

2.1.3 Outline of Reservoir Plan

(1) Runoff Water

Quantity of inflow water to the reservoir was calculated for 8 sites including Bugesera3 and Bugesera 4 in LWH project report. Based on the result of the calculation, inflow water quantity of 4 sites in this project is estimated. Normally, the capacity of the reservoir is determined estimating the inflow water quantity from the record of stream flow quantity, however, there are only limited data of stream flow quantity in Rwanda and there is no data to estimate the inflow water of the 4 sites. Therefore, the inflow water quantity is estimated using a formula proposed by Ministry of Water Resources in Ethiopia which estimates runoff water in tropical mountainous area from monthly rainfall data.

The inflow water quantity for the objective for sites in this project is calculated, assuming that, the quantity per area of Bugesera 2 is the same as that of Bugesera3, the quantity per area of Gatsibo31 is the same as that of Gatsibo32, the quantity per area of Ngoma21 and Ngoma22 is the same as average of Bugesera4, Bugesera3 and Kayonza15. The result is shown in the Table 2.1.40.

There is no perennial flow in Bugesera2, Bugesera3 and Ngoma21, and there happens a stream only when it rains. Since the water flow data is very important for planning a reservoir, it is necessary to observe the water flow even in a short period and utilize as a reference data to examine the result of calculation.

There are springs downstream of Ngoma22 and they should be included in the estimation to establish an effective irrigation plan.

Following is an example of calculation for Bugesera3 in LWH project report.

The rain fall data of nearest observation station Karama Plateau is not enough and shortfall is compensated with the data from Kigali. Monthly rain fall data is shown in the Table 2.1.39.

The inflow water quantity is estimated using a formula proposed by Ministry of Water Resources in Ethiopia which estimates runoff water in tropical mountainous area from monthly rainfall data.

$$Q_j = C_j * R_j * \left(\frac{R_j - S_j}{R_{mj}} \right)^\alpha$$

Q_j = Direct runoff of month

C_j = Monthly runoff coefficient

R_j = Monthly areal rainfall amounts over the Bugesera3 dam Watershed

R_{mj} = Average monthly areal rainfall for a reference period (mm)

S_j = Initial water losses (storage, interception, etc.) (mm)

α = The parameter for twining with variability of the natural flow (1.035)

$R_j < S_j, Q_j = 0$

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
C_j	0.10	0.12	0.19	0.25	0.15	0.04	0.03	0.05	0.09	0.16	0.20	0.13
S_j	29	24	19	14	19	38	38	38	29	24	14	24
R_{mj}	70	74	106	140	95	13	7	19	41	82	111	69

The result of calculation is shown in the Table 2.1.40.

Table 2.1.39 Bugesera3 Monthly Rainfall

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1971	24	104	47	163	156	4	0	36	82	76	89	33	813
1972	53	39	195	83	71	63	55	1	11	63	136	74	843
1973	68	33	70	129	61	2	20	4	64	165	48	66	729
1974	72	124	12	138	65	3	1	29	37	54	54	82	671
1975	40	69	117	173	105	13	8	10	35	78	123	110	881
1976	72	82	174	128	58	0	0	18	50	99	134	121	935
1977	113	67	100	235	240	13	3	6	13	43	106	61	1000
1978	25	41	113	54	176	3	0	2	36	63	122	26	659
1979	55	30	137	160	18	6	0	81	60	100	46	81	773
1980	65	124	86	112	136	12	1	3	104	58	144	59	903
1981	111	127	126	189	65	0	0	69	46	78	89	61	961
1982	61	44	42	182	136	15	2	2	54	98	106	103	845
1983	29	73	53	174	26	51	1	14	24	113	135	85	779
1984	57	102	86	173	29	0	35	28	21	102	124	68	826
1985	58	57	87	272	50	1	1	2	54	88	182	31	883
1986	64	96	80	235	83	7	0	0	6	68	103	99	841
1987	72	96	88	136	219	21	0	6	54	77	200	27	997
1988	115	109	166	92	153	0	9	49	41	99	120	58	1012
1989	66	58	81	234	79	18	1	22	26	71	86	109	851
1990	71	129	121	164	40	0	0	7	83	84	76	99	875
1991	64	88	73	120	184	16	6	14	28	114	64	43	813
1992	44	45	83	121	44	24	1	1	31	68	51	69	582
1993	122	83	58	76	123	7	0	34	12	27	115	24	681
1994	120	53	183	111	45	0	0	33	42	51	149	96	884
1995	73	53	106	133	117	54	0	1	40	102	132	38	849
1996	40	90	121	107	43	39	22	48	43	41	64	23	681
1997	111	42	88	147	61	57	4	21	6	130	139	109	915
1998	136	185	143	80	228	30	5	21	46	83	115	45	1118
1999	62	17	194	105	45	0	0	33	42	38	100	85	720
2000	21	54	89	72	53	0	0	3	18	101	136	62	609
2001	77	56	228	72	63	0	71	11	46	176	175	81	1057
2002	148	61	88	134	149	0	0	0	19	78	110	108	894
2003	58	28	66	104	51	0	0	33	79	83	96	40	638
2004	64	67	101	173	24	3	0	8	40	55	72	68	674
2005	62	39	119	79	90	9	0	21	60	100	52	24	655
2006	22	84	100	187	121	4	9	13	19	45	199	115	916
Mean	70	74	106	140	95	13	7	19	41	82	111	69	827
Max	148	185	228	272	240	63	71	81	104	176	200	121	1118
Min	21	17	12	54	18	0	0	0	6	27	46	23	582

Table 2.1.40 Inflow into Bugesera3 (LWH Detailed Survey and Design Study Report, 2008)

Inflow (m3/s) into Bugassera 3 reservoir														
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Q	1000m ³
1971	0.000	0.022	0.003	0.067	0.052	0.000	0.000	0.000	0.015	0.011	0.018	0.001	0.016	496.7
1972	0.002	0.001	0.095	0.015	0.008	0.007	0.005	0.000	0.000	0.006	0.046	0.010	0.016	512.5
1973	0.005	0.001	0.009	0.040	0.006	0.000	0.000	0.000	0.007	0.069	0.004	0.007	0.012	388.9
1974	0.006	0.033	0.000	0.046	0.007	0.000	0.000	0.000	0.001	0.004	0.005	0.013	0.010	302.2
1975	0.001	0.008	0.030	0.077	0.021	0.000	0.000	0.000	0.001	0.011	0.037	0.026	0.018	557.1
1976	0.006	0.012	0.073	0.039	0.005	0.000	0.000	0.000	0.003	0.021	0.044	0.033	0.020	620.2
1977	0.020	0.007	0.021	0.151	0.137	0.000	0.000	0.000	0.000	0.002	0.026	0.006	0.031	972.4
1978	0.000	0.002	0.027	0.005	0.069	0.000	0.000	0.000	0.001	0.007	0.036	0.000	0.012	386.3
1979	0.003	0.000	0.043	0.065	0.000	0.000	0.000	0.015	0.006	0.021	0.004	0.013	0.014	446.8
1980	0.005	0.033	0.014	0.029	0.038	0.000	0.000	0.000	0.028	0.005	0.052	0.005	0.017	549.3
1981	0.019	0.035	0.035	0.093	0.007	0.000	0.000	0.009	0.003	0.011	0.017	0.006	0.020	617.6
1982	0.004	0.002	0.002	0.086	0.038	0.000	0.000	0.000	0.005	0.021	0.026	0.022	0.017	541.4
1983	0.000	0.009	0.004	0.078	0.000	0.003	0.000	0.000	0.000	0.029	0.045	0.014	0.015	478.3
1984	0.003	0.021	0.015	0.077	0.001	0.000	0.000	0.000	0.000	0.022	0.037	0.008	0.015	483.6
1985	0.003	0.004	0.015	0.207	0.003	0.000	0.000	0.000	0.005	0.016	0.088	0.000	0.028	896.1
1986	0.004	0.018	0.012	0.150	0.012	0.000	0.000	0.000	0.000	0.008	0.025	0.020	0.021	654.4
1987	0.006	0.018	0.015	0.045	0.112	0.000	0.000	0.000	0.005	0.011	0.109	0.000	0.027	843.6
1988	0.021	0.024	0.066	0.019	0.050	0.000	0.000	0.002	0.002	0.021	0.035	0.005	0.020	643.9
1989	0.005	0.005	0.013	0.149	0.011	0.000	0.000	0.000	0.000	0.009	0.016	0.026	0.020	615.0
1990	0.006	0.037	0.032	0.068	0.002	0.000	0.000	0.000	0.016	0.014	0.012	0.020	0.017	544.0
1991	0.004	0.015	0.010	0.034	0.076	0.000	0.000	0.000	0.000	0.029	0.008	0.002	0.015	467.8
1992	0.001	0.002	0.013	0.035	0.002	0.000	0.000	0.000	0.000	0.008	0.005	0.008	0.006	194.5
1993	0.024	0.012	0.005	0.012	0.030	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.010	299.6
1994	0.023	0.004	0.083	0.029	0.002	0.000	0.000	0.000	0.002	0.003	0.057	0.019	0.019	583.4
1995	0.006	0.004	0.024	0.043	0.027	0.004	0.000	0.000	0.001	0.022	0.043	0.001	0.015	459.9
1996	0.001	0.015	0.032	0.026	0.002	0.000	0.000	0.002	0.002	0.002	0.008	0.000	0.008	236.5
1997	0.019	0.002	0.015	0.054	0.006	0.005	0.000	0.000	0.000	0.040	0.048	0.026	0.018	565.0
1998	0.031	0.084	0.047	0.013	0.122	0.000	0.000	0.000	0.002	0.014	0.032	0.002	0.029	911.9
1999	0.004	0.000	0.093	0.025	0.002	0.000	0.000	0.000	0.002	0.001	0.023	0.014	0.014	431.0
2000	0.000	0.004	0.016	0.011	0.004	0.000	0.000	0.000	0.000	0.022	0.046	0.006	0.009	286.5
2001	0.007	0.004	0.134	0.011	0.006	0.000	0.014	0.000	0.003	0.080	0.081	0.012	0.029	925.1
2002	0.038	0.006	0.015	0.044	0.047	0.000	0.000	0.000	0.000	0.011	0.029	0.025	0.018	565.0
2003	0.003	0.000	0.008	0.025	0.003	0.000	0.000	0.000	0.014	0.013	0.021	0.002	0.007	233.9
2004	0.004	0.007	0.021	0.077	0.000	0.000	0.000	0.000	0.001	0.004	0.011	0.008	0.011	349.5
2005	0.004	0.001	0.031	0.013	0.015	0.000	0.000	0.000	0.006	0.021	0.005	0.000	0.008	252.3
2006	0.000	0.013	0.020	0.092	0.029	0.000	0.000	0.000	0.000	0.002	0.107	0.030	0.024	770.0
Mean	0.008	0.013	0.030	0.057	0.026	0.001	0.001	0.001	0.004	0.016	0.034	0.011	0.017	530.1
Max	0.038	0.084	0.134	0.207	0.137	0.007	0.014	0.015	0.028	0.080	0.109	0.033	0.031	972.4
Min	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.006	194.5

(2) Sediment

Sediment is estimated utilizing the formula proposed by DFID guideline in LWH project report. The sediment for the objective for sites in this project is calculated, assuming that, the quantity per area of Bugesera 2 is the same as that of Bugesera3, the quantity per area of Gatsibo31 is the same as that of Gatsibo32, the quantity per area of Ngoma21 and Ngoma22 is the same as average of Bugesera4, Bugesera3 and Kayonza15. The result is shown in the Table 2.1.42. Since the terrain, soil and

vegetation is not so different among the sites, sediment per area of each site is not so different.

In the LWH report, design sediment is 30% of 30 years' cumulated sediment in case sediment can be reduced to 30% by soil conservation work. In this project, design sediment shall be 30% of 30 years' cumulated sediment.

Figure 2.1.62 shows sediment per area in 7 countries in East and Southern Africa. Among sites less than 10km², Bugesera3 (30%) is relevant. In Rwanda, soil conservation work progressed so far, planting Napier grass or Vetivar grass along the contour line and contour ridge cultivation became widespread and bare land became fewer. Therefore, quantity of sediment will be fewer than expected. Normally, the design sediment is cumulative counting of a hundred years but 30 years in LWH. Further measures for soil conservation is required to extend the life of the reservoir.

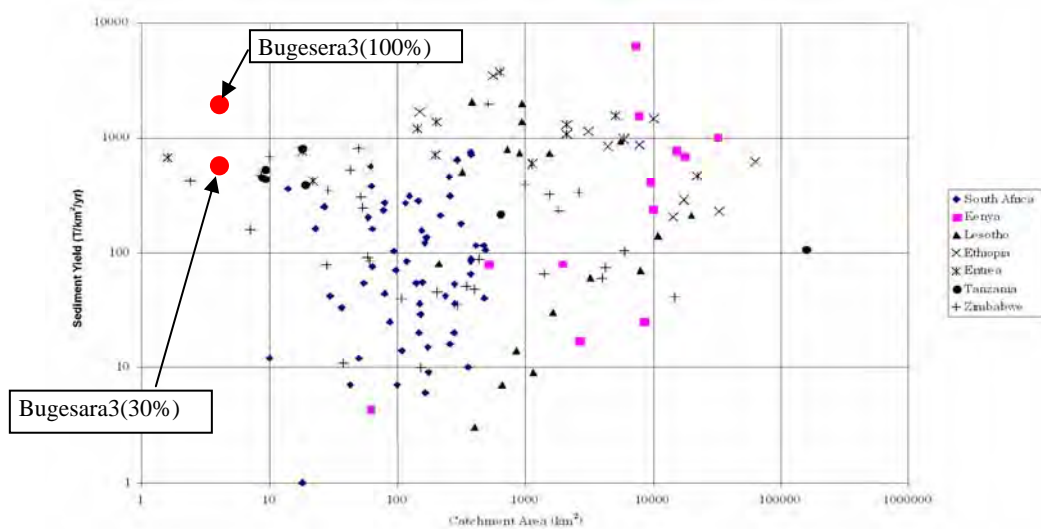


Figure 2.1.62 Sediment yield data for East and Southern Africa

(Guidelines for Predicting and Minimizing Sedimentation in Small Dams, DFID, 2004)

Following is calculation for Bugesera3

Formula

$$S y = 0.0194 * \text{Area}^{-0.2} * \text{MAP}^{0.7} * \text{Slope}^{0.3} * \text{SASE}^{1.2} * \text{STD}^{0.7} * \text{VC}^{0.5}$$

where

S y : Sediment yield (t/km²/year)

Area : Catchment Area (Bugesera3 : 3.05 km²)

MAP : Mean annual precipitation (Bugesera3 : 827 mm)

Slope : River slope (fraction) from the catchment boundary to the dam (Bugesera3 : 0.048)

SASE : Signs of active soil erosion (from Table 2.1.41 Bugesera3 : 25)

STD : Soil type and drainage (from Table 2.1.41 Bugesera3 : 21)

VC : Vegetation condition (from Table 2.1.41 Bugesera3 : 28)

The result is; S y = 1460 t /km²/year

Assuming the density = 1.2; 1216m³/km²/year

For 30 years

$$30 * 1216 * 3.05 = 111,293 \text{ m}^3$$

Considering soil conservation work, it will be reduced to 30%.

$$111,293 * 0.3 = 33,389 \text{ m}^3$$

Table 2.1.41 Catchment Characterization form (Guidelines for Predicting and Minimizing Sedimentation in Small Dams, DFID, 2004)

Soil Type & Drainage	No effective soil cover; either rock or thin shallow soils	40	Poorly drained compacted soils; much ponding on soil surface after heavy rains	30	Moderately well drained medium-textured soils; some ponding on soil surface after heavy rain	20	Well drained coarse-textured soils; little ponding on soil surface after heavy rain	10
Vegetation Condition over Whole Catchment	Little effective plant cover; ground bare or very sparse cover over 80% of catchment	40	Fair cover: >50% of catchment is cultivated with annual crops	15	Good cover: 20-50% of catchment is cultivated with annual crops	10	Excellent cover: <20% of catchment is cultivated with annual crops	5
			<30% of catchment is under good grass cover or protected forest cover	15	30-60% of catchment is under good grassland or protected forest cover	10	>60% of catchment is under well-maintained grassland and/or protected forest cover	5
Signs of Active Soil Erosion	Many actively eroding gullies (dongas) draining directly into dam and/or watercourses; active undercutting of riverbanks along main watercourses	40	Some actively eroding gullies (dongas) draining directly into dam and/or watercourses; moderate undercutting of riverbanks along main watercourses	20	Few actively eroding gullies (dongas) draining directly into dam and/or watercourses; little undercutting of riverbanks along main watercourses	10	No actively eroding gullies (dongas) draining directly into dam and/or watercourses; no undercutting of riverbanks along main watercourses	5

(3) Reservoir Capacity

Effective capacity is calculated from runoff, sediment and dead water. Dead water capacity of this project is assumed to be 10%.

Table 2.1.42 Effective Capacity of Each Reservoir

	Catchment Area km ²	Total Run off 1000m ³	Total Run off 1000m ³ /km ²	Reservoir Capacity 1000m ³	Dead water capacity 1000m ³	Sediment /30years 1000m ³	Sediment /30years 1000m ³ /km ²	Effective Capacity 1000m ³
Detail Design of LWH								
Bugesera 3	3.05	531.0	174.1	487.0	34.0	33.4	10.9	419.6
Bugesera 4	3.83	912.6	238.3	901.5	44.5	44.5	11.6	812.5
Gatsibo 8	2.56	483.9	189.0	440.0	39.0	28.8	11.3	372.2
Gatsibo 32	2.02	414.0	205.0	669.0	249.0	24.2	12.0	395.8
Karongi 12	4.51	2,277.0	504.9	568.0	63.0	57.5	12.7	447.5
Karongi 13	11.42	4,159.9	364.3	827.0	164.0	145.5	12.7	517.5
Kayonza 15	2.78	554.8	199.6	431.0	46.0	33.0	11.9	352.0
Nyanza 23	2.94	838.9	285.3	651.0	38.0	35.3	12.0	577.7
Proposed 4 sites								
Bugesera 2	3.24	564.1	174.1	456.5	46.0	35.5	10.9	375.0
Ngoma 21	2.06	420.2	204.0	442.0	22.0	23.7	11.5	396.3
Ngoma 22	8.81	1,797.1	204.0	1,371.0	137.0	101.1	11.5	1,132.9
Gatsibo 31	0.53	108.7	205.0	23.0	2.0	6.4	12.0	14.6

Effective Capacity = Total Capacity – Dead water capacity - Sediment

The quantity per area of Bugesera 2 is the same as that of Bugesera3

The quantity per area of Gatsibo31 is the same as that of Gatsibo32

The quantity per area of Ngoma21 and Ngoma22 is the same as average of Bugesera4, Bugesera3 and Kayonza15.

(4) Irrigable Area

The irrigable area is calculated water requirement and effective capacity of each dam. Three cases of cropping patterns were considered;

Case1: cropping pattern concentrated in commercial crop which LWH report recommends

Case2: cropping pattern granted farmers' wish

Case3: introducing paddy field

The result is shown in the Table 2.1.43.

Irrigable area of Gatsibo31 is extremely small and relevance of the project is very low. The irrigable area of Bugesera4 was calculated on the reservoir scale in LWH report. However, it needs reconsideration due to the height and fault, and the scale of the reservoir is expected to be reduced and the irrigable area will be reduced.

Cropping pattern needs to be discussed with MINAGRI. Various value for irrigation efficiency of paddy is proposed in many countries and it will be decided considering the value in neighboring countries.

1) Cropping pattern

Water requirement varies depending on cropping pattern. Three patterns were considered for each site.

Case1: This is recommended in the LWH report. 10% or 20% of plantain and 80% or 90% of commercial crop such as Pineapple, Mango, Avocado, Coffee, etc. Since paddy is cultivated 15% currently in Ngoma22, 20% of paddy and 80% of coffee is adopted.

Case2: This cropping pattern granted farmers' wish. 65 to 75% of maize, vegetable and 5 to 20% of plantain in Bugesera2, Ngoma21 and Gatsibo31. The cropping pattern of Bugesera3 and Bugesera4 is assumed to be the same as Bugesera2 because the farmers' wish was not surveyed.

Case3: Since many farmers in Bugesera2 and Ngoma21 wanted rice growing, the cropping pattern of 20 % of paddy and 80% of maize and vegetables was adopted.

2) Water Requirement

Water requirement for each crop is determined considering temperature, sun shine, humidity, wind speed and monthly precipitation. FAO-CROPWATT program was utilized as same as LWH report to calculate the water requirement.

In the LWH report, mean monthly precipitation is used. However, generally, the water requirement is calculated considering drought of once 5 years or 10 years. In this project, the 4th lowest precipitation in 36 years was adopted as data of monthly precipitation.

