicians				
		Strengthening Program of Commune and Water Committee Organization			

Table P.1