Irrigation efficiency : pipeline conveyance efficiency 95% x field application efficiency 0.7 = 0.65

Various value for irrigation efficiency of paddy is proposed in many countries and it will be decided considering the value in neighboring countries. Here 0.5 is adopted.

(5) Beneficiaries

The beneficiary area and actual number of beneficiary was not fixed in this study. According to the interview to the farmers in this study, farmland area per capita varies widely and it differs among sites. In the LWH report, average farmland per capita is 1.16ha in Bugesera3 and 1.5ha in Bugesera4. However, according to the interview to the farmers in this study, it is about 0.7ha. From this, the number of beneficiary is estimated 67 to 143 per 100ha.

Table 2.1.43 Water Requirement and Irrigable Area

Site case	Cropping Pattern	Irrigation Water Requirement	Irrigation Efficiency	Water Requirement	Total Water Requirement	Effective Reservoir Capacity	Total Irrigable area
		mm	%	m ³ /ha	m ³ /ha	1000m ³	ha
Bugesera 2 (1)	Banana20%, Pineapple80%	240.10	65	3,694	3,694	375.0	102
Bugesera 2 (2)	Maize65%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	361.90	65	5,568	5,568	375.0	67
Bugesera 2 (3-1)	Maize55%, Vegetables(1) 10%, Vegetables(2)10%, Banana5%	283.76	65	4,366	7,418	375.0	51
Bugesera 2 (3-2)	Paddy 20%	152.63	50	3,053			
Ngoma 21(1)	Banana20%, Avocado80%	509.32	65	7,836	7,836	376.3	48
Ngoma 21(2)	Maize75%, Vegetables(1) 10%, Vegetables(2)10%, Banana5%	400.46	65	6,161	6,161	376.3	61
Ngoma 21(3-1)	Maize65%, Vegetables(1) 5%, Vegetables(2)5%, Banana5%	309.99	65	4,769	7,722	376.3	49
Ngoma 21(3-2)	Paddy 20%	147.64	50	2,953			
Ngoma 22 (1-1)	Pineapple80%	42.74	65	658	3,610	1,132.9	314
Ngoma 22 (1-2)	Paddy 20%	147.64	50	2,953			
Ngoma 22 (2-1)	Maize15%, Vegetables(1) 30%, Vegetables(2)30%, Banana5%	255.29	65	3,928	6,880	1,132.9	165
Ngoma 22 (2-2)	Paddy 20%	147.64	50	2,953			
Gatsibo 31 (1)	Banana10%, Coffee90%	743.71	65	11,442	11,442	14.6	1
Gatsibo 31 (2)	Maize70%, Vegetables(1) 5%, Vegetables(2)5%, Banana20%	486.65	65	7,487	7,487	14.6	2
Bugesera 3 (1)	Banana10%, Pineapple90%	182.85	65	2,813	2,813	419.6	149
Bugesera 3 (2)	Maize65%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	361.90	65	5,568	5,568	419.6	75
Bugesera 3 (3-1)	Maize55%, Vegetables(1) 10%, Vegetables(2)10%, Banana5%	283.76	65	4,366	7,418	419.6	57
Bugesera 3 (3-2)	Paddy 20%	152.63	50	3,053			
Bugesera 4 (1)	Banana20%, Mangoes80%	734.40	65	11,298	11,298	812.5	72
Bugesera 4 (2)	Maize65%, Vegetables(1) 15%, Vegetables(2)15%, Banana5%	361.90	65	5,568	5,568	812.5	146
Bugesera 4 (3-1)	Maize55%, Vegetables(1) 10%, Vegetables(2)10%, Banana5%	283.76	65	4,366	7,418	812.5	110
Bugesera 4 (3-2)	Paddy 20%	152.63	50	3,053			

Water requirement = Irrigation water requirement × 100 × 100 / 1000 / irrigation efficiency

Total irrigable area = effective reservoir capacity / total water requirement

(6) Beneficiary Area

1) Bugesera2 and Bugesera3

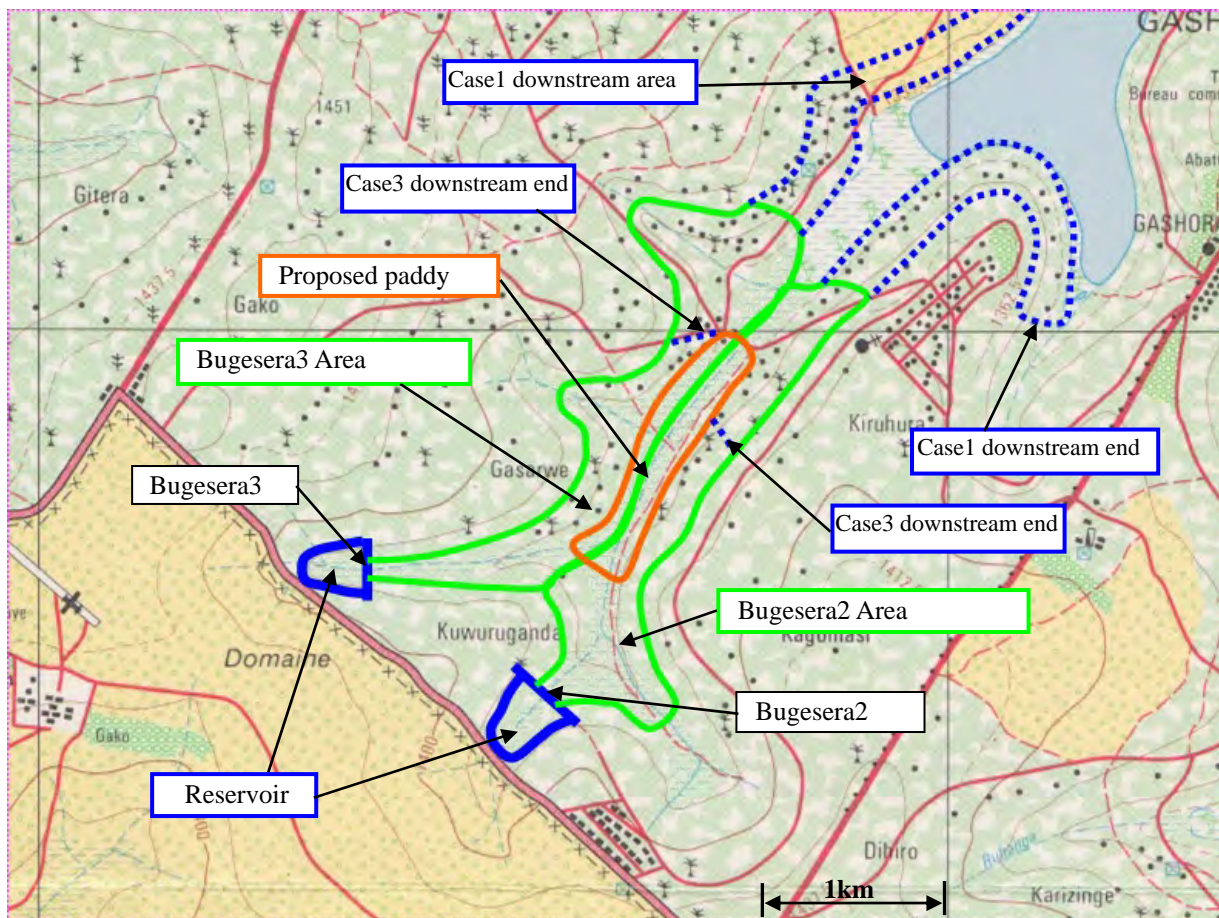


Figure 2.1.63 Bugesera2 and Bugesera3 Beneficiary Area

Current percentage of cropping area of each crop based on farmers interview and site survey is shown in the following Table. The percentage of Bugesera3 is not shown in LWH report but crops are almost same as Bugesera2 and it is assumed that the percentage is same as Bugesera2.

Table2.1.44 Current percentage of cropping area of each crop in Bugesera2

beans	cassava	sorghum	maize	Sweet potato	banana
30%	24%	22%	12%	7%	4%

Banana is planted in the river bed area and it is not grown well due to lack of rain fall. Other crops are planted on the slope area. The irrigable area varies depending on cropping pattern. The irrigable area of each cropping pattern is shown in the Table below.

Table 2.1.45 Cropping pattern Bugesera2 Gashora

Case	Cropping pattern	Irrigable Area ha
Case1	Banana20%、 pineapple80%	102
Case2	Maize65%、 Vegetable(1)15%、 Vegetable(2)15%、 Banana5%	67
Case3	Paddy20 %、 Maize55 %、 Vegetable(1)10 %、 Vegetable(2)10 %、 Banana5%	51

Table 2.1.46 Proposed Cropping Pattern Bugesera3 Rilima

Case	Cropping pattern	Irrigable Area ha
Case1	Banana10%、 Pineapple90%	149
Case2	Maize65%、 Vegetable(1)15%、 Vegetable(2)15%、 Banana5%	75
Case3	Paddy20 %、 Maize55 %、 Vegetable(1)10 %、 Vegetable(2)10 %、 Banana5%	57

Case1 is the recommended cropping pattern in LWH report and it consists of commercial crop mainly. Case2 granted farmers' wish and case 3 adopted paddy 20%.

The area of green line shows the command area of case2. The left side of river bed is the area of Bugesera3 and the right side Bugesera2. In the case1, Bugesera2 command area covers up to the dotted line at the slope facing to lake Rumila downstream right side of the area. Bugesera3 command area also covers up to the dotted line downstream left side and it extend to about 3km from the village road. In the case3, Bugesera2 command area covers paddy in the right side of river bed area and up to dotted line about 500m before the village road. Bugesera3 covers paddy in the left side of river bed area and up to the village road.

The river bed area downstream of the confluence of Bugesera2 and Bugesera3 is comparatively low flat and about 20 ha of paddy field can be developed with small scale land consolidation. Beneficiaries of paddy will be 30 to 40 households in Bugesera2 and Bugesera3.

Enough and stable water supply will become possible to cultivate rice by construction of the reservoir. Currently sorghum and cassava which need less water are mainly cultivated, however, maize and vegetables will become cultivated with irrigation and production will increase.



Bugesera2 downstream river bed area

2) Ngoma21 Remera

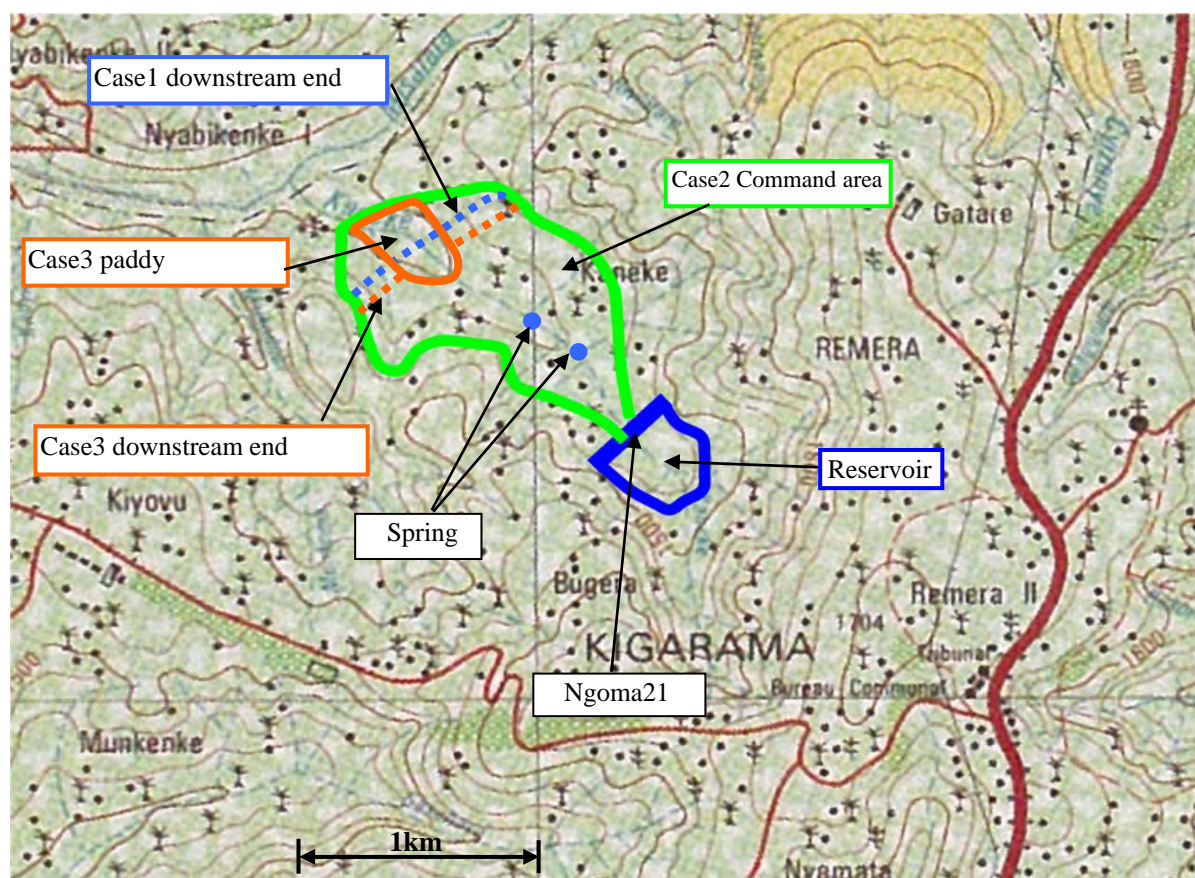


Figure 2.1.64 Ngoma21 Beneficiary Area

Current percentage of cropping area of each crop based on farmers interview and site survey is shown in the following Table.

Table 2.1.47 Current percentage of cropping area of each crop in Ngoma21

Cassava	Sorghum	Sweet Potato	Beans	Tomato	Maize	Cabbage	Banana
18%	29%	17%	16%	4%	7%	4%	5%

Banana is cultivated in the river bed area downstream of proposed dam axis and upstream of spring. The irrigable area stretches in downstream slope area due to rapid river bed slope. Sorghum is cultivated predominantly and cassava, sweet potato, maize, vegetable etc. are cultivated on the slope. The irrigable area of each cropping pattern is shown in the Table below.

Table 2.1.48 Proposed Cropping Pattern Ngoma21 Remera

Case	Cropping Pattern	Irrigable Area ha
Case1	Banana20%、 Avocado80%	48
Case2	Maize75%、 Vegetable(1)10%、 Vegetable(2)10%、 Banana5%	61
Case3	Paddy20 % 、 Maize65 % 、 Vegetable(1)5 % 、 Vegetable(2)5 % 、 Banana5%	49

Case1 is the recommended cropping pattern in LWH report and it consists of commercial crop mainly.

Case2 granted farmers' wish and case 3 adopted paddy 20%.

The area of green line shows the command area of case2. The command area of case1 is smaller 13ha than case2 and it covers up to the dotted blue line. The command area of case3 covers up to dotted orange line and paddy is in the area of orange line.



Sorghum and banana in river bed area



Sorghum in slope area, scattered sun flower

There are few low flat lands in the river bed area. Very limited area can be paddy field with small scale of farm land consolidation. In case3, the area of paddy is estimated about 10ha and the number of beneficiary 20 to 30.

Enough and stable water supply will become possible to cultivate rice by construction of the reservoir. Currently sorghum and cassava which need less water are mainly cultivated, however, maize and vegetables will become cultivated with irrigation and production will increase.

3) Ngoma22 Rurenge

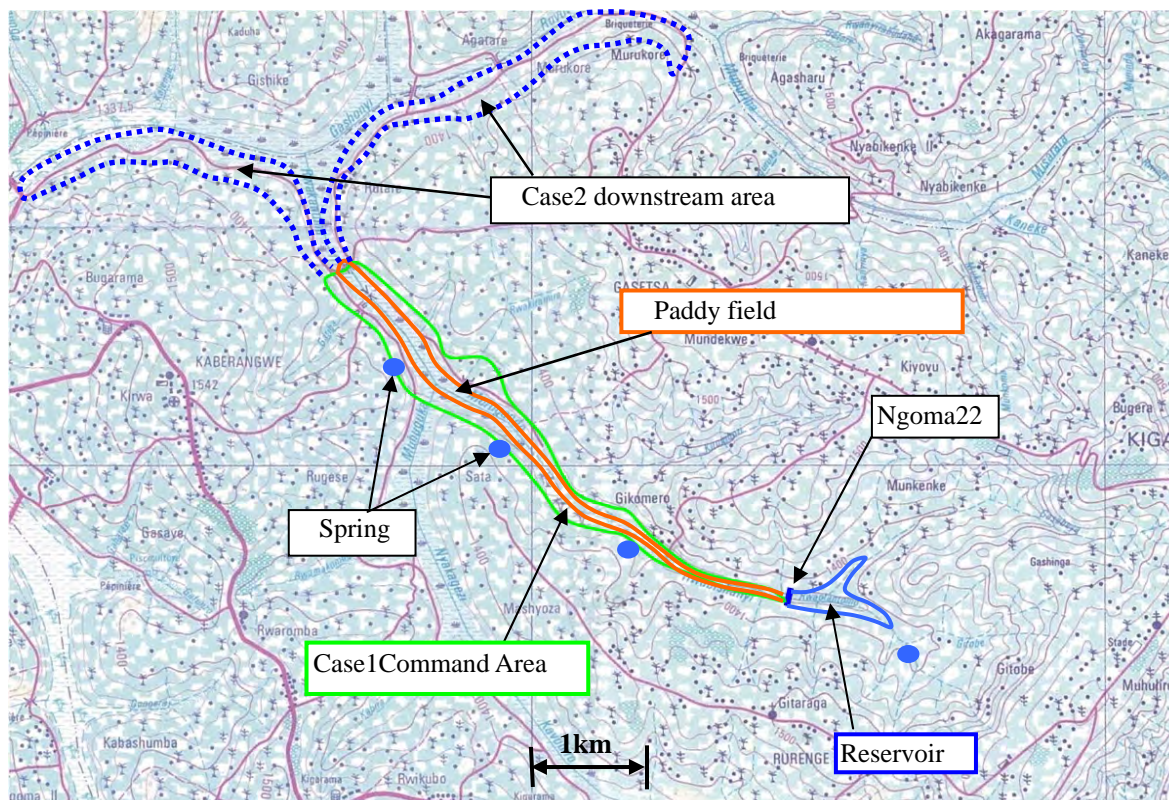


Figure 2.1.65 Ngoma22 Beneficiary Area

Current percentage of cropping area of each crop based on farmers interview and site survey is shown in the following Table.

Table 2.1.49 Current percentage of cropping area of each crop in Ngoma22

Sorghum	Beans	Maize	Rice	Cassava	Sweet Potato	Banana	Cabbage
24%	24%	20%	15%	5%	5%	5%	2%

Rice is cultivated in the river bed area from the proposed dam axis to downstream. The area is about 50 ha up to the village road about 5km downstream from the dam axis, and spread more to the downstream. The number of household cultivating rice is estimated about 180 from the membership of cooperative. Sorghum is cultivated in most of slope area. Coffee is cultivated in small scale in upper part of the hill.

The irrigable area of each cropping pattern is shown in the Table below.

Table 2.1.50 Proposed Cropping Pattern Ngoma22 Rurenge

Case	Cropping Pattern	Irrigable Area ha
Case1	Paddy20%、Pineapple80%	314
Case2	Paddy20 %、Maize15 %、Vegetable(1)30 %、Vegetable(2)30 %、Banana5%	165

The area of green line in the Figure 2.1.65 shows the command area of case2. The irrigable area of

case1 covers downstream and upstream area from the confluence indicated by dotted line. Its shape is very long and thin. The length of pipeline is very long comparing to the area and it is not economical. Since it is difficult to extend the area of paddy due to terrain, proposed area of paddy will not extended.

The width of river bed is about 50m at the dam axis and 250m at the wide area downstream. The slope of both side is average about 1:6 and rather steep, and the beneficiary area will be very long and thin and pipeline will be very long. The irrigable area will cover about 100m from the end of river bed area both side at the end of irrigable area.

Enough and stable water supply will become possible to increase unit yield of rice by construction of the reservoir. Currently sorghum and cassava which need less water are mainly cultivated, however, maize and vegetables will become cultivated with irrigation and production will increase.



Paddy and sorghum at downstream of dam axis



About 2km downstream of the dam axis

4) Bugesera 4

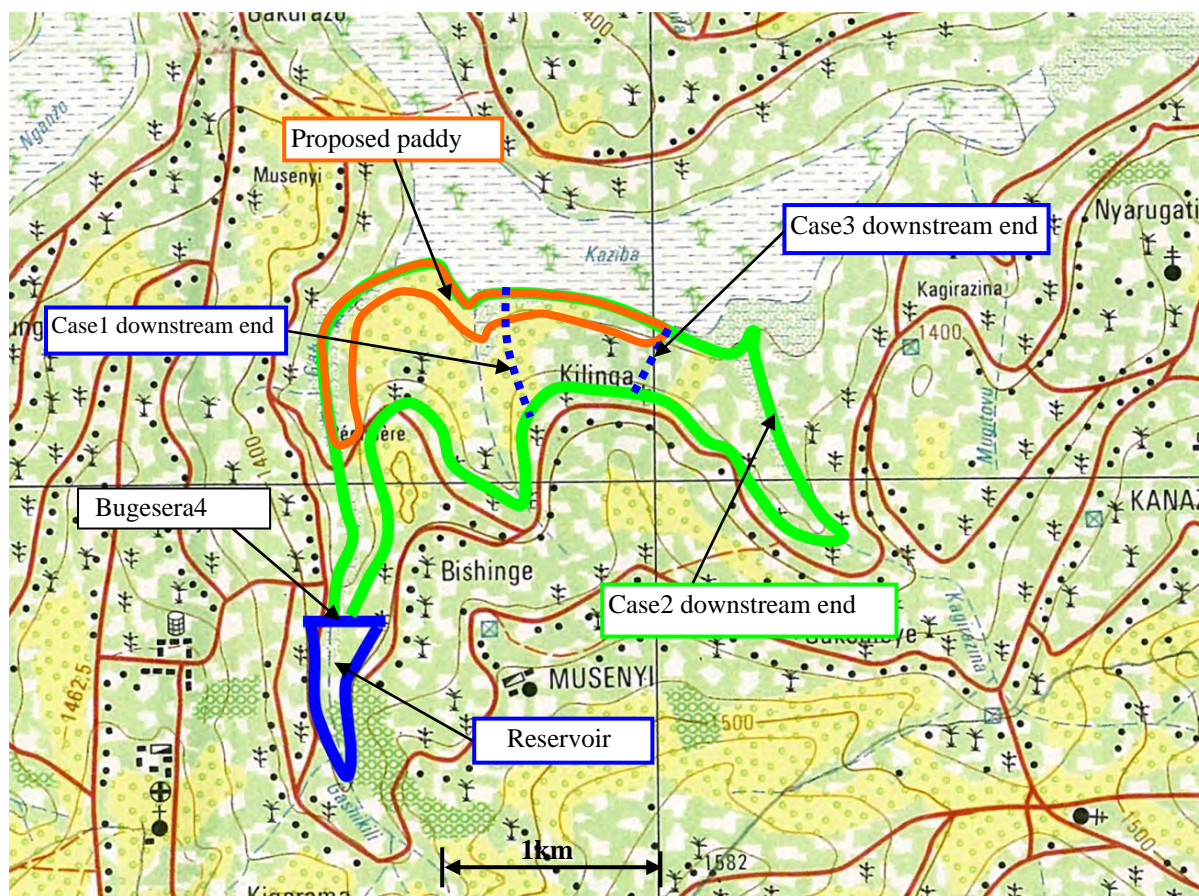


Figure 2.1.66 Bugesera4 Beneficiary Area

Currently, Banana and Cassava are cultivated predominantly and beans, sugar cane, Irish potato, avocado, coffee and vegetable are also cultivated.

The irrigable area of each cropping pattern is shown in the Table below.

Table 2.1.51 Proposed Cropping Pattern Bugesera4 Rilima

Case	Cropping Pattern	Irrigable Area ha
Case1	Banana20%, Mango80%	72
Case2	Maize65%, Vegetable(1)15%, Vegetable(2)15%, Banana5%	146
Case3	Paddy20 % , Maize55 % , Vegetable(1)10 % , Vegetable(2)10 % , Banana5%	110

The area of green line in the Figure 2.1.66 shows the command area of case2. It reaches to the marsh land at about 1.5km from the dam axis and it extends to the east along the marsh land and its area is 146ha. The irrigable area of case1 covers up to dotted line in the middle of the area of case2. The paddy field in case3 is shown by orange line along marsh land and upland area covers up to the end of area of paddy indicated by dotted blue line.

Rice cultivation is considered to be able in the low area along the marsh land and its area is estimated about 20ha and beneficiary about 60 households. The situation of the marsh land is not grasped and need further survey. The farm land in marsh land will be allocated to the farmers by the government and it is expected that more farmers will be benefited.

Enough and stable water supply will become possible to cultivate rice by construction of the reservoir. Currently cassava which needs less water is mainly cultivated, however, maize and vegetables will become cultivated with irrigation and production will increase.



Bugesera4 beneficiary area



Sorghum in river bed area, Bugesera4

(7) Hillside Irrigation

1) Irrigation System

Generally, following irrigation systems are utilized to supply water to the fields..

- River diversion system : Gravity irrigation system taking water from the river to the field. It is utilized in the scheme which has a stream flow. There is a few sites which have perennial stream flow among LWH sites, however, in Ngoma22, this type of irrigation system is utilized currently. It is utilized only in a valley.
- Water impounding dam system : Water is saved in a pond and used when it is needed for the field. It is adopted in LWH and this project. In case of a large scale, gravity system is utilized and in case of small scale, water is supplied to the field around the pond with watering can or treadle pump. It is effective in LWH project sites.
- Shallow Well : Excavating a shallow pond and utilize groundwater. It is utilized in a area that has comparatively high groundwater level. Water is supplied to the field around the pond with watering can or treadle pump. As the result of investigation of test pit, the groundwater level in the slope area is low and this system can be utilized only in the river bed area. However, since the groundwater level is not so high in the river bed area in Bugesera2 and Bugesera3, it is difficult to apply this system in this project sites.

- Deep well : Excavating a deep well by drilling and supply water by pumping up groundwater. It is disadvantageous in the point of cost and difficult to be applied for this project.
- Pump irrigation system : Pumping up water from a river or lake to irrigate. It is applied in case that there is a enough water source near the site. A pump irrigation system assisted by Luxemburg is applied in Gashora sector in Bugesera District pumping up water from lake Rumila. A small portable pump (3.5hp) can irrigate 5ha and it makes a profit under proper cropping pattern. However, since MINAGRI and Districts don' t have a supporting system for maintenance of pump irrigation system, maintenance of pumps depends on trader.

For the reasons stated above, water impounding dam type irrigation system is applied to hillside irrigation and this project.

2) Example of small scale pond system

In “THE STUDY ON SUSTAINABLE RURAL AND AGRICULTURAL DEVELOPMENT IN BUGESERA DISTRICT, EASTERN PROVINCE IN THE REPUBLIC OF RWANDA” conducted by JICA, 22 pond ware constructed in pilot projects. The scale of the pond is 120 m³ capacity and the depth 2.5m. However, they had a lot of leakage and water was not stored. Farmers didn't pay attention to maintenance of the ponds and abandoned many of them because water could not be stored. Plastic sheet was introduced to stop water leakage but they need further monitoring at the point of cost and durability. The study team investigated one of them and found that the plastic sheet was damaged and maintenance was not scheduled due to cost. Some concrete lining pond were constructed by assistance of China, however, they are costly.

A multistage pond system is considered to be effective for pond system in slope area. An example is shown in following figure.

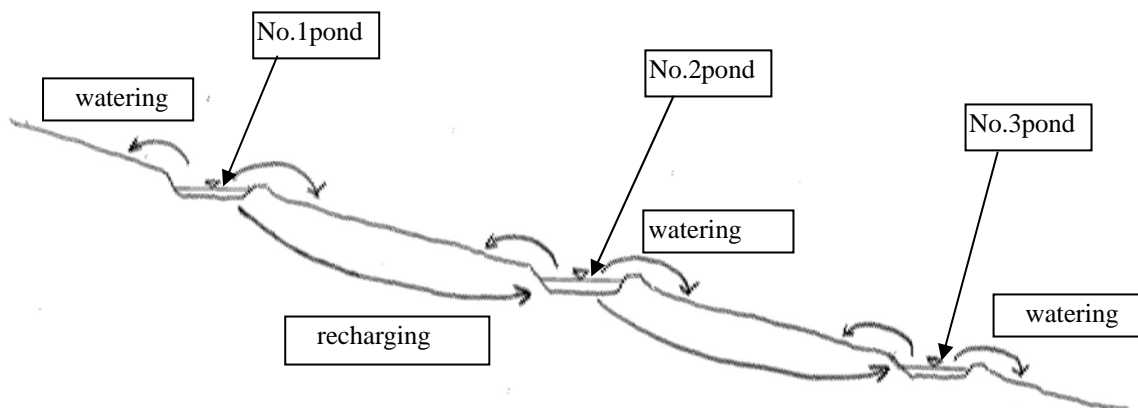


Figure 2.1.67 Multistage pond system

The pond is not lined and some amount of water leakage is allowed. Water stored in No.1 pond

recharge groundwater and leach out in No.2 and No.3 pond. Water in No.2 pond recharge groundwater and leach out in No.3 pond. The groundwater level of lower pond become high to ground surface and it makes less leakage of the pond. Water is supplied with watering can or treadle pump to the field around the pond..

There is a spring in Ngoma21 and it is not utilized for irrigation currently. Since quantity of spring water is about only 1 litter/second, there will be a lot of leakage and ineffective discharge and a large loss in a canal system. However, with the multistage pond system, the loss is reduced and about 2ha can be irrigated.

In case of Ngoma21, combined system of pond and canal is recommended. Water is supplied to the field if it is required and stored in the pond if it is not required. However, in case of Ngoma21, since the permeability of the layer deeper than 5m is high, the depth of the pond should be less than 2m.

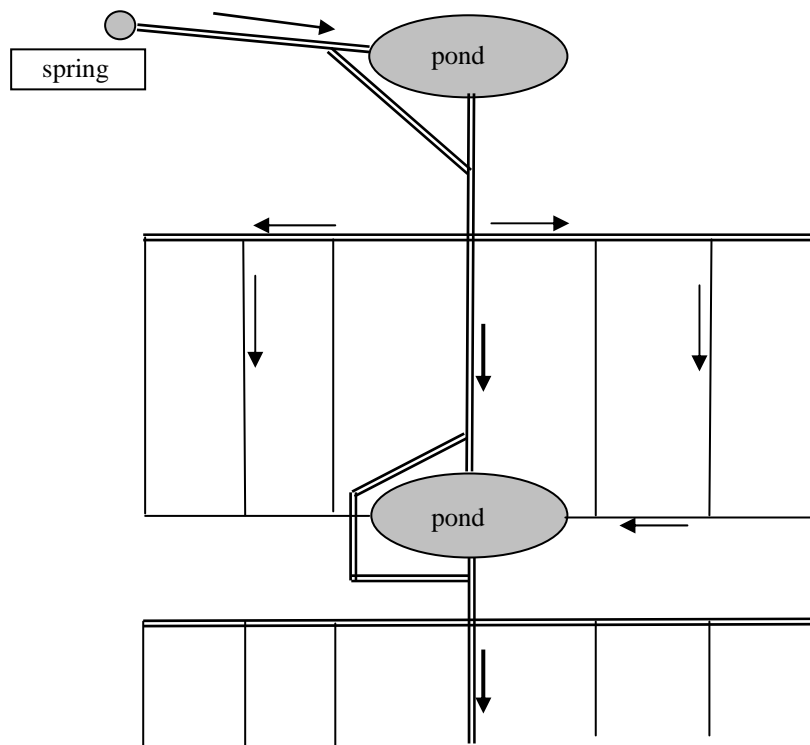


Figure 2.1.68 Combined system of pond and canal

2.1.4 Outline of Work Schedule

Work schedule for embankment material is estimated from workable days in a year and capacity of heavy equipment.

Workable days for embankment in a month are estimated 15.7 days/month considering 108 days of over 1mm rainfall. Workable days for excavation work in a month are estimated 28 days/month considering days of over 10mm rainfall.

2 cases were considered based on the capacity of heavy equipment, 600m³/day and 900m³/day respectively. The result is shown in the Table 2.1.52 and 2.1.53.

The work period of Ngoma21 will be more than one year even in case 2 due to the embankment volume. The work period of Bugesera4 will be 20 month even in case 2 due to large volume of embankment in the LWH report. However, its height and the location of dam axis will be reconsidered and the embankment volume will be reduced largely, and then the work period will be reduced also to less than one and half year.

In case that the work period will be at most one year, the embankment volume should be less than 120,000 m³ by case2, and in case of one year, the volume should be less than 180,000 m³ by case 2.

Major construction firms in Rwanda own necessary equipment for case2. Midsize firms own necessary equipment for case1, but they need to buy or rent some equipment in case2.

(1) Workable days for embankment material

Workable days in a year are estimated as follows;

$$N = (A - n \times 1.2) \times 0.8$$

N : workable days in a year

A : days of temperature over 3°C in a year

n : days of rainfall over 1mm in a year

Average days of rainfall over 1mm between 1971 to 2008 in Kigali is shown in the table below.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Days	8.2	9.2	12.4	15.3	10.4	2,1	1.2	3.8	7.9	12.6	14.1	10.7	108

Workable days are

$$(365 - 108 \times 1.2) \times 0.8 = 188 \text{ days} = 15.7 \text{ days/month}$$

The days of rainfall over 10mm are average 2 days per month. The workable days for excavation are 28 days per month (holidays are not considered)

(2) Embankment work schedule

Outline of construction work procedure is shown in the Figure 2.1.69.

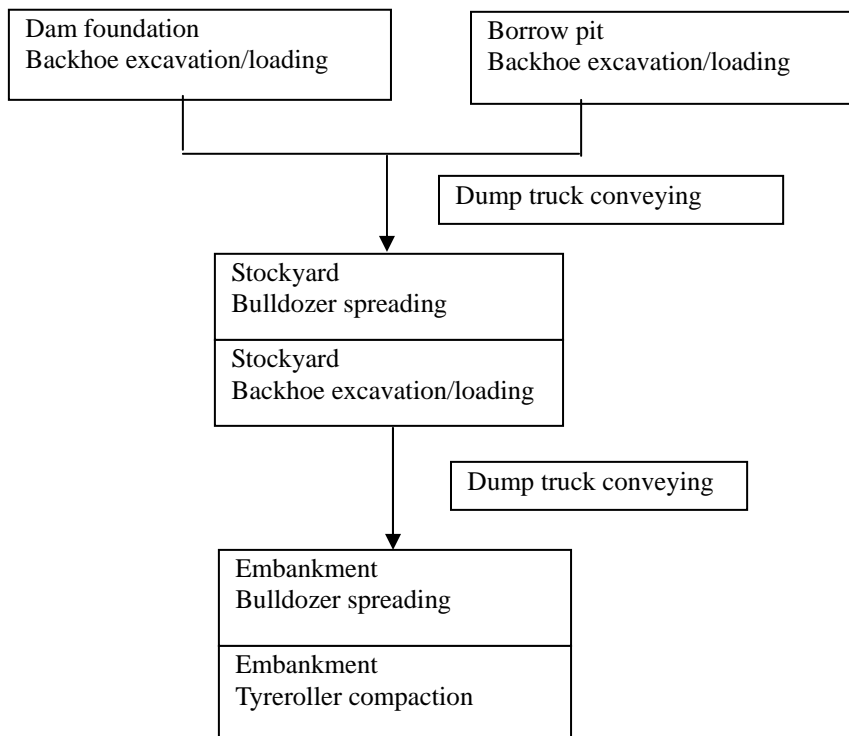


Figure 2.1.69 Work procedure of embankment work

(3) Outline of required work period

Work capacity of each equipment is as follows;

Backhoe 0.6m³ class, excavation and loading : 300m³/day

Bulldozer 15t class, spreading: 690m³/day

Tyre roller, compaction : 1330m³/day

Dump truck 10t class, conveying distance less than 1.0km: 125m³/day

Arrangement of each equipment is as follows;

Case1

Backhoe: Excavation and loading at dam foundation 2 units → Excavation and loading at Borrow pit 2 units, Excavation and loading at stockyard 2 units

Bulldozer: Spreading at stockyard 1 unit, spreading at embankment 1 unit

Tyre roller: compaction at embankment 1 unit

In this case, work quantity of embankment per day depends on the capacity of backhoe and it is 600m³/day. The work quantity of excavation of foundation per day is 600m³. The number of necessary dump truck is 5 units.

Case2

Backhoe: Excavation and loading at dam foundation 3 units → Excavation and loading at Borrow pit 3 units, Excavation and loading at stockyard 3 units

Bulldozer: Spreading at stockyard 2 unit, spreading at embankment 2 unit

Tyre roller: compaction at embankment 1 unit

In this case, work quantity of embankment per day depends on the capacity of backhoe and it is 900m³/day. The work quantity of excavation of foundation per day is 900m³. The number of necessary dump truck is 8 units.

The work period of case1 and case2 is shown in the Table 2.1.52 and 2.1.53. Preparation one month, temporary work one month and mobilization and demobilization one month are considered.

Table 2.1.52 Rough estimation of work period case1

	Unit	Bugesera2	Ngoma21	Ngo,ma22	Bugesera3	Bugesera4
Excavation	m ³	20,000	24,000	12,000	6,900	16,800
Period	Month	1.2	1.4	0.7	0.4	1.0
Embankment	m ³	111,000	140,000	65,000	114,600	224,900
Period	Month	11.8	14.9	6.9	12.2	23.9
Total Period	Month	13.0	16.3	7.6	12.6	24.9
Total work period	Month	16.0	19.3	10.6	15.6	27.9

Table 2.1.53 Rough estimation of work period case2

	Unit	Bugesera2	Ngoma21	Ngo,ma22	Bugesera3	Bugesera4
Excavation	m ³	20,000	24,000	12,000	6,900	16,800
Period	Month	0.8	1.0	0.5	0.3	0.7
Embankment	m ³	111,000	140,000	65,000	114,600	224,900
Period	Month	7.8	9.9	4.6	8.1	15.9
Total Period	Month	8.6	10.9	5.1	8.4	16.6
Total work period	Month	11.6	13.9	8.1	11.4	19.9

2.1.5 Cropping Plan

Present crops grown in the Project areas are summarized in the Table 2.1.54. Due to rain-fed agriculture at the present situation, drought tolerant crops such as sorghum, cassava, sweet potato are the dominant. However, if the irrigation was introduced, farmers should be encouraged to grow crops which are effectively grown with irrigation and profitable as to meet the investment.

Cropping pattern with the Project is proposed corresponding the aspiration of the farmers (crops they wish to grow with irrigation) recognized by the socio-economic survey, and also considering the technical conditions such as the capacity of the proposed dam and the policy of LWH Project. Especially in all the sites except for Gatsibo 31 Rugarama, most of the farmers wish to grow rice if there was enough irrigation water. Therefore, cropping pattern with rice will also be considered. Tables below shows the present crops in the Project areas and the farmer's aspiration on crops to grow with irrigation.

Table 2.1.54 Present Crops in the Project Areas

Site	Present Situation	
	Hillside	Low land (Bottom of valley)
Bugesera 2 Gashora	Maize, sorghum, beans, sweet potato, cassava, banana	Same as hillside
Ngoma 21 Remera	Maize, sorghum, beans, sweet potato, cassava, banana, vegetables	Same as hillside
Ngoma 22 Rurenge	Maize, beans, cassava, banana, vegetables	Rice, cabbage
Gatsibo 31 Rugarama	Maize, sorghum, beans, sweet potato, cassava, banana, vegetables	Rice (out of the beneficial area)

Table 2.1.55 Aspiration of Farmers with Irrigation (from Baseline Survey)

Crop	Bugesera 2	Ngoma 21	Ngoma 22	Gatsibo 31
No. of Sample HH	40	39	37	38
Maize	55%	79%	16%	82%
Cabbage	55%	41%	59%	-
Tomato	30%	28%	41%	3%
Carrot	33%	28%	30%	3%
Other Vegetables	53%	26%	57%	84%

Other Vegetables: onion, eggplant, leek etc.

Table 2.1.56 Intention of Rice Crop of the Sample Farmers

Crop	Bugesera 2	Ngoma 21	Ngoma 22	Gatsibo 31
No. of Sample HH	40	39	37	38
Rice	100%	100%	84%	24%

Source: Result of the Baseline Survey by JICA Study Team

Cropping seasons are Season A (from September) and Season B (February to April). According to the interviews to farmers in the sites, crop yields are low because of poor rainfall. Therefore, the irrigation will be intended to supplement water for the crop seasons A and B. Three cases of cropping patterns with the Project are proposed: 1) following the proposed cropping pattern of the detail design

reports of LWH in other sites (Case 1), 2) following the farmer’s aspiration for crops to grow with irrigation (Case 2), and 3) considering the transfer of upland crops to paddy (Case 3). In Ngoma 22 Rurenge, since paddy fields have been developed, rice crop is incorporated in Case 1 and Case 2. For Gatsibo 31 Rugarama, because the intention of farmers to grow rice is low, Case 3 is not considered. As for the cropping plans of Bugesera 3 and Bugesera 4, Case 1 is followed to the cropping plan of the respective D/D reports and Case 2 and Case 3 are followed to the plan of Bugesera 2, since the areas are close to each other. Following are the proposed cropping patterns:

Table 2.1.57 Proposed Cropping Pattern: Bugesera 2 Gashora (Case 1)

(Bugesera 2 Gashora)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	20%												
Pineapple	80%												

Banana: First harvest is 13 months from planting. After that every year harvested. Replacement of suckers is 35years.

Pineapple: First harvest is 16 months from planting. After 3 years suckers are replaced.

Table 2.1.58 Proposed Cropping Pattern: Bugesera 2 Gashora (Case 2)

(Bugesera 2 Gashora)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize	65%												
Cabbage + Bean	15%												
Tomato + Bean	15%												
Banana	5%												

Cropping Intensity: 195%

Table 2.1.59 Proposed Cropping Pattern: Bugesera 2 Gashora (Case 3)

(Bugesera 2 Gashora)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	20%												
Maize	45%												
Cabbage + Bean	15%												
Tomato + Bean	15%												
Banana	5%												

Cropping Intensity: 195%

Table 2.1.60 Proposed Cropping Pattern: Ngoma 21 Remera (Case 1)

(Ngoma 21 Remera)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	20%												
Fruit (Avocado)	80%												

Note: First harvest is after 4 years. March to April si harvesting season.

Table 2.1.61 Proposed Cropping Pattern: Ngoma 21 Remera (Case 2)

(Ngoma 21 Remera)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize	75%												
Cabbage + Bean	10%												
Tomato + Bean	10%												
Banana	5%												

Cropping Intensity: 195%

Table 2.1.62 Proposed Cropping Pattern: Ngoma 21 Remera (Case 3)

(Ngoma 21 Remera)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	20%												
Maize	55%												
Cabbage + Bean	10%												
Tomato + Bean	10%												
Banana	5%												

Cropping Intensity: 195%

Table 2.1.63 Proposed Cropping Pattern: Ngoma 22 Rurenge (Case 1)

(Ngoma 22 Rurenge)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice	20%												
Pineapple	80%												

Note: Present paddy fields are considered for the proposed cropping pattern.

Table 2.1.64 Proposed Cropping Pattern: Ngoma 22 Rurenge (Case 2)

(Ngoma 22 Rurenge)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rice	20%		Rice								Rice			
Maize	15%		Maize								Maize			
Cabbage + Bean	30%		Cabbage								Bean			
Tomato + Bean	30%		Bean								Tomato			
Banana	5%	Banana												

Cropping Intensity: 195%

Table 2.1.65 Proposed Cropping Pattern: Gatsibo 31 Rugarama (Case 1)

(Gatsibo 31 Rugarama)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	10%										Banana		
Coffee	90%										Coffee		

Note: First harvest is after 3 years. Harvesting season is March to April. Replacement is after 30 years.

Table 2.1.66 Proposed Cropping Pattern: Gatsibo 31 Rugarama (Case 2)

(Gatsibo 31 Rugarama)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Maize	70%		Maize								Maize			
Cabbage + Bean	5%		Cabbage								Bean			
Tomato + Bean	5%		Bean								Tomato			
Banana	20%	Banana												

Cropping Intensity: 195%

Table 2.1.67 Proposed Cropping Pattern: Bugesera 3 (Case 1)

(Bugesera 3)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	10%										Banana		
Pineapple	90%										Pineapple		

Note: Case 2 and Case 3 of Bugesera 3 are the same with Bugesera 2.

Table 2.1.68 Proposed Cropping Pattern: Bugesera 4 (Case 1)

(Bugesera 4)

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	20%												
Mango	80%												

First harvest is after 4 years.

Note: Case 2 and Case 3 of Bugesera 4 are the same with Bugesera 2.

2.1.6 Operation and Maintenance System

The Government of Rwanda has been promoting the establishment of cooperatives to achieve the targets of Vision 2020, MDGs and EDPRS. In fact the existing projects such as RSSP have been establishing agriculture cooperatives to transfer the responsibility of the operation & maintenance of the facilities. This Study also investigated the situation of farmers organization following the policy of the cooperative establishment.

(1) Position of Cooperative in Rwanda

In Rwanda, traditional self-help form called Ubudehe, Umubyizi and Umuganda has been still surviving in the rural society. The government has, however, had a lesson that no efforts have been made to consolidate this traditional philosophy of mutual assistance into economically oriented development initiatives. This has given motivation to the government to promote cooperatives. Institutionalization of cooperative initiated in 1949 during the colonial era. Although the cooperative movement was succeeded after the independence, the situation of cooperative was far from the notion of self-help as it was used as an instrument to implement the policy of the government.

After 1994, the government and development agencies introduced the culture of dependency by conditioning external assistance to the formation of cooperatives and other forms of associations. Thus, members looked at a cooperative as a means of only getting financial assistance from donors rather than as an economically productive enterprise (National Cooperative Policy on Promotion of Cooperatives). However, the government has now recognized the cooperative as an association to create economic value and as a development partner for poverty reduction and economic growth, so that the government is promoting the establishment of cooperatives with the philosophy of self-help.

On EDPRS (2008 – 2012), promotion of cooperatives is stated in order to build the technical and organizational capacity of farmers. Also the Ministry of Commerce, Industry, Investment Promotion, Tourism and Cooperatives (MINICOM, former name), which is in charge of cooperatives, formulated the “National Policy on Promotion of Cooperatives” emphasizing the cooperative as a viable tool for

poverty reduction and economic growth. MINICOM has also formulated “The Sector Strategies Document for Cooperative Sector” in February 2006. MINICOM was re-named to the Ministry of Trade and Industry in February 2008 and then the Rwanda Cooperative Agency (RCA) was established in December 2008 to take over the administration of the cooperatives from the ministry as a part of the government decentralization. Registration of cooperative has been transferred from the Minister to the Director General of RCA.

In Rwanda, “Cooperative” is defined as a group of people engaged in economic activities. As for the group engaged in non-economic activities it is defined as “Association”. Association is registered in the Ministry of Justice. At present, around 3,000 cooperatives have been registered. Among them around 60% is agricultural cooperative. 40% consists of various cooperatives such as commerce, handcraft, savings, etc. Definition of the activities of the group is necessary to be registered as a cooperative, especially specification of crops is requisite to establish agricultural cooperative. In case establishing water users association (WUA) as a cooperative, WUA should be defined in relation to economic activities in order to be recognized as a cooperative.

(2) Existing Cooperatives in the Project Sites

Following table shows the existing cooperatives in the Project sites:

Table 2.1.69 Existing Cooperatives within the Project Sites

Site	Cooperatives within the Project Sites	Remark
Bugesera 2 Gashora	Coop. dealing with maize, cassava, soap making, dyeing and Coop. dealing with vegetables	
Ngoma 21 Remera	None	There are several cooperatives in Remera Sector, in which the Project will be located.
Ngoma 22 Rurenge	TWIFATANYE Rice Cooperative (180 members, 15ha)	The cooperative has not been registered.
Gatsibo 31 Rugarama	No cooperative at the hillside. In the marshland, there is a rice cooperative called COPRORIZ-Ntende.	RSSP has started constructing 2 dams to expand the paddy field in the marshland since April 2009. Therefore the marshland will be out of the beneficial area of the Project.

In Bugesera 2 Gashora and Ngoma 22 Rurenge, it needs to confirm the members of the existing cooperatives and the beneficiaries of the Project, so that the water users association or water users committee under the cooperative will be established as the way of strengthening the existing cooperatives rather than establishing new one. As for Ngoma 21 and Gatsibo 31, there will be a requirement to establish new cooperatives.

(3) Operation and Maintenance System

The policy of the government of Rwanda is that the responsibility of O&M of the facilities will be transferred to the farmer beneficiaries from the Project after the completion of the construction.

Therefore, farmers' organization will be carried out through the Project implementation. In Rwanda generally an agriculture cooperative, which deals with the business from purchase of inputs to marketing of the farm produces, has been established in the existing irrigation schemes and the cooperative will be responsible for O&M of the irrigation facilities.

In principle, the agriculture cooperative operates and maintains the irrigation facilities and when issues beyond the capacity of the cooperative to solve come up, local administrations such as Sector and District will give advice or support to the cooperatives. This is the basic frame of the O&M of the irrigation facilities. District and Sector has a role to support farmers in irrigation schemes from farming skill to facility O&M. Also Project Units such as RSSP keep monitoring the O&M of the facilities for a certain period and support the cooperatives. In this section assesses the present status of the cooperative (farmers' organization), which conduct O&M, based on the field survey of other similar projects.

1) RSSP (Rural Sector Support Program)

RSSP has been constructing dams for rice irrigation as a component of the program (marshland development). In the marshland development, there are sites which have been already used as paddy field and the others which were converted from upland to paddy field by the project. RSSP has implemented land consolidation or reclamation for paddy. Because the marshland belongs to the government, change of land use and reallocation of land has been carried out by the project in consultation with the farmer beneficiaries. O&M of the irrigation facilities are delegated to the agriculture cooperative, which the Project assisted to establish. Not only the irrigation facilities but also RSSP includes the component of building dry yard and capacity building of the cooperative by dispatching agronomist and engineers to the cooperative. These staff will stay for a certain period in the cooperative and are expected to be hired by the cooperative after the project termination. If there is an existing cooperative in the marshland, O&M of the facilities is delegated to the existing cooperative.

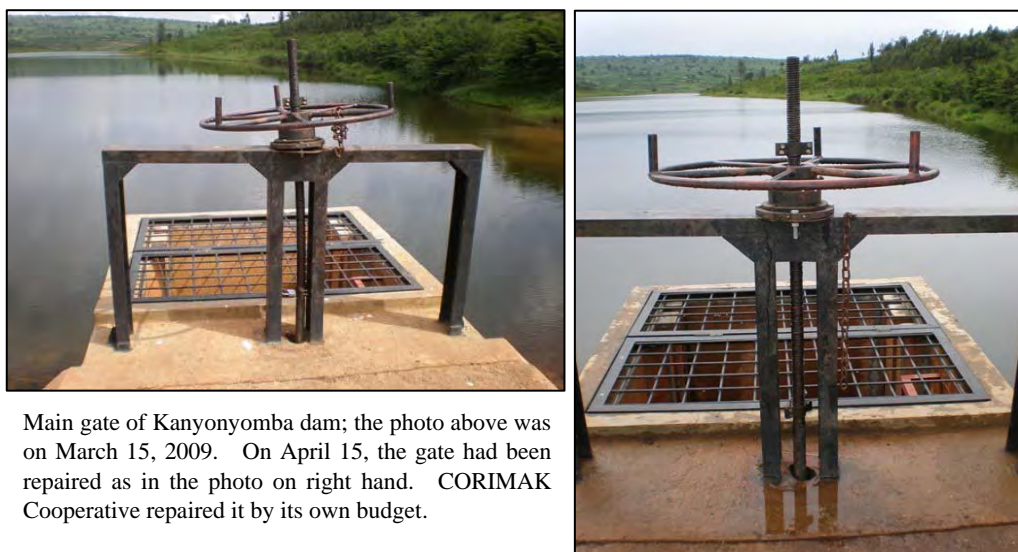
All the farmer beneficiaries of the Project belong to the rice cooperative. Therefore, the cooperative can function as water users' association, which requires all the beneficiaries to be the member. Rice cooperative plays a very important role for rice farming since they supply seeds to the farmers and also purchase the produce from the farmers. In general, cooperative and water users association are established independently in other countries, but in Rwanda, adding the function of water management to the cooperative would be a practical way considering the current cooperative movement in Rwanda.

The performance of the cooperatives differs by site. The agriculture cooperative in Kanyonyomba in Gatsibo District was established by the Project and has been operating for three years. The cooperative has faced several issues for management. Some farmers used to cultivate upland crops in the Project area, but with the Project the area was converted to paddy field and the new cooperative was established. There are issues that the supply of seeds from the cooperative has got shortage and a

guardian of the dry yards has not been paid since he was hired.

The first committee of the cooperative had been accused of mismanagement and the new committee has been assigned since 2008. RSSP office and the local administration in charge are aware of the issue of the cooperative and they indicate the necessity of maintaining the support to the cooperative. In fact the salary of the agronomist dispatched from RSSP has still been paid by RSSP. It may be required to continuously monitor and evaluate the activities of the cooperatives after their establishment. On the other hand, the cooperative in Agasasa in Southern Province has a long history of developing marshland into paddy field since 1970's and their performance of the irrigation facility management as well as cooperative activities such as procurement of seeds and marketing of produces has been observed well.

The case of RSSP also indicates the extent of the role of the government administration. In March 2009 there is a damage on the gate of the dam in Kanyonyomba. The rod of the handle of the gate had been bent so that the gate had been kept open. Ineffective water release from the dam had been observed.



Main gate of Kanyonyomba dam; the photo above was on March 15, 2009. On April 15, the gate had been repaired as in the photo on right hand. CORIMAK Cooperative repaired it by its own budget.

The gate has been repaired by mid April 2009 by the cooperative, which is managing the facilities of Kanyonyomba. For this repair, the cooperative was able to manage it with its own budget, but the incident suggests how the government intervenes to the cooperative when issues likely beyond the capacity of the cooperative happen. In the box below describes the incidents of Kanyonyomba and how the stakeholders reacted to them. Another site of RSSP in Bugesera District, some problems of design or implementation are observed as leakage of water under the spillway has been observed. In this case, though it needs to carefully identify the cause, the Project might take necessary measures for the incidence, but it should also indicate the necessity to clarify the responsible boundary between farmer organization and the government administration.

Incidence happened to RSSP Kanyonyomba site and the reaction of the stakeholders:

Kanyonyomba dam was constructed as the component of marshland development of RSSP in 2006. There are two dams constructed in the site (main dam and a small supplementary dam). Total area is around 600ha, but actual irrigated area reaches 417ha. The beneficiaries reside in 40 imidugudu in 8 Cells in 4 Sectors and total number of beneficiary households is around 3,600. Before the Project, farmers in vicinity used to cultivate upland crops such as sorghum and sweet potato partially in the marshland. With the Project, paddy field was reclaimed and the area was converted to rice cultivating area. Since the marshland is owned by the government, the Project initiated to convert the land to paddy field. The Project distributed 10a each to the beneficiaries. Selection of farmers to receive the land was carried out with the criteria: 1) those who used to cultivate in the marshland, 2) those who lost land due to the construction work, 3) poor in the area, and 4) woman headed family.

Agriculture cooperative called CORIMAK was established in 2006 upon the construction of the dams to manage the facilities. In accordance with the land law, the marshland, which is government owned land, was leased to the members of the cooperative for 99 years. The number of the cooperative members is equal to the beneficiaries of the Project, but the committee of the cooperative does not know the exact number of the members and now is conducting census. The committee collects 2,000Rwf for membership fee and maintenance fee 200Rwf every crop season from the members. Since the committee does not know the exact number of the members, there should be farmers who are cultivating rice in the Project area without paying the fees.

Kanyonyomba area is divided into 12 irrigation zones and a leader is assigned in each zone. The fee is collected through these leaders. Because the cooperative does not have a milling machine, the cooperative gives intermediate service to the farmer members to sell the produce to middlemen. The cooperative hires an accountant, an agronomist (paid by RSSP), 8 gate keepers, and 11 guards.

Site Situation

A farmer says that he was able to increase his income by rice cultivation and he bought mobile and repaired his house. But he indicated the issues happening in the site. Following summarizes major issues:

- 1) A farmer whom the team interviewed does not recognize the water management and he was taking water whenever for his convenience. A hole to divert water from the main canal is also observed. The farmer interviewed did not know who the main gate keeper was and how the gate keeper was assigned.
- 2) The cooperative did not supply enough seeds to the farmer members in this season. Each farmer member contributed 2000Rwf to the cooperative to purchase the seeds, but the supply service of the cooperative was not taken place in this season and farmers are facing shortage of seeds. Farmers do not know where to get seeds.
- 3) The rod of the handle of the main gate had been broken and un-repaired.
- 4) A Guard for a dry yard has not been paid for two years though he made contract with the cooperative.

Reaction of the Cooperative:

1) On water management

In each zone a water management committee is assigned with 5 members and canal clearing is practiced for maintenance work. Also there are 8 gatekeepers. The cooperative needs to review the effects of the current O&M set up and its activities.

2) On procurement of seeds

The cooperative was to procure seeds from RADA. However, the quality of seeds was not so good this year that half of them did not germinate. The agronomist of the cooperative went to RADA to get seeds but the quantity was not enough. The agronomist visited other cooperatives to get seeds.

3) On the breakage of the main intake gate

The cooperative was aware for the breakage from the time just the incident happened and investigated who broke it. They repaired the gate by mid April. It cost 10,000Rwf. It took around one month and a half to repair it.

4) On delay of payment to employee

This is because of the mismanagement of the former committee. There are even cases in court. In June 2008, the cooperative changed the committee and new president was elected to improve the management.

Reaction of the District:

District (local government) has been cooperating with RSSP since the planning stage. The District also cooperated with RSSP for the site selection. At the construction stage, the District supported RSSP by mediating the communication between the contractors and the farmers. Also the District and RSSP made a report for compensation together. The District was involved in the establishment of the cooperative, as well.

After the use of the irrigation facilities, the agronomist of the cooperative, the agriculture officer of the Sector and the agriculture of the District are working together to support the rice farming of the farmers in the area. The central government (MINCOM, Rwanda Cooperative Agency) has established a task force and the District also joins in this task force. The

District is monitoring the cooperatives in the District. The District sometimes observe the general assembly of the cooperative and pick up problems and give advice to the committee if there is a problem in management. The District was aware of mismanagement of former committee and the District gave advice to the election of the new president, as well.

1) On water management

No reaction from the District so far.

2) On procurement of seeds

The District has received the report on the shortage of seed supply in this crop season and the follow up activities of the agronomist of the cooperative. The District agriculture officer gave them advice.

3) On the breakage of the main intake gate

The District agriculture officer was aware about the incident and also received the report that the gate was repaired by the cooperative. It shows the close communication between the District and the cooperative.

4) On delay of payment for employee

The District also pays attention to the capacity of the cooperative for employment. In 2007 the District paid the wage of a gate keeper of the CORIMAK cooperative for a half year due to lack of budget of the cooperative. This kind of subsidy was decided by the Mayor, Vice-mayor and Officer in charge of economic affair of the District. At that time, the District judged that helping the cooperative, which was still new, would lead the stable management of the cooperative in future.

2) Pump Irrigation by Luxemburg Assistance

This Project is to pump water from the lake Rumira located the downstream of Bugesera 2 site by 3 pump stations and irrigate hillside with sprinklers. Irrigated area is 32ha. Two pump stations the team visited were still under furnishing the houses and surroundings of the pumps, but pump itself has been operated since 2007. According to the interview to a member of the cooperative, the cooperative was established at the same time of pump installment in 2007. There was, however, conflict over the way of cropping between the individual interest and cooperative interest. Eventually in 2007, farmers went with cropping according to the interest of the individuals. In November 2008, the farmers decided to grow tomato together (contract with nearby processing factory), but a disease occurred at the time of flowering stage in February in 2009 and all the tomatoes were spoiled.

On-farm irrigation is practiced with sprinklers and the cooperative manages the use of the sprinklers. The cooperative members are going to collectively cultivate tomato, French bean, chili and onion. The cooperative members have paid the membership fee, which has been used for the source of purchasing fuel. The membership fee is 4,500Rwf/10a. The cooperative was to collect common service charge from the members at the harvesting time, but because they could not harvest last tomato crop, there has not been any collection of the charge.



Lux-Development assisted project (pump water from lake Rumira)

This cooperative is to deal with vegetables. Unlike rice cooperatives, crops to cultivate tend to be various and also there is a conflict among farmers between those who like to grow vegetables (cash crop) and those who like to grow maize and beans (staple food crop). Some people accept to cultivate crops collectively but others prefer to be individual cropping. This Project indicates the significance of coordinating farmers for the selection of crops for efficient irrigation water use and potential conflict of the farmers over the selection of crops. Cooperative should grow capacity to coordinate farmer members on rational water use and crop selection.

3) Other Agriculture Cooperatives

CORIMAK agriculture cooperative in RSSP Kanyonyomba site was described with many problems, but generally the cooperatives in Rwanda are active and there are advanced ones, which are equipped with office and utensils and hire local residents. Following introduces advanced cooperatives working in the vicinity of the Project areas.



Office of COPRORIZ-Ntende cooperative (Gatsibo)

COPRORIZ – Ntende cooperative in Rugarama Sector, Gatsibo District was established in 2003 and registered as rice cooperative in 2005. Total membership is 916. The cooperative was established when MINAGRI implemented marshland development project with assistance from a NGO called ADRA. Total beneficiary area counts 180ha, or 0.2ha per household. The land belongs to the government. Farmers cultivating upland crops on the hillside are nothe members of the cooperative. RSSP has decided to construct 2 dams in the area of the cooperative and the construction starts in April 2009, With the RSSP project, the beneficiary area will expand up to 516ha. The activities of the cooperative are 1) trainings, 2) procurement of fertilizers and pesticides, 3) marketing of products, 4) loan to the members, 5) implementing small^scale projects, and 6) assisting farmers to produce seeds. They have an office building and the hired staff are total 12 (manager, accountant, agronomist, cashier for milling machine, milling machine operator and his assistant, storekeeper 2 guards 2 gate keeper and an office cleaner). Although they raise the issue of low salary for the staff, the management of the cooperative is good and they have been awarded as an excellent cooperative from MINACOM. In the office of the cooperative, a file of each membership card with the photograph of the member is kept and they also provide ID card to the members.

JICA Technical Assistance titled “The Study on Sustainable Rural and Agricultural Development in Bugesera Disrict” has assisted Corinyabriba agriculture cooperative located in Ruhoha Sector in Bugesera District as a pilot project. In the pilot project, the study provided simple agriculture equipment and trainings for rice cultivation. With this assistance, the cooperative was activated and

following outputs have been created: 1) Paddy yield is increased from 3-4t/ha to 7-8t/ha, 2) One improved rice seed was selected as certified seed by RADA and has been available for sale, 3) The cooperative opened its office in Ruhuha town and employed an accountant to strengthen accounting and 4) Rice milling business has commenced purchasing of one-pass milling.

2.1.7 EIA

(1) Future Schedule

The future schedule on the EIA work of the proposed project based on Rwandan EIA system is shown in Figure 2.1.70. As a first step, the project developer needs to be decided. After the project developer is decided, the basic design study is carried out in the Japanese side and the basic dimensions and the estimated scopes of environmentally affected areas and scoping items will be clarified. At the study, the Japanese side will assist the Rwandan project developer who is responsible for EIA study. REMA will conduct screening for the proposed project after the project developer submit his application document consisting of project brief and REMA will decide the TOR for EIA study for the proposed project.

As mentioned before, the proposed irrigation project is subject to EIA. After the TOR is decided, the project developer needs to appoint an EIA Expert. The JICA Basic Design Team will assist the EIA Expert based on the results of the Basic Design. In RSSP, it took total about four (4) months from its application to approval. Therefore, the proposed project will require four (4) to six (6) months on a safe side. Afterwards, E/N (Exchange of Notes) will be agreed between both countries and will be followed by the land expropriation process after the approval for the implementation of the project by the project developer.

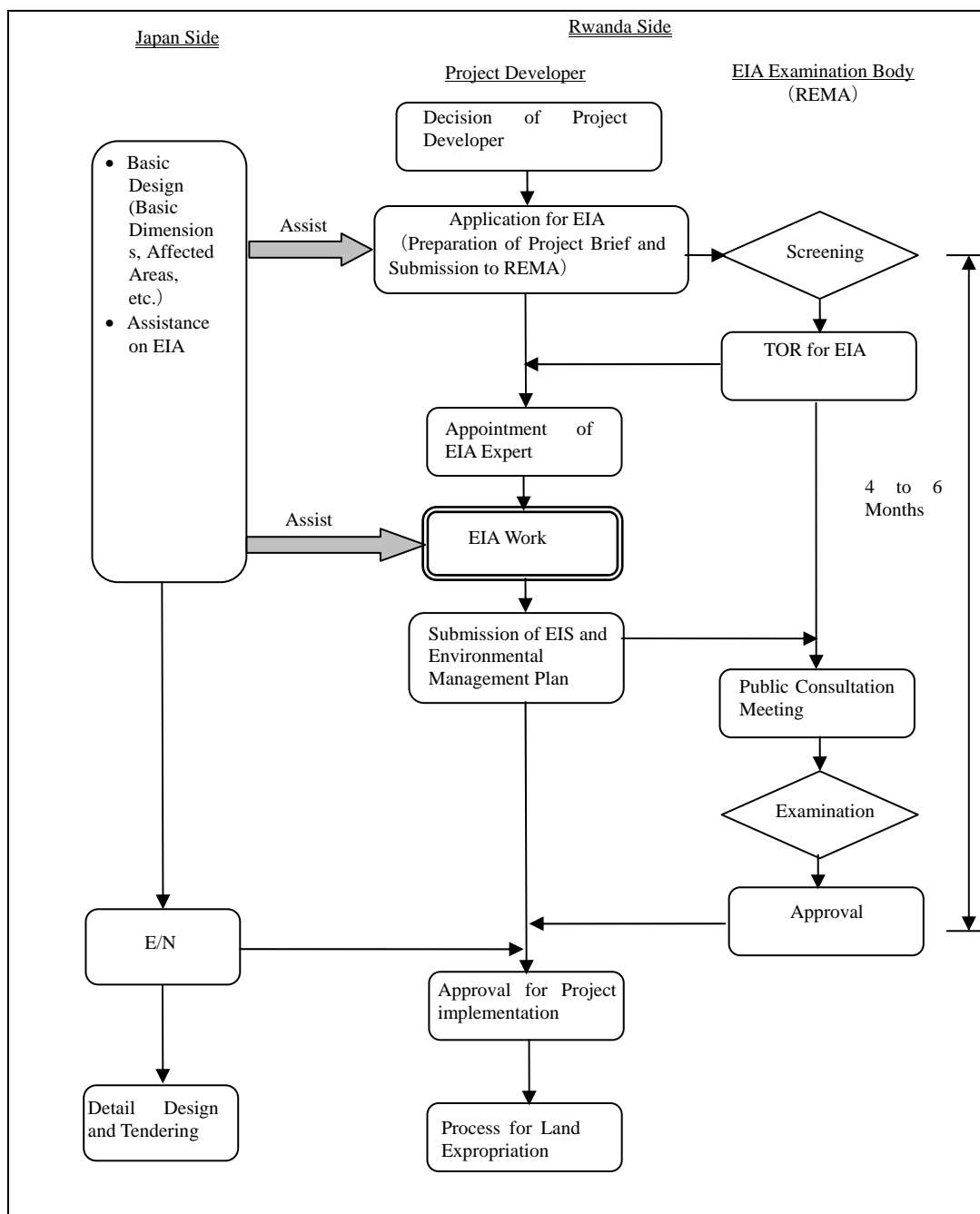


Figure 2.1.70 Proposed JICA Project and EIA Process

(2) Decision of Project Developer

A project developer needs to be decided for carrying out EIA of the proposed project. MINAGRI, RADA, eastern province and district office will be a candidate for the project developer. However, the current major works of MINAGRI and RADA is to make policies and conduct monitoring of projects. The provinces and districts don't seem to have sufficient budget and staffs, while the administrative functions were already shifted to them since the decentralization of 2002. The project developer of the

proposed project needs to be decided promptly.

(3) Appointment of EIA Expert and Assistance by JICA basic Design Team

Only an EIA Expert registered in REMA can conduct EIA study, a smooth transfer from the project developer to the expert needs to be made with regard to the project profile, impact items and affected areas. The JICA Basic Design Team will assist the project developer when the necessity on above transfer of information by the project developer to EIA Expert is considered.

(4) Significant Issues on Environmental and Social Considerations for Project Implementation

The followings are the significant issues on environmental and social considerations in relation to implementation of the proposed project. The appropriate mitigation measures should be taken for the possible adverse impacts and the further study also should be carried out for the unclear impacts.

1) Land Expropriation and Compensation Plan for Submerged Agricultural Lands

Neither houses nor the resettlement of communities were identified by the submerged reservoir of the proposed project in this study. However, some agricultural lands to be submerged were identified and some lands in the downstream side are also estimated to be affected by the facilities of irrigation canals. According to MINAGRI and the officers working for RSSP, the lands in swamps or marshlands basically belong to the state. Above fact can bring the possibility that the marshlands without any water flow at the project site will belong to state lands. Therefore, the land ownership should be clarified and the project developer should prepare an appropriate plan for land expropriation and compensation, and execute a compensation for the affected people if the submerged lands belong to private lands.

2) Measures for Landless Farmers

Landless farmers were identified in this study. According to the officers working in RSSP, they executed money compensation only for the affected landowners. In the proposed project, some measures of provisions of jobs to the landless farmers as staffs of operation and maintenance in the future water users association, or provision of lands to them in the future reallocation of lands in the downstream farm fields are recommended.

3) Environmental Issues during Construction

The village roads approaching the project sites will be used for the access roads in the proposed project. However, the measures such as an appropriate construction plan, safety plan should be prepared by the future contractors since some impacts of noise / vibration or accidents during construction at the access road is estimated since it is located on a steep slope faced by dwelling houses.

2.1.8 Study on Environmental and Social Considerations

This study was carried out for the legal framework, environmental administration, system / process on environmental impact assessment in Rwanda and the site survey on surrounding environment and

society of the project sites. The study results are shown below. In addition, the result of preliminary scoping for the project is attached to the report as a supplementary explanation.

(1) Laws and Registration

The followings are the laws and registration in Rwanda relating to the environmental and social consideration.

1) Organic Law on Environmental Protection, Conservation and Management

The organic law on environmental protection, conservation and management (Organic Law No. 04/2005 of 08/04/2005 establishing the Modalities of Protection, Conservation and Promotion of Environment) was enacted in April, 2005. According to the law, the following clauses are legal mandates in relation to the environmental protection / management on the implementation of the projects that develops major facilities such as reservoir dams or irrigation facilities.

Article 17: Any action concerned with water resources such as irrigation, the development of swamps and wetlands and others, shall always be subject to prior environmental impact assessment.

Article 19: Special protection shall be taken for the swamps with permanent water. Such protection shall consider their role and importance in terms of the preservation of biodiversity.

Article 30: Public or private construction works such as the construction of roads, dams are subject to environmental impact assessment.

Article 66: The committees responsible for conservation and protecting the environment is established at province, City of Kigali, district, town, municipality, sector and the cell levels.

Article 67: Every project shall be subjected to environmental impact assessment, before obtaining authorization for its implementation. This shall apply to programmes and policies that may affect the environment. An order of the Minister having environment in his or her attributions shall determine the list of projects mentioned in this organic law.

Article 85: With an exception of activities related to protection and conservation of streams, rivers and lakes, agricultural activities shall be permitted only at a distance over ten (10) meters away from the banks of streams and rivers and fifty (50) meters away from the banks of lakes. In such distances there shall be no agricultural activities permitted. The order of the Minister having environment in his or her attributions determines a list of rivers mentioned in this article, and specifies other limits to be respected regarding streams.

Article 86: No livestock activities shall be allowed within ten (10) meter from banks of rivers and fifty (50) meter from lake banks.

Article 87: It is prohibited to construct houses in wetlands (rivers, lakes, big or small swamps), to build markets, a sewage plant, a cemetery and any other buildings that may damage the wetlands in various ways. All buildings shall be constructed in a distance of at least twenty (20) meters away from the bank

of the swamp.

2) Laws and Registration on Environmental Impact Assessment

The laws and registration on environmental impact assessment in Rwanda is the General Guidelines and Procedure for Environmental Impact Assessment (which was enacted in November) and the Prime Ministerial Order (No.003/2008 of 15/08/2008, No.004/2008 of 15/08/2008).

Above guideline set up the criteria for screening for EIA as below;

- The degree of the utilization of natural resources
- The degree of remaining impact
- The degree of impacts to be caused by projects and the mitigation measures
- The scope of environmental management plan and its implementation plan
- The presence of significant number of resettled residents, families and communities
- Whether the project sites are located in the environmentally vulnerable areas such as national parks, natural parks and important wetlands or not

In addition, above prime ministerial order on the requirements / process on the implementation of environmental impact assessment regulates that the development activity of dam reservoir for irrigation shall require environmental impact assessment. The details of the process on EIA are mentioned later.

3) Wetland Law

MINTERE enacted a regulation on wetland protection (Ministerial order No.2 of 24 September 2001 relating to the Utilization and Management of Wetlands in Rwanda: Wetland Regulation) in September 2001.

The agricultural development of the proposed project shall follow the articles below;

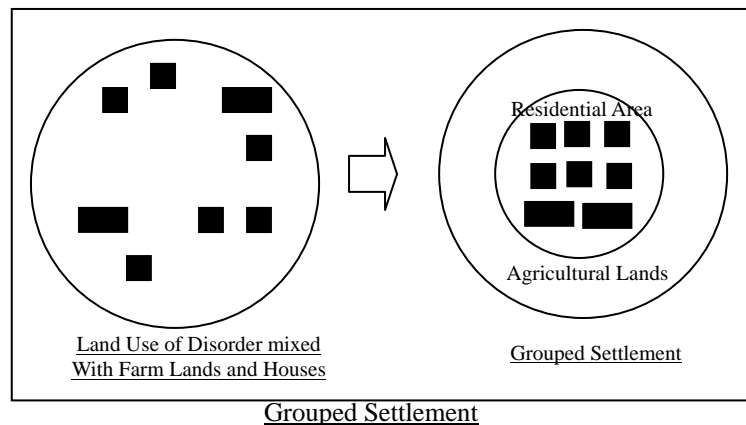
- The agricultural activities shall be permitted only at the distance over 10 meters from the river bank or the distance over 50 meters from lakesides. Any agricultural activity shall be prohibited within above distances. However, a principal head of a province can decide these developments by judging the scale of a wetland. In case that a wetland covers several provinces, the decision shall follow the rules which were established by the mayors of the provinces concerned. If any party cannot obtain agreement, the minister of agriculture can decide whether above agriculture development can be implemented or not.
- Tree planting which may affect the wetland environment is prohibited
- No livestock activities shall be allowed within ten (10) meter from banks of rivers and fifty (50) meter from lake banks. A cowhouse shall not be developed in a distance of 10 to 150 m from a

river bank or at a distance of 50 to 150 m.

- Any activity of planting the trees of eucalyptus or banana is prohibited except the purpose of environmental conservation

4) Registration on Land

MINTERE enacted the organic land law (Organic Law on No 08/2005 determining the Use and Management) in 2005. Two things should be taken into consideration in Rwanda when we face land issues One thing is that this country is the most populated country in Africa and that the majority of people live in rural areas and work on agriculture which is a basic industry. Another thing is the massive change of population which was caused by the genocide in 1994 and brought the complicated problems on movement of people and ownership of lands. In parallel with above problems, it is also a big problem that enough land has not been provided to the landless farmers or refugee returnees. The central government currently plans to promote the efficiency of infrastructure development and land use through “Land Shearing“ and concentrating dwelling houses into one place by executing “Grouped Settlement”



Above organic land law also has the purposes below;

- a. To allow a long-term lease right other than property right of lands and it also allow land transactions at markets through regulating land transactions including trading of land properties
- b. To improve the current state on unclear land properties which was cause by the conflicts among people after the genocide / civil war in 1994
- c. To improve the land management through land consolidation and raising the productivity

Table 2.1.70 shows the clauses in above organic land law that are widely related to agriculture and irrigation development projects. In addition, the registration system of lands has not been developed in Rwanda and the government is preparing for the registration system nation wide.

Table 2.1.70 Organic Land Law and Relationship with Development of Agriculture / Irrigation Projects

Chapter	Section	Article	Contents
1	—	3	The state has supreme powers to manage all the national land, and this is done in public interest aimed at sustainable, economic development and social welfare, in accordance with procedures provided for by law. In that regard, it is the state that guarantees the right to own and use the land. The state also has rights to expropriation due to public interest, settlement and general land management through procedures provided by law and prior to appropriate compensation.
	—	4	Any discrimination either based on sex or origin in matters relating to ownership or possession of rights over the land is prohibited.
	—	5	Any person or association with legal personality that owns land either through custom, or who acquired it from competent authorities or who purchased it are allowed to own it on long term lease in conformity with provisions of this organic law.
	—	8	There are hereby established land commissions at national, provincial and the City of Kigali level and at the level of district, town and municipality.
2	1	9 to 10	Urban and rural land.
	2	11	Individual land is composed of the land acquired through custom, written law which excludes public land or district, town, municipality and the City of Kigali land, the one acquired from competent authorities, purchased land, gift, exchange and sharing.
	Sub-section 1	12	State land which makes up the public domain consists of all the land meant to be used by public or land reserved for organs of state services as well as national land reserved for environmental protection.
	- ditto -	13	Lake and river waters and underground water are public domain.
3	1	20	In respect of public interest and in a bid to improve rural land productivity, the Minister having Agriculture in his or her attributions in conjunction with local authorities and the respective residents may approve the consolidation of small plots of land in order to improve land management and productivity. Each landholder shall be entitled to the rights over his or her parcel of land.
	2	24	The right to land lordship is guaranteed by the state in terms of lease. The period of land lease shall not be less than three (3) years or more than ninety-nine (99) years. Such a period may be extended.
	- ditto -	29	Swamp Land belongs to the state. It shall not definitively be allocated to individuals and no person can use the reason that he or she has spent a long time with it to justify the definitive take over of the land.
	4	30	Registration of land a person owns is obligatory.
	5	—	Transfer of land rights
	6	—	Land lease for agricultural production
	- ditto -	39	This section regulates land lease and other immovable properties meant for agriculture excluding matters related to forestry, which are governed by particular laws.
	- ditto -	41	The period for agricultural land lease is mutually determined by both of the contractual parties. However, any lease contract carried out by a guardian shall not exceed a period of three (3) years.
4	—		Rights and obligations of landlords
	2	63	Productive use, appropriate protection and sustainable land productivity shall be based on the area's master plan and the general structure on land allocation, organization and use and specific plants certified by relevant authorities.
5	—	—	Prescription
6	—	—	Penalties

5) Registration on Expropriation for Public Interest and Valuation Law

The law on land expropriation (The New Expropriation Law) was enacted in April, 2007. The law regulates the mandatory clauses and process relating to land expropriation and compensation. The Valuation law which was also enacted in 2007 regulates the valuation methods on expropriated properties

The jurisdiction demarcation on land expropriation is set up as below in case of RSSP;

- Central government level: MINAGRI as a implementation and accountable body, PSCU (Project Support and Coordination Unit) as a unit for project support and coordination
- District level: Execution of land expropriation and the compensation plan by the district land bureau, their guidance, management and monitoring
- Sector / Cell level: Execution of resettlement and compensation by committees who are legally delegated by the project implementation unit at sector and cell levels

The process on land expropriation is shown in Figure 2.1.71.

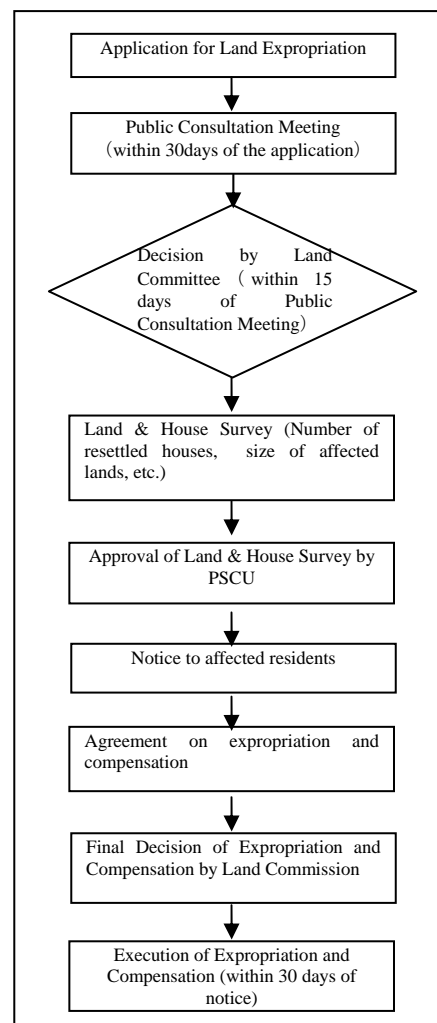


Figure 2.1.71 Process on Land Expropriation

In RSSP, a project developer needs to apply for an application form including the contents of the project, land use plan, environmental impact / mitigation measures and budget allocation for compensation to land commission. A public consultation meeting is held within thirty (30) days of the application and the decision whether they approve the project or not is made within fifteen (15) days of the meeting by the land commission which consists of the persons concerned from central government to cell level. Afterwards, a survey for the lands or houses to be resettled is carried out by PSCU of RSSP, and notice to affected residents and the final agreement on compensation are taken into process.

6) Valuation Law

According to the Valuation Law, any affected individual by a land expropriation has a right to obtain compensation properly. The compensation amount should be computed by an independent appraiser. The law regulates that the computation of compensation amounts for lands or other properties should be based on market prices. However, it does not regulate the details of expense items.

(2) Environmental Administration

REMA, who is an affiliated body of MINTERE, is the only agency that has a jurisdiction of environmental conservation. According to the article of 69 of the organic law on environmental protection, conservation and management, any EIA application should be examined and approved by REMA. REMA has authorization to examine and approve on EIA of all projects.

(3) Process on EIA

The EIA process for project implementation based of above EIA guideline is shown in Figure 2.1.72. As a first step, a project developer should prepare a Project Brief consisting of the contents as shown in Table 2.1.71 and submit it to REMA for their application for EIA process. REMA conducts a screening for the project within ten (10) days of the application. If a full EIA is required at the screening, REMA decides a TOR (Terms of References) indicating the study items and its scope to be required for the project developer's EIA work. The EIA is usually carried out by a registered EIA Expert who is delegated by the project developer. A decision making on whether the project implementation is approved or not is made after a public consultation meeting. According to the interview with the responsible persons in RSSP, it took about four (4) months from the commencing of its application to its approval by REMA.

Table 2.1.71 Project Brief

Contents of Project Brief	
1)	Name, title and address of developer
2)	Name, purpose, objectives and nature of project, including attributes such as size of project, design, activities that shall be undertaken during and after the establishment of the project, products and inputs, sources of inputs, etc.
3)	Description of the proposed project site and its surroundings and alternative sites, if any, where the project is to be located.
4)	Description of all planned activities and all materials to be used
5)	Description of how the proposed project and its location conform to existing laws, regulations and policies governing such project and the use of the site/area proposed for its location.
6)	Description of any likely environmental impacts that may arise due to implementing various phases/stages of the project and proposed mitigation measures thereto.
7)	Description of all mitigation and compensating measures to reduce, minimize or offset the negative impacts
8)	Description of any other alternatives, which are being considered (e.g. siting, technology, construction and operation procedures, sources of raw materials, handling of wastes, etc., decommissioning / closure and site restoration)
9)	Any other information that may be useful in determining the level of EIA required
10)	Attachments: cadastral (deed) plan / lease contract of the land, etc.

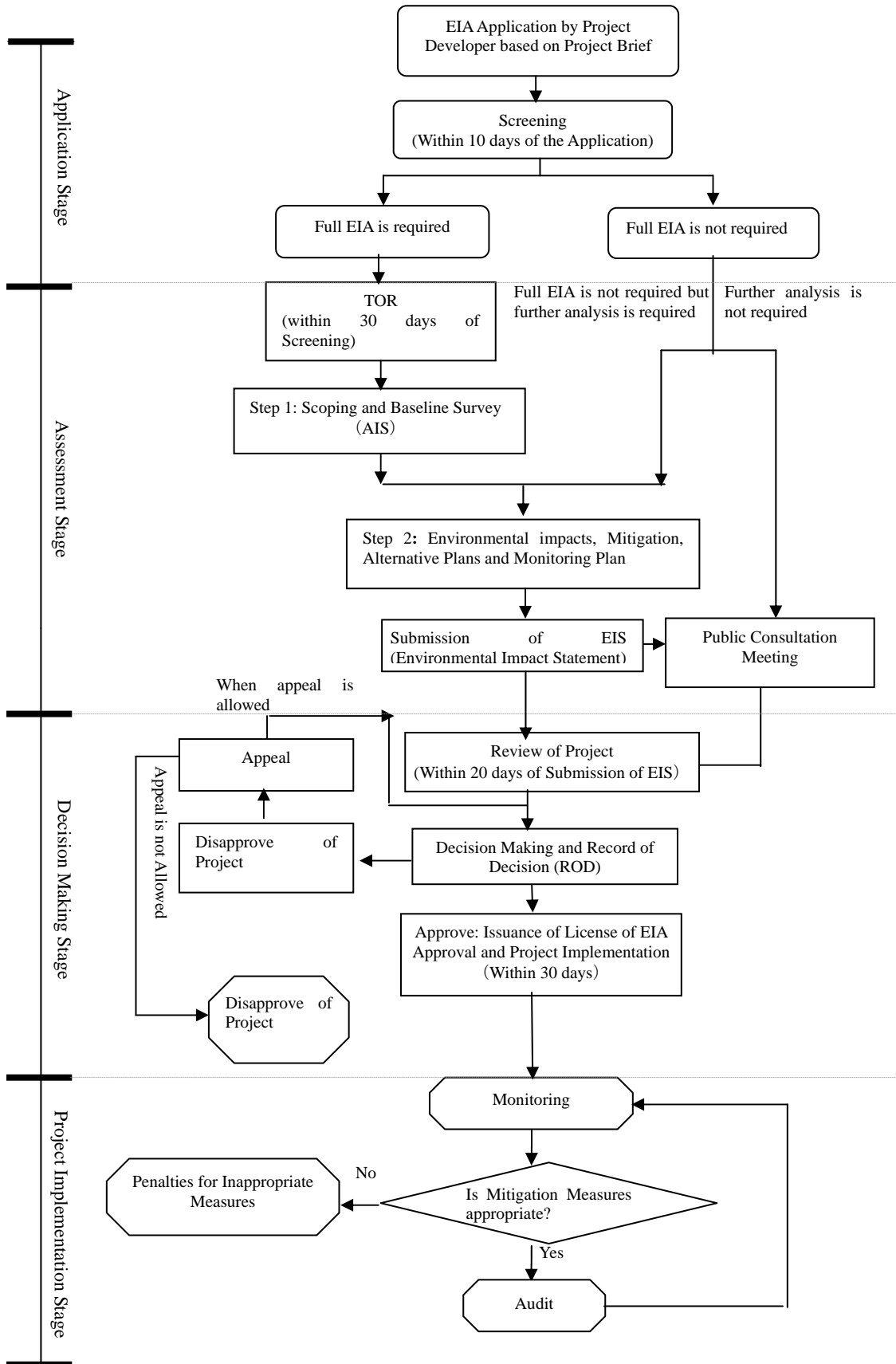


Figure 2.1.72 Flow on EIA Process

(4) Current State on Surrounding Environment and Society

1) Gashora, Bugesera 2

Natural Environment

The project site is located in a valley of the altitude of about 1,350 m and smooth slope, and its upstream / downstream area and the neighboring area of the proposed dam axis are the farm lands of banana, sorghum, maize and beans. The upstream area of the project site crossing a trunk road is a military land and is rich in high vegetation of woods. No water flow such as streams and springs was identified at the project site in spite of rainy season and the site is dry land. At the downstream side of the project site a borrow pit was identified together with the outcropped soil. The borrow pit seems to have been used for other projects. There are no national parks or protection area for flora / fauna except a lake in the downstream side at the distance of about 3.5 km from the project site which is currently a habitat of water birds.

Social Environment

There are no houses at the project site and farm land is already developed. Three imidugudus were identified which cover the project site but they are located at remote areas from the project site. These imidugudus are located at the mountain ridges far from the project site. The residents are almost all farmers and landowning farmers are the largest majority of the households at the project site and followed by labor farmers according to the interview with the officers of sector office. There is no hospital at the project site except one clinic. The residents do not use electricity and they use kerosene lamp for lighting and firewood for fuel. As for the friction among the farmers, land inheritance is the largest issue and the sector head tries to settle the issues. The current land use of the project site is agricultural land and archaeological site or cultural assets were not identified.

Pollution

No significant pollution was identified but the outbreak of malaria and parasite infection was identified. The traffic volume of the trunk road in the upstream of the project site was very small and that of the village road reaching the communities was unpaved and had no car traffics.

2) Remera, Ngoma 21

Natural Environment

The project site is located in a valley of its altitude of about 1,400 m, and shrub was identified in the downstream side and the combined farm lands with banana, sorghum and maize were identified in the downstream. There were no houses at the project site. No water flow was identified except the spring in the downstream of the site. There are no national parks or protection area for flora / fauna. The road approaching the project site is on a steep slope and about thirty (30) houses were identified along the entrance parts of road.

Social Environment

Four (4) imidugudus covering the project site were identified and most of the residents were farmers. They were classified as land-owning farmers, farmers engaging in intensive farming and labor farmers. As well as in Gashora, Bugesera 2, the residents do not use electricity and they use kerosene lamp for lighting and firewood for fuel. The friction among the residents was not identified but the imidugudu leader tries to settle the friction between the parties concerned. The surrounding land use is agricultural land and no archaeological site or cultural assets was identified.

Pollution

No significant pollution was identified but the outbreak of malaria and parasite infection was identified. The project site is located at the valley and there is no traffic, air pollution and noise at the approaching road.

3) Rurenge, Ngoma 22

Natural Environment

The project site is located in a valley of its altitude of about 1,400 m. One stream with 1 m width was identified. The stream is never dried up even in dry season. Two (2) springs were identified and used for the residents. There were no houses at the project site. Shrub is the major vegetation in the downstream of the project site and sorghum and maize are cultivated at the slopes. Some farming was identified near the proposed dam axis. Paddy field is currently developed at the downstream of the project site. The road approaching the project site is located on a steep slope and about thirty (30) houses were identified along the entrance parts of road.

Social Environment

Six (6) imidugudus covering the project site were identified and most of the residents were farmers. They were classified as land-owning farmers, farmers engaging in intensive farming and labor farmers. As well as in Gashora, Bugesera 2, the residents do not use electricity and they use kerosene lamp for lighting and firewood for fuel. The friction among the residents was not identified but the agriculture cooperative tries to settle the friction between the parties concerned. The refugee returnees from Tanzania are farming at the agricultural lands provided by the government. The surrounding land use is agricultural land and no archaeological site or cultural assets was identified.

Pollution

No significant pollution was identified. The project site is located at the valley and there is no traffic, air pollution and noise at the approaching road.

4) Rugarama, Gatsibo 31

Natural Environment

The project site is located in a valley of its altitude of about 1,440 m. The upland fields of banana, sorghum and maize are currently developed near the project site. There are no houses at the site. A gully is developed by crossing the proposed dam axis and it is connected with drainage canal at the downstream. Erosion of natural ground was identified at the gully banks. There was no water flow even in the rain season.

Social Environment

Four (4) imidugudus covering the project site were identified and most of the residents were farmers. They were classified as land-owning farmers, farmers engaging in intensive farming and labor farmers, and the labor farmers is most common. As well as in Gashora, Bugesera 2, the residents do not use electricity and they use kerosene lamp for lighting and firewood for fuel. There are some frictions in relation to land boundaries among the farmers but the agriculture cooperative tries to settle it first and they appeal it to the government (court) when the cooperative cannot settle it. The surrounding land use is agricultural land and no archaeological site or cultural assets was identified.

Pollution

The residents are suffering from above soil erosion caused by the gully. The nearby trunk road is severed by the soil erosion at heavy rain and it causes some damage to crop production.

2.1.9 Technical Assistance

(1) Outline of Technical Assistance

Components of Technical Assistance are planned based on the results of field survey on agriculture practices in the sites and the practices of O&M of the facilities. The technical assistance, which will be implemented by the Japan's Grant Aid Project, is planned to consist of following three categories:

- 1) Assistance for farmers organization for irrigation water management
- 2) Trainings on the operation and maintenance of irrigation facilities
- 3) Trainings on irrigated farming (on-farm irrigation of upland crops and paddy irrigation)

The primary target is to assist in organizing farmer beneficiaries to agriculture cooperative or water users association (cooperative), which will manage the water distribution among the beneficiaries. Secondly, trainings to the farmer beneficiaries on the operation and maintenance of the irrigation facilities, which will be constructed by the Project, will be required. Then irrigated farming (on-farm irrigation) trainings will be required for farmers to utilize irrigation water efficiently and effectively. Because farmers are at the moment practicing rain fed farming, it will be effective and efficient to disseminate the use of irrigation water at on-farm level to the farmer beneficiaries. These assistance and trainings will include the capacity development of local administration who were directly assisting farmers as well as farmer beneficiaries themselves.

(2) Assistance for Farmers Organization for O&M and Irrigation Water Management

There are options whether to establish agriculture cooperative and set up water management committee within the cooperative or to establish water users association as a cooperative as discussed above section of "Operation and Maintenance Plan". This issue will be planned based on the intentions of the farmer beneficiaries, but at least all the farmer beneficiaries have to be the member of the water users association. As for the agriculture cooperative, all the members of the cooperative could be the members of the water users association or the members of the agriculture cooperative could be bigger than the number of the members of the water users association.

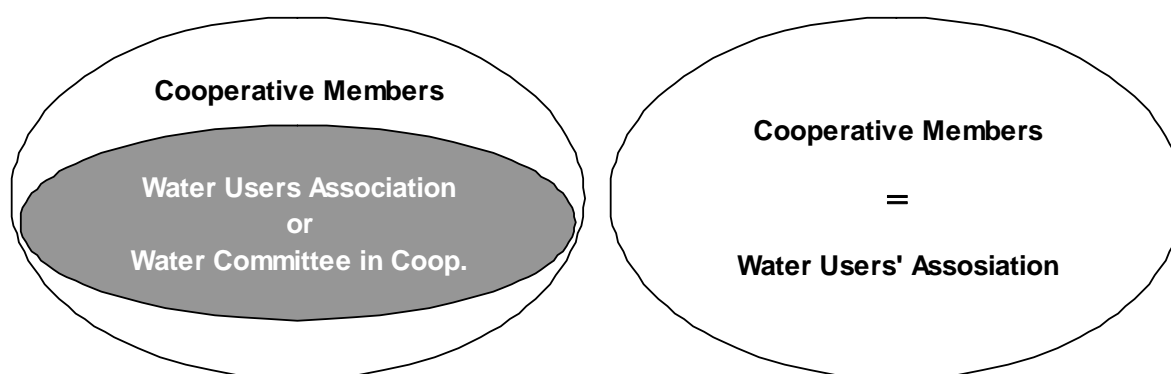


Figure 2.1.73 Relation of the Membership of Water Users Association and Agriculture Cooperative
(Members of water users association should be equal to or within the members of the agriculture cooperative)

Process of establishing farmers organization and the assistance by the Project according to the process is described below:

< Procedure of establishing agriculture cooperative >

There has been already a developed procedure to establish the cooperative as the agriculture officer at Sector level and officer in charge of cooperative at District level assist and supervise the farmers to lead them to register them as cooperative. The Project will, therefore, monitor this procedure.

Step	Procedure
1	Farmers hold general assembly and elect the committee and signing on the minutes and by-law of the cooperative.
2	With these documents the committee submits a letter of application to Sector office.
3	After the Sector approves the application, all the documents are forwarded to the cooperative officer in the District. When the Mayor of the District approves the existence of the cooperative activities of the farmer group, the documents are again forwarded to the Rwanda Cooperative Agency (RCA).
4	Final evaluation of the documents is conducted at RCA and the Director General will finally approve the registration.

< Procedure of establishing water users association or water management committee within the agriculture cooperative >

In case of establishing water users association or water management committee within the agriculture cooperative, following procedure would be assumed and the Project is to support the process. In case of establishing water users association as a cooperative, the process below will be positioned as preparatory work for establishing cooperative described above. In case of establishing water management committee within the agriculture cooperative, it would take time to establish the agriculture cooperative. Therefore, the setting up of water management committee should start at the same time of establishing the cooperative. The procedure will be worked out in cooperation with the local administration officers, so that the process of water users association establishment will be on OJT process to the local administration officers, as well.

Step	Procedure	Assistance from Project
1	Explanation on water users association / water management committee	Assist in holding meetings at village level
2	Identification of the cultivators by irrigation block	Assist in field walk to identify the cultivators
3	Election of representative of each block	Assist in holding meeting by block
4	Election of committee from the representatives of the irrigation blocks.	Assist in holding meetings of the representatives
5	Preparation of By-law	Assist in preparing the By-law
6	Approval of the committee and By-law by the general assembly	Assist in holding general assembly
7	Trainings to the committee and irrigation block representatives (institutional and financial management)	Assist in administrating trainings

(3) Technical Assistance

1) Operation and Maintenance of Irrigation Facilities

The Project will conduct trainings on operation and maintenance of the irrigation facilities. The trainings include the operation and maintenance of the intake of the dam, gates (division box) along the main canal and the practical will be conducted with the actual facilities to be installed by the Project. The trainings will be provided for the committee of the water users association / water management committee of the agriculture cooperative, and the representatives of the irrigation blocks with attendance of the local administrative staff.

2) Trainings of Irrigated Farming

Given the present situation of the farming in the Project sites, there will be two cases: irrigation with upland crop and paddy crop after the construction of the irrigation facilities. Trainings for the irrigated farming especially on-farm irrigation will be conducted as following items:

Irrigated Farming of Upland Crops:

Farmers with rain fed farming practice a simple tilling of the land with manual tool and do not make ridges. It seems that they make the surface of the soil soft so that the soil can absorb and retain rain water as much as possible. But when farmers divert irrigation water onto farmland, there should be some device to spread water equally on each and every corner of the land.

For the land with slope, trainings for furrow irrigation with contour ridging will be conducted. At the same time a simple method of contour measuring using A-frame or line level, which is easily practiced by the farmers, will be introduced to the farmers. On the relatively flat land, trainings for basin irrigation will be conducted.

On the rain fed farmlands in the Project area, intercropping with maize, sorghum, cassava, sweet potato and beans is common. But for irrigated farmland, on which uniform water distribution is expected, intercropping such as maize and potato would affect crop because of the difference of water requirement by crop. Therefore, orientations on farming methods in irrigated farmland would be required, which would include selection of crops.



On the present rain fed farmland in the slope, there is no ridge prepared but the seeds are broadcasted. There are terraces to mitigate soil erosion but the farmland is not leveled.



Basin irrigation practiced on relatively flat land. A basin with length of 5m and width of 1.2m is made in the farmland and water is distributed through farm ditches inside the farmland. Basin irrigation can be applied for any crops but if the water logging takes more than 2 days, furrow irrigation will be favorable. (A case in Malawi)

Furrow irrigation applied in the slope. Irrigation water is channeled to between ridges. The method is applicable for crops planted in line such as maize (JICA, The Study on the Capacity Building and Development for Smallholder Irrigation Schemes in the Republic of Malawi)

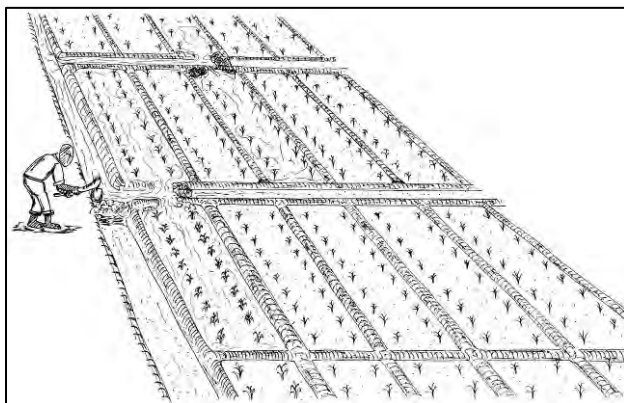
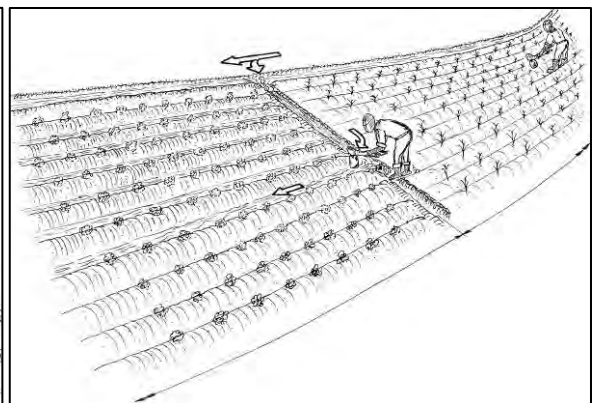


Illustration of Basin Irrigation



Furrow Irrigation with Contour Ridges

Paddy Cultivation:

In Ngoma 22 site, there are paddy fields and after the construction of the dam, paddy cultivation will be expanded. Farmers in other sites also have aspiration to grow rice if enough irrigation water were supplied. Trainings will therefore be planned on paddy cultivation, which would include paddy irrigation (rotational irrigation by bock), and improved rice cultivation such as seed selection, land leveling, nursery preparation, line transplanting etc.



A paddy field in Ngoma 22 Rurenge:
Land is not leveled. Transplanting is random. But there are farmers who practice line transplanting in the site.



Paddy field in Bugesera: The pilot project of Japanese development study was implemented. Transplanted in line and tillering is high.

(4) Inputs

It is suggested that the technical assistance should be carried out with a dispatch of a Japanese expert for around three months at the end period of the construction phase of the Project. Assistance in farmers organization will be a cooperative work with the expert and the local administrative officers (Sector and Cell), so that capacity development of the officers will be incorporated in the process. It is also suggested to prepare a manual of organizing farmers for water management. For the trainings on O&M of the irrigation facilities and irrigated farming, resource persons would be recruited from agencies such as RADA, MINAGRI. It is suggested to prepare an O&M manual for the irrigation facilities and leaflets for irrigated farming, which would be easy to understand for farmers. There is an option that the trainers for irrigated farming could be invited from Malawi, where the irrigated farming is prevailing. Following table summarizes the contents and outputs of the technical assistance.

Table 2.1.72 Contents and Outputs of the Technical Assistance

Activity	Target	Method of Implementation	Who to Conduct	Outputs
Assistance for farmers organization	Local administration officers and farmer beneficiaries	OJT through actual organization process. Trainings to the representatives of farmers organization on institutional and financial management (classroom type training)	Officers in District, Sector and Cell, and expert.	Report of the activity Manual of farmers organization
Trainings on O&M of irrigation facilities	Local administration officers and representatives of farmers organization	Training using the constructed facilities	Technical officers in MINAGRI etc, and expert	Report of activity O&M manual
Trainings on irrigated farming for upland crop	Farmer beneficiaries and local administration officers (agronomist)	Training on the farmland of the Project site after the completion of the construction work. Some seminar on farming at the Cell office is also considered.	Technical officers in MINAGRI / RADA and external trainer as required.	Report of activity Leaflet for irrigated farming
Trainings on paddy cultivation	Farmer beneficiaries and local administration officers (agronomist)			Report of activity Leaflet for irrigated farming

2.1.10 Economic Analysis

(1) Basis of Economic Analysis

MINAGRI is preparing a guideline, “Common Framework Engagement” for LWH Project and it stipulates to carry out financial and economic evaluation for each site. Also detail guideline for the financial and economic analysis is under preparation as Annex 11. Then it was indicated from the officer in charge of LWH that the consultant should follow TOR, which has been prepared for the F/S and D/D of the on-going 24 sites. The economic analysis of this Study will follow the TOR indicated, whose content shows actually a general methodology of the economic analysis, namely the analysis includes to examine internal rate of return (IRR), cost benefit ratio (B/C), and net present value (NPV) using financial and economic prices. Also the guideline indicates the opportunity cost of capital as 12% as a criterion of project selection. Following are the assumptions for the analysis:

- 1) Current Price as of April 2009 is used.
- 2) Standard Conversion Factor (SCF) of 0.92 is applied for converting financial price (market price) of tradable goods to economic price¹. SCF is calculated from the statistics of trade and tariff in Rwanda (refer to Table 2.1.73). As for chemical fertilizers, the tariff for them has been abandoned and therefore economic price of the chemical fertilizers is made equal to the financial price. Economic price of non-tradable goods is also made equal to financial price. Table 2.1.9 lists the prices applied for the analysis.

¹ Economic price is determined under the market of perfect competition. In the existing world, international market is used as a proxy to the perfectly competitive market. Market price of tradable goods in a country is considered distorted by the tariff or taxes and therefore SCF is applied to remove the distortion and convert the financial price (market price) into economic price.

- 3) Labor conversion factor is applied for farm labor wage (unskilled labor wage) considering the potential unemployment. According to the Household Living Condition Survey (2005/06) (EICV), labor conversion factor of 0.5 is applied.².
- 4) Transfer costs such as land tax are eliminated from the economic analysis.

Table 2.1.73 Estimation of Standard Conversion Factor (SCF)

Current price		(Unit : million US\$)			
Item	2006	2007	2008	Average	
(1) Import	548.06	737.19	589.31	624.85	
(2) Export	147.30	176.70	145.30	156.43	
(3) Import Tax	64.96	66.25	64.99	65.40	
(4) Export Tax	0.00	0.00	0.00	0.00	
(5) Export Subsidy	0.00	0.00	0.00	0.00	
(6)=(1)+(2)	695.36	913.89	734.61	781.29	
(7)=(1)+(2)+(3)-(4)+(5)	760.32	980.14	799.60	846.69	
(8)SCF=(6)÷(7)	0.91	0.93	0.92	0.92	

Data: BNR, Statistical year book, MINEFIN

Import / Export Amount : BNR

Import tax : MINFIN Revenue data

Exchange rate : Rwanda Statistics and Figures in Year 2008

² Employment data of EICV(2005/06) shows farm laborer (8.2%), subsistence farmer (31.6%), unpaid farm laborer (39.7%), non-farm laborer (10.9%), non-farm self-business (8.0%), and non-farm unpaid laborer (1.6%). Among them agriculture categories related to farming are farm laborer, subsistence farmer and unpaid farm laborer and the share of unpaid farm laborer counts about 50%. Considering the unpaid laborer as potential unemployment, the opportunity cost of the farm labor is estimated at 0.5.

Table 2.1.74 List of the Unit Price for the Evaluation (April 2009)

Item	Unit	Financial Price	Economic Price	Remark
Products				
Sorghum	kg	300	276	SCF
Sweet potato	kg	55	51	SCF
Cassava	kg	50	46	SCF
Rice	kg	280	258	SCF
Maize	kg	250	230	SCF
Haricot bean	kg	300	276	SCF
Banana	kg	50	46	SCF
Cabbage	kg	100	92	SCF
Tomato	kg	200	184	SCF
Pineapple	kg	150	138	SCF
Avocado	pcs	50	46	SCF
Mango	kg	400	368	SCF
Coffee (cherry)	kg	600	552	SCF
Seeds/Seedlings				
Sorghum	kg	180	166	SCF
Sweet potato	vine	150	150	non-tradable
Cassava	nos	10	9	SCF
Rice	kg	500	460	SCF
Maize	kg	300	276	SCF
Haricot bean	kg	300	276	SCF
Banana	kg	300	276	SCF
Cabbage	kg	800	736	SCF
Tomato	kg	21,667	19,934	SCF
Pineapple	nos	44	40	SCF
Avocado	seedling	2,000	1,840	SCF
Mango	seedling	1,000	920	SCF
Coffee (cherry)	seedling	25	23	SCF
Fertilizers				
NPK	kg	480	480	no tariff
DAP	kg	480	480	no tariff
Urea	kg	410	410	no tariff
DSP	kg	500	500	no tariff
CAN	kg	400	400	no tariff
Manure	kg	5	5	non-tradable
Pesticides				
Thiodan	liter	11,000	10,120	SCF
Ridomil	kg	10,000	9,200	SCF
Dithane	kg	1,600	1,472	SCF
Dimethoate	liter	6,000	5,520	SCF
Kitazine	liter	8,500	7,820	SCF
Materials				
Mulching grass	kg	500	500	non-tradable
Farm Labor	man-day	800	320	Labor conversion factor

Note: Tools such as hoes, saw, shovels re converted by SCF to economic price.

Economic price of local materials is equivalent to market price

(2) Project Cost

The Project cost consisting of construction cost and O&M cost is estimated for each Project site. Project cost is divided into foreign currency (F/C) and local currency (L/C) and SCF is applied to F/C in converting them into economic price. Construction cost by site is estimated for each case of cropping pattern since the irrigation service area differs by the cases. Tables from 2.1.75 to 2.1.77 show the project costs by site and by case. Construction period is assumed one year and O&M cost is estimated for each and every year as an average annual cost. Construction cost per ha of Gatsibo 31 is extraordinarily high due to very little irrigation service area. Construction cost per ha of Ngoma 21 is also very high.

Table 2.1.75 Project Cost by Site (000Rwf): Case 1

Site	Bugesera 2	Bugesera 3	Bugesera 4	Ngoma 21	Ngoma 22	Gatsibo 31
Service Area (ha)	102	149	72	48	314	1
Const. cost (F. Price)						
F/C	1,310,943	1,129,768	1,161,778	1,281,814	2,738,460	521,260
L/C	248,349	210,356	252,863	257,870	422,646	108,362
Total	1,559,292	1,340,124	1,414,641	1,539,684	3,161,106	629,622
(in US\$)	(2,736,000)	(2,351,000)	(2,482,000)	(2,701,000)	(5,546,000)	(1,105,000)
Cost /ha (US\$)	(26,824)	(15,779)	(34,472)	(56,270)	(17,662)	(1,105,000)
Annual O&M cost	460	460	460	460	460	460
Const. cost (E. Price)						
F/C	1,206,068	1,039,383	1,068,835	1,179,269	2,519,383	479,560
L/C	248,349	210,360	252,863	257,870	422,646	108,361
Total	1,454,417	1,249,743	1,321,698	1,437,139	2,942,029	587,921
(in US\$)	(2,552,000)	(2,193,000)	(2,319,000)	(2,521,000)	(5,161,000)	(1,031,000)
Cost /ha (US\$)	(25,020)	(14,718)	(32,208)	(52,521)	(16,436)	(1,031,000)
Annual O&M cost	344	344	344	344	344	344

Table 2.1.76 Project Cost by Site (000Rwf): Case 2

Site	Bugesera 2	Bugesera 3	Bugesera 4	Ngoma 21	Ngoma 22	Gatsibo 31
Service Area (ha)	67	75	146	61	165	2
Const. cost (F. Price)						
F/C	1,098,766	907,342	1,615,682	1,394,072	1,651,393	521,260
L/C	219,416	180,025	314,759	273,178	274,409	108,362
Total	1,318,182	1,087,367	1,930,441	1,667,250	1,925,802	629,622
(in US\$)	(2,312,000)	(1,908,000)	(3,387,000)	(2,925,000)	(3,379,000)	(1,105,000)
Cost /ha (US\$)	(34,507)	(25,440)	(23,199)	(47,951)	(20,479)	(552,500)
Annual O&M cost	460	460	460	460	460	460
Const. cost (E. Price)						
F/C	1,010,865	834,755	1,486,427	1,282,546	1,519,281	479,560
L/C	219,416	180,025	314,759	273,178	274,409	108,361
Total	1,230,281	1,014,780	1,801,186	1,555,724	1,793,690	587,921
(in US\$)	(2,158,000)	(1,780,000)	(3,160,000)	(2,729,000)	(3,147,000)	(1,031,000)
Cost /ha (US\$)	(32,209)	(23,733)	(21,644)	(44,738)	(19,073)	(515,500)
Annual O&M cost	344	344	344	344	344	344

Table 2.1.77 Project Cost by Site (000Rwf): Case 3

Site	Bugesera 2	Bugesera 3	Bugesera 4	Ngoma 21
Service Area (ha)	51	57	110	49
Const. cost (F. Price)				
F/C	939,859	793,522	1,370,098	1,205,821
L/C	197,747	164,504	281,270	247,508
Total	1,137,606	958,026	1,651,368	1,453,329
(in US\$)	(1,996,000)	(1,681,000)	(2,897,000)	(2,550,000)
Cost /ha (US\$)	(39,137)	(29,491)	(26,336)	(52,041)
Annual O&M cost	460	460	460	460
Const. cost (E. Price)				
F/C	864,670	730,040	1,260,491	1,109,355
L/C	197,747	164,504	281,270	247,508
Total	1,062,417	894,544	1,541,761	1,356,863
(in US\$)	(1,864,000)	(1,569,000)	(2,705,000)	(2,380,000)
Cost /ha (US\$)	(36,549)	(27,526)	(24,591)	(48,571)
Annual O&M cost	344	344	344	344

(3) Economic Benefits of the Project

Following benefits are considered tangible:

- 1) Increase of unit yield of crop by stable supply of irrigation water. For instance, increase of unit yield of rice in case of RSSP sites reaches double in 4 crop seasons (refer to Table 2.1.78).
- 2) Increase of farm income by changing the crops from subsistence crop to cash crop by stable irrigation water supply.

Table 2.1.78 Result of Monitoring of Rice Production in RSSP Sites

No.	District	Baseline Yield (t/ha)	Crop Season											
			2007 A			2007 B			2008 A			2008 B		
			Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
1	Huye	2.50	210	3.00	630	210	4.00	840	210	5.00	1,050	210	5.00	1,050
2	Nyanza	3.00	180	3.00	540	180	4.00	720	180	5.50	990	180	6.00	1,080
3	Bugarama	4.00	240	4.00	960	240	6.00	1,440	240	8.00	1,920	240	8.00	1,920
4	Kamonyi	3.00	250	3.50	875	250	5.00	1,250	250	7.00	1,750	250	7.50	1,875
5	Ngoma	2.50	350	3.00	1,050	350	4.50	1,575	350	6.50	2,275	350	6.50	2,275
6	Bugesera	2.50	205	3.00	615	205	4.50	923	205	6.00	1,230	205	6.00	1,230
7	Gatsibo				0			0	600	4.50	2,700		5.00	0
8	Huye	2.00	100	2.50	250	100	3.00	300	100	4.50	450	100	4.50	450
9	Kirehe	3.00	53	3.00	159	53	4.50	239	53	7.00	371	53	7.00	371
10	Rusizi	4.00	205	6.00	1,230	205	7.00	1,435	205	8.00	1,640	205	8.00	1,640
Average		2.94		3.44			4.72			6.20			6.35	

Note: In No.7 there was no rice grown before the project.
Data: RSSP

The Project benefit is estimated at the difference of the net returns between with and without project situations. The net returns of crop production with and without project are estimated based on the result of the baseline survey, data in MINAFRI, RADA, RODHA, etc. For financial analysis using financial price (market price), valuation of family labor is not counted in the production cost, namely net income of crop production is used for estimation of the benefit. As for economic analysis, valuation of family labor is included in the production cost, namely net profit of the crop production is used for economic evaluation. Table 2.1.79 shows the incremental benefit of the Project by each case. It is also assumed that unit yields of crops with project will take four crop seasons to realize the full extent referring to the monitoring result of the RSSP sites.

Table 2.1.79 Annual Incremental Benefit (At the Full Extent of Unit Yield with Project)

Site	Case	Service area (ha)	Incremental Benefit (000Rwf/yr)		Benefit per ha (Rwf)	
			Financial Price	Economic Price	F. Price	E. Price
Bugesera 2	1	102	295,511	262,333	2,897	2,572
	2	67	128,425	111,319	1,917	1,661
	3	51	94,956	94,645	1,862	1,856
Bugesera 3	1	149	431,590	383,167	2,897	2,572
	2	75	143,675	124,553	1,916	1,661
	3	57	106,520	105,741	1,869	1,855
Bugesera 4	1	72	208,606	185,181	2,897	2,572
	2	146	307,533	268,973	2,106	1,842
	3	110	204,622	203,423	1,860	1,849
Ngoma 21	1	48	111,672	108,993	2,327	2,271
	2	61	104,626	93,579	1,715	1,534
	3	49	81,584	84,652	1,665	1,728

Ngoma 22	1	314	854,979	843,528	2,723	2,686
	2	165	307,272	305,549	1,862	1,852
Gatsibo 31	1	1	1,139	873	1,139	873
	2	2	3,230	2,853	1,615	1,427

(4) Economic and Financial Evaluation of the Project

With the costs and benefits estimated above, IRR, B/C and NPV are calculated. Discount rate of 12% is applied to calculate B/C and NPV. When economic internal rate of return (EIRR) exceeds 12%, which is the opportunity cost of capital in Rwanda, and B/C rates more than one (1), and NPV is positive, it means that the benefit exceeds the investment (Project cost). Table 2.1.80 summarizes the results of the calculation by site and by case.

Table 2.1.80 Results of Evaluation by Site and by Case

Site	Case	IRR (%)		B/C (i=12%)		NPV (000 Rwf) (i=12%)	
		Economic	Financial	Economic	Financial	Economic	Financial
Bugesera 2	1	15.4	16.4	1.29	1.38	380,563	524,149
	2	8.6	9.5	0.77	0.83	-255,393	-203,513
	3	8.4	7.7	0.76	0.71	-227,945	-291,594
Bugesera 3	1	24.3	25.9	2.20	2.34	1,337,807	1,603,678
	2	12.6	13.8	1.04	1.12	37,538	118,544
	3	12.1	11.3	1.01	0.95	6,722	-42,666
Bugesera 4	1	12.0	12.9	1.00	1.07	4,509	88,774
	2	15.9	17.2	1.27	1.36	435,934	615,268
	3	13.8	12.9	1.13	1.06	175,285	89,985
Ngoma 21	1	4.8	4.4	0.45	0.42	-701,114	-797,259
	2	4.4	4.8	0.51	0.53	-680,516	-697,459
	3	4.8	3.8	0.53	0.48	-566,755	-676,374
Ngoma 22	1	23.8	22.5	2.10	1.97	2,888,640	2,741,268
	2	18.2	16.9	1.44	1.34	699,874	591,913
Gatsibo 31	1	n.a.	n.a.	0.002	0.005	-526,147	-562,857
	2	n.a.	n.a.	0.04	0.04	-505,937	-541,206

Case 1 (Banana + Fruit tree) shows higher rates in the above indicators. As for Case 2 (upland crops) and Case 3 (including 20% of rice crop area), both of which are the reflection of the farmers' aspiration, EIRR in Bugesera 3, Bugesera 4 and Ngoma 21 exceed 12%. Case 3 includes rice production in the cropping pattern. Rice crop is more profitable than maize but consumes more water than other crops, so that irrigable area becomes smaller resulting in relatively expensive project in terms of cost per ha compared to Case 2. Therefore, it is resulted that EIRR of Case 2 is higher than that of Case 3.

EIRR of Case 2 and Case 3 of Bugesera 2, and the cases of Ngoma 21 are lower than 12%. As for Ngoma 21 site, as mentioned above the facts that the project cost per ha is very high and the irrigable area is relatively small due to the geographical conditions have contributed to lower EIRR. For Bugesera 2 site, there are main road and military area in upstream reaches of the proposed dam site. These are constraining the design of the dam and affected to expand the irrigable area. This constraint has contributed to the lower EIRR. On the other hand Ngoma 22 site has a wide irrigable area making the EIRR high. The irrigable area of Gatsibo 31 site is so little that the economic efficiency does not become viable as B/C merely counts 0.04.

(5) Sensitivity Analysis

A sensitivity analysis is carried out for the Case 2, which is a reflection of the farmers' aspiration, among the cases. EIRR is calculated to the cases: 1) 10% increase of project cost, 2) 10% decrease of benefit, 3) 10% increase of project cost + 10% decrease of benefit, and furthermore as factors of decreasing benefit, 4) 10% decrease of unit yields with project, and 5) 10% decrease of crop price. Table 2.1.81 summarizes the result of sensitivity analysis with EIRR. The result indicates that the economic efficiency is more sensitive with the decrease of benefit than increase of project cost. EIRR of Bugesera 4 and Ngoma 22 exceeds the opportunity cost of capital even the case of 10% increase of project cost and 10% decrease of benefit showing high economic efficiency of the Project in the sites. About the factors threatening the economic efficiency such as unit yield and unit price of crops, it is indicated that the decrease of unit yield with project seems more sensitive than decrease of unit price of crop.

Table 2.1.81 Sensitivity Analysis on EIRR (Unit: %): Case 2

Site	Base	Cost 10% increase	Benefit 10% decrease	Cost 10% up + Benefit 10% dwn	Yield 10% down	Crop price 10% dwn
Bugesera 2	8.6	7.5	7.4	6.4	6.7	6.9
Bugesera 3	12.6	11.2	11.1	9.8	10.3	10.5
Bugesera 4	15.9	14.2	14.1	12.6	13.2	13.4
Ngoma 21	4.4	3.6	3.5	2.7	2.9	3.1
Ngoma 22	18.2	16.4	16.2	14.5	14.9	15.4
Gatsibo 31	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

2.1.11 Obligations of Rwandan Government

In order to secure smooth project implementation and operation and maintenance, obligations of the measures to be undertaken by the Government of Rwanda during preparation, procurement of equipment, construction and operation and maintenance under the Grant Aid Project was discussed as follows.

- Securement and compensation of land: Compensation for the land for reservoir, dam and other facilities. Securement of land for temporary facility yard.
- Farm land consolidation: Farm land consolidation and terracing necessary for irrigation farming.
- EIA: The project developer is MINAGRI and EIA will be arranged by MINAGRI assisted by the study team.
- Access road to the sites will be secured by the Government of Rwanda.
- Facilities of electricity and others needed for the Project implementation at outside the sites.
- Securement of disposal area, borrow area and quarry site.
- To exempt Japanese nationals from customs duties, internal taxes, and other fiscal levies which will be imposed in Rwanda with respect to the supply of materials, equipment and services or to bear the same.
- To bear the necessary commission to the bank based on the Banking Arrangement and Authorization to Pay.
- Other items described in the minutes of the meeting were confirmed.

2.2 Other Results

2.2.1 Natural Condition

Natural condition of the project area was surveyed o following items.

(1) Climate and Hydrology

Various data such as temperature, precipitation, precipitation, evapotranspiration, sunshine, wind direction, wind speed were collected as basic information for determining scale of dam body, capacity of the reservoir and design flood discharge. METEO RWANDA has almost all the meteorological information. Collected data are shown in the list below.

Table2.2.1 Meteorological data list (METEO RWANDA)

Daily Raifall

Station	start	end	years
KIGALI AERO	1971-01	2009-01	39
BUTARE AERO	1971-01	1993-05	23
GIKONGORO	1990-01	2009-02	20
KAMEMBE AERO	1957-07	2008-06	52
GISENYI AERO	1975-07	2009-02	35
RUHENGERI-AERO	1977-03	2005-09	29
ISAE BUSOGO	2006-01	2008-11	3
NYAMATA	2008-01	2008-12	1
NYAGAHANGA-EFA	2008-01	2008-12	1
Eastern Province			
KIBUNGO	1932-01	1993-07	62
KARAMA PLATEAU	1960-06	1981-12	22
BARE	1978-11	1993-12	15
GAHORORO	1960-01	1994-02	35
NYARUBUYE	1944-01	1994-02	50
ZAZA	1930-10	1994-02	64
GABIRO	1931-05	1989-12	58
KAGITUMBA	1940-01	1990-08	51
KIZIGURO	1931-01	1990-03	60

Max 24hr Monthly

Station	start	end	years
KIGALI AERO	1971-01	2008-12	38
GABIRO	1932-01	1988-12	57
KAGITUMBA	1940-01	1990-07	51
KIZIGURO	1931-01	1990-03	59
NYAGATARE	1954-09	1977-12	24
KARAMA PLATEAU	1960-07	1981-12	22
AKAGERA	1983-06	1992-05	9
BARE	1978-11	1993-12	15
GAHINI	1930-10	1970-02	40
GAHORORO	1960-01	1994-02	34
KIBUNGO	1932-01	1993-08	62
NYARUBUYE	1944-01	1994-02	50
RUHUNDA	1975-01	1993-08	19
RUKIRA	1964-08	1992-07	29
RUSUMO-BGM	1968-04	1991-05	24
RWAMAGANA	1930-10	1994-02	63
RWINKWAVU	1954-04	1994-02	40
ZAZA	1930-10	1994-02	63

Daily Hymidity

Station	start	end	years
KIGALI AERO	1971-01	2009-02	39
BYIMANA	1990-12	1993-03	4
BUTARE AERO	1971-01	1993-05	23
GIKONGORO	1990-01	2009-02	20
KAMEMBE AERO	1971-01	2008-07	38
RUBENGERA METEO	1991-08	1993-12	3
GISENYI AERO	1975-07	2009-02	35
RUHENGERI-AERO	1977-03	1992-08	16
ISAE BUSOGO	2006-01	2008-11	3
BYUMBA METEO	1991-04	1992-03	1
KIBUNGO	1990-01	1993-02	4

Daily Sunshine Hour

Station	start	end	years
KIGALI AERO	1971-01	2007-10	37
BUTARE AERO	1988-09	1993-05	5
GIKONGORO	1990-01	2000-09	2
KAMEMBE AERO	1971-05	2000-04	30
GISENYI AERO	1986-04	1994-02	9
RUHENGERI-AERO	1983-04	1992-09	10
ISAE BUSOGO	2006-01	2008-03	2
BYUMBA METEO	1990-06	1990-07	0.2
KIBUNGO	1990-01	1992-03	2

Temperature Min

Station	start	end	years
KIGALI AERO	1971-01	2009-02	38
KARAMA PLATEAU	1960-06	1981-12	22
BYIMANA	1960-01	1999-12	40
BUTARE AERO	1971-01	1993-05	23
RUBONA COLLINE	1958-01	2007-11	50
GIKONGORO	1990-01	2009-02	29
KAMEMBE AERO	1957-07	2008-07	51
RUBENGERA METEO	1991-08	1993-12	2
GISENYI AERO	1975-07	2009-03	34
RUHENGERI-AERO	1977-03	2005-09	29
ISAE BUSOGO	2006-01	2008-11	3
BYUMBA METEO	1990-06	2009-03	19
NYAGATARE	1954-09	1977-12	23
KIBUNGO	1973-04	1993-07	21
Eastern Province			
GAHINI	1930-10	1931-12	2
GAHORORO	1960-04	1993-04	33
RUSUMO-BGM	1968-04	1974-12	7
RWAMAGANA	1930-10	1933-10	3
ZAZA	1945-01	1994-02	49

Temperature Max

Station	start	end	years
KIGALI AERO	1971-01	2009-01	38
BUTARE AERO	1971-01	1993-05	23
GIKONGORO	1990-01	2009-02	19
KAMEMBE AERO	1957-07	2008-06	51
GISENYI AERO	1975-07	2009-03	34
RUHENGERI-AERO	1977-03	2005-09	28
ISAE BUSOGO	2006-01	2008-11	3
KIBUNGO	1973-04	1993-07	21
Eastern Province			
GAHINI	1930-10	1931-12	1
GAHORORO	1960-04	1994-02	34
RUSUMO-BGM	1968-04	1974-12	7
RWAMAGANA	1930-10	1933-10	4
ZAZA	1945-01	1994-02	49

Temperature Mean

Station	start	end	years
KIGALI AERO	1971-01	2009-02	28
BYIMANA	1990-10	1996-08	6
BUTARE AERO	1971-01	1993-05	22
GIKONGORO	1990-01	2007-01	17
KAMEMBE AERO	1971-01	2008-07	38
RUBENGERA METEO	1991-08	1993-12	3
GISENYI AERO	1975-07	2009-03	24
RUHENGERI-AERO	1977-03	1992-09	16
ISAE BUSOGO	2006-01	2008-12	3
BYUMBA METEO	1991-04	1992-03	1
KIBUNGO	1990-01	1993-04	4

Daily Solar Radiation

Station	start	end	years
KIGALI AERO	1971-01	2007-10	37
BUTARE AERO	1988-09	1993-05	5
GIKONGORO	1990-01	2000-09	2
KAMEMBE AERO	1971-05	2000-04	30
GISENYI AERO	1986-04	1994-02	9
RUHENGERI-AERO	1983-04	1992-09	10
ISAE BUSOGO	2006-01	2008-03	2
BYUMBA METEO	1990-06	1990-07	0.2
KIBUNGO	1990-01	1992-03	2

Daily Evaporation

Station	start	end	years
KIGALI AERO	1971-01	2009-02	39
BYIMANA	1990-10	1993-01	3
BUTARE AERO	1971-01	1993-05	23
GIKONGORO	1990-01	2000-09	21
KAMEMBE AERO	1971-01	2008-07	38
RUBENGERA METEO	1991-08	1993-12	3
GISENYI AERO	1975-07	2009-02	34
RUHENGERI-AERO	1977-03	1991-02	15
ISAE BUSOGO	2006-01	2008-11	3
BYUMBA METEO	1991-01	1992-03	1
KIBUNGO	1990-01	1993-07	4

Wind Speed and Direction

Station	start	end	years
KIGALI AERO	1974-01	1991-09	18
BUTARE AERO	1974-01	1993-05	20
KAMEMBE AERO	1974-01	1993-12	20
GISENYI AERO	1976-01	1978-12	13
RUHENGERI-AERO	1977-05	1992-09	15

Wind Speed Frequency January to December

KIGALI AERO
 BUTARE AERO
 KAMEMBE AERO
 GISENYI AERO
 RUHENGERI-AERO

(2) The River and the Catchment Area

Investigation on condition of the river and catchment area was carried out to grasp present condition of the site before the construction of the reservoir. Items to be investigated are flow quantity, water quality, water temperature, condition of river bed etc. These data is basic data for considering quantity and figuration of sediment and ensuring the regular function of the river. Investigation on health disorder caused by water was carried out to confirm the quality of the water in the site. The site survey and interview to the resident people on flood sign to estimate flood discharge. Water quality in the site was examined and confirmed. It will be a data for comparison after construction of the reservoir. Items to be tested and the result is as follows;

Table 2.2.2 Test Result of Water Quality

Item	Bugesra 2	Ngoma 21	Ngoma 22	Gatsibo 31	Standard (Paddy)
Ph	7.65	7.09	7.08	7.49	6.0-7.5
COD	2	0	0	6	<6ppm
Dissolved Oxygen	5.3	2	6.2	4.5	>5ppm
Suspended Solids	3330	7	189	61	<100ppm
Total Nitrogen	1.2	0.7	7.5	3.25	<1ppm
E. Conductivity	21	210	151.8	423	<300 μ S
Arsenic	0	0	0	0	<0.05ppm
Zinc	0	0	0	0.04	<0.5ppm
Copper	0	0.06	0	0	<0.02ppm

Standard : Design Standard for Rural Development Project (Ministry of Agriculture, Forestry and Fishery, Japan)

There is no stream in Bugesera 2 and the water sample was taken from a pond. SS is much larger than the standard and T-N is larger than the standard because of cattle manure. However, the water of the reservoir will be run off surface water during the rain and the quality will be expected to have no problem.

The water from Ngoma22 is taken from a spring. In case of small DO value, growth of roots is harmed and copper will harm the growth of roots and leaves. Since the water sample was taken from the pipe of spring, the reason of small DO value is unimaginable. Copper is undetected in Ngoma22 Rurenge which locates at next valley to Ngoma21, and the possibility of pollution of ground water is considered very low. Proposed reservoir locates at the upstream of the spring and the water of the reservoir will be run off surface water during the rain and the quality will be expected to have no problem. However, in case that the spring water will be used for irrigation, it is recommended to pay attention to water quality and to reexamine.

There is a spring at the upstream end of the reservoir of Ngoma22 Rurenge. The sample was taken in the rain. The stream roiled by run off surface water and SS value is a little large. T-N value is large and DO value is small. It is considered that domestic waste water and cattle manure flow into the stream. It is necessary to take measures to reduce them in the catchment area.

Sample from Gatsibo 31 is mixture of ground water and surface water during rain. T-N value and EC value is large. Large EC value means high density of saline and it causes inhibition of water and nutrition absorption and metabolism.

Generally, T-N value is large in each site and it is recommended to take measures to reduce domestic wastewater and cattle manure.

(3) Selection of Dam Axis

The site survey was conducted to determine the dam axis. The dam axis is selected at the location of short crest length, large reservoir area at the upstream and no possibility of land slide and considering water leakage path.

(4) Boring Exploration at Dam Axis

Boring exploration was conducted at the selected dam axis. The result was utilized for considering bearing capacity and permeability of the foundation. The survey was conducted at 3 sites excluding Gatsibo 31. Items and quantity of survey is as follows;

Core boring: 15m at river bed, 10m at both abutment

Standard Penetration Test: 10 Nos. (1m interval) at river bed, 7 Nos. (1m interval) at both abutments

Permeability Test: 3 times (5m interval) at river bed, 2 times (5m interval) at both abutments.

Perforated PVC pipe was inserted in the boreholes as ground water level observation hole.

(5) Survey for Embankment Material

The type of the dam is assumed to be homogeneous type which move on with deformation of foundation, and which can reduce water seepage by lengthening creep length. The survey was conducted to confirm that the material can be adopted for homogeneous type dam. The borrow pit was selected in the reservoir area considering economy and environment. Items to be tested are as follows;

Creep length : the length of path of infiltration flow in the dam body caused by the difference of water level between upstream and downstream. It is necessary to lengthen the creep length to inhibit destruction of dam body.
--

Excavation of test pit : 2 locations in each site

Laboratory test : natural water content, specific gravity, sieve analysis, liquid limit, plastic limit

(6) Investigation of Faults

Great rift valley consists of the eastern valley which begins at dead sea in Jordan, through red sea and Ethiopia, and end in Tanzania and western valley which begins at the north of lake Albert, through lake Edward, lake George, lake Tanganika and reach to lake Malawi. There are many faults are indicated in geological map of Rwanda that locates at the North of lake Tanganika. Under this geological condition, it is necessary to consider the relation faults and dam carefully. Existing geological map was checked and investigation of faults by site surveying was carried out.

(7) Seismic Investigation

In the Eastern Valley, seismic activity is not so active, on the other hand, in the Western Valley, shallow earthquake happens very often. According to UN commission, damage by earthquakes in Rwanda is estimated not so big. However, Toro earthquake (M-6.7) in 1966 gave large damage in western Uganda. And the earthquake occurred at the border of Congo in December 2007, gave a lot of human and physical damage.

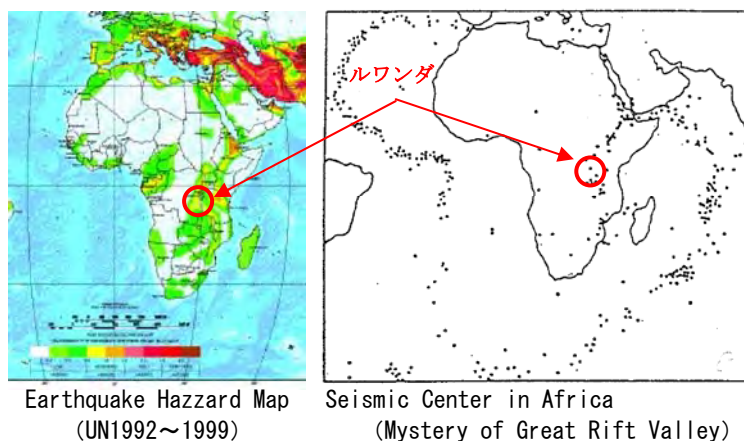


Figure 2.2.1 Earthquake Information

According to above map, since shallow earthquake occurs often, consideration of seismic-resistant design will be required.

(8) Topographic Survey

Topographic survey was conducted to design outline of reservoir, water level and dam body. Items to be surveyed are as follows;

Table 2.2.3 Topographic Survey

Site	Plane survey at dam axis	Longitudinal survey along the dam axis	Cross sectional survey along the dam axis
Bugesera2 Gashora	420m x both up and down stream 50m = 42,000m ²	400 m	Upstream and downstream each 50m
Ngoma21 Remera	420m x both up and down stream 50m = 42,000m ²	420 m	Upstream and downstream each 50m
Ngoma22 Rurenge	220m x both up and down stream 50m = 22,000m ²	220 m	Upstream and downstream each 50m
Gatsibo31 Rugarama	280m x both up and down stream 50m = 28,000m ²	280 m	Upstream and downstream each 50m

2.2.2 Socio-economic Survey

This section summarizes the results of the Socio-economic survey. Details are shown on the Annex.

(1) Implementation of the Survey

The socio-economic survey was carried out with the set of workshops and interviews with questionnaire to potential farmer beneficiaries. Following table shows the program of the socio-economic survey.

Table 2.2.4 Program of the Socio-economic Survey

Schedule	Target	Items for Survey and Explanation to the Beneficiaries
1st day Key-informant interview	Officers of Sector, Cell and representatives of Imidugudu	Confirm benefited imidugudu, population, issues in the area, agriculture practice, farmer organizations, land, extension services, water, electricity, health, and other social aspects.
2nd day Explanation for potential beneficiaries and workshop	Potential farmer beneficiaries of target imidugudu	Current farming, irrigation practice, explanation on project, necessity of farmer organization for O&M, location of the project, discussion on the project
3rd day to 6th day Individual interview with questionnaire (baseline survey)	Potential farmer beneficiaries of imidugudu (around 40househods per site)	Family structure, land use, cropping pattern, farm inputs, crop production, market, constraints on farming, income, interest in the project and willingness for farmer organization, etc.

The Socio-economic survey started on March 23 and by March 26, the exercises of the first and second programs were completed in all the 4 sites. After that, the baseline survey was carried out and the survey was completed in 3 days in each site. When we conducted the workshop with potential farmer beneficiaries in Rurenge Sector, it was found that part of the potential beneficial area (on the other side of the valley hill) belongs to the neighbor Sector, Remera. There for another workshop with the concerned farmers in Remera Sector was held for the Rurenge site (Ngoma 21 Rurenge). On the workshops with the farmers, majority of the participants was male, but female participants were relatively high in Gashora and Remera Sectors. Table below summarizes the outline of the execution of the socio-economic survey.



Workshop with farmers in Rurenge Sector

Table 2.2.5 Outline of the Socio-economic Survey Execution

Site	1st Day (Key-informant Interview)	2nd Day (Workshop with Potential Farmer Beneficiaries)	Baseline Survey
Gashora Sector (Bugesera2)	March 23 At Sector office Participants:13 (Sector officer: 7) (Cell officer:6)	March 24 At Kagomashi Cell office Participants: 47 (male 29, female 18) 3 Imidugudu residents participated.	March 25 ~ 27 Valid HH 40
Remera Sector (Ngoma 21)	March 25 At Sector office Participants: 11 (Sector / Cell officer:6) Imidugudu rep.:5)	March 26 At Bugera Cell office Participants: 26 (male 17, female 9) 4Imidugudu residents participated.	March 27 ~ 29 Valid HH 39
Rurenge Sector (Ngoma 22)	March 25 At Sector office Participants:36 (Sector / Cell officer:10) (Imidugudu rep.: 26)	March 26 At project site (on the day, there was a communal workand people were working on clearing the road to the project site. After the work, the workshop was held.) Participants: 206 (male 195, female 11) 4 Imidugudu residents from RurengeSector participated. April 17 2 Imidugud residents from Remera Sector participated. Participants: 35 (male 22, female 13)	March 27 ~ 29 Valid HH 37
Rugarama Sector (Gatsibo 31)	March 23 At Gihuta Cell office (beneficial site) Participants: 10 (Sector / Cell officer: 5) (Imidugudu rep.: 5)	March 24 At the yard of Sector office compound Participants: 96 (male 82, female 14) Potential beneficial Imidugud would 4, but because there was a survey team recently came in to survey nearby another dam construction site funded by Rural Sector Support Program (RSSP), some people were mixed up with that project. Hence another 2 Imidugudu residents, who would be benefited from the other dam construction came to the workshop. The number of participants of 4 Imidugudu, which would be benefited from this project, was 70 (male 59, female 11).	March 25 ~ 27 Valid HH 38

(2) The First Day Session

Feature of the Sector

This section outlines the results of the first day of the survey. Following table summarizes the feature of the sectors described by the participants of the first day session:

Table 2.2.6 Feature of the Sector by the Participants

Sector	Feature
Gashora	The sector has a big potential for irrigation and agricultural development since it has plenty of marshland (4 lakes belong to the sector). The sector is promoting maize crops with the support of the private company named “PRODEV Bugesera”. In this project, the company provides seeds, fertilizer and agricultural machinery to the farmers and the company is getting 50 % of the crop yields. The cooperative produce maize crops with its area of 300 ha. There is an irrigation project with its scale of 104 ha which was started with the support by Luxemburg government. 34 ha of its irrigation area belong to Kagomasi cell. In the Sector, production of maize and beans is increasing, while sorghum and sweet potato are decreasing. The reasons: the regional agricultural policy is to increase the highly marketable crops for the increasing crops.
Remera	The feature of the Sector is characterized with the aspects: 1) Enough fertile land, 2) Flat area will make the farmers active for farming and selling products, and 3) The settlement of population is growing due to the government policy of land consolidation for cultivation. In the Sector, production of haricot beans, sorghum, banana and tomato is increasing since they are marketable. On the other hand, production of non-marketable crops like sweet potato, taro and cassava is decreasing. Specifically the unit yield of banana is increasing because the farming technique is improved and farmers could get a new variety of seeds.
Rurenge	In 2006, the Sector was established merging three sectors: Rurenge, Rumbuwe and Kaberangae Sectors. Rurenge Sector has a natural forest of 6ha with wildlife in there. The Sector wishes to make the forest a national park. There is a big pond for fish breeding in the Sector constructed by Chinese. Major crops are rice in valley, tomatoes, banana, beans, pineapples, and sorghum. Coffee is also seen a lot as coffee trees are grown in 26,000ha in the Sector. There are three marshlands in which rice is cultivated. They are Mwambo (90ha), Gisaya (50ha), and Rwampunga (15ha). The proposed dam site covers Rwampunga marshland. Generally the crop production shows increasing tendency due to fertilizer application, introducing new variety seeds, though rice yield remains still low.
Rugarama	Rugarama Sector is described as agriculture dominated area with mainly rice, banana, sugarcane, a large-scale market in the Sector and there is a health center established with the assistance of a NGO (ADRA). Major crops in the Sector are rice, banana, and sugarcane. Vegetables are few but cabbages are major vegetable grown in the Sector. The cultivated area is decreasing due to soil erosion and also the cultivated area per capita is decreasing due to population increase. Crop yields are generally decreasing due to climate change, poor agriculture technology, and population increase. Because of population increase, the land use is becoming more intensive so that the soil fertility has been degraded.

Ranking of Agricultural Issues

The participants were asked to rank the agricultural issues in the area. Following table shows the issues ranked by the participants:

Table 2.2.7 Ranking of Issues on Agriculture by the Participants

Issue	Gashora	Remera	Rurenge	Rugarama
1	No water at dry season	Climate change: little water at dry season.	Climate change (change abruptly)	Storages for farm products
2	The marshlands are not developed for agricultural development	Access to input: fertilizer, improvement of seeds	Marketing (perishable is difficult to store)	Irrigation
3	Processing facility of crop products toward increasing their marketability is not enough.	Poor farming technology and farming practice.	Machinery (no adoption)	Pests

(3) The Second Day Session

Following summarizes the major contents of the discussions on the second day. Table below shows the major questions and answers during the session in each Sector.

Table 2.2.8 Q & A during the Second Day Session

Sector	Question	Answer
Gashora	Can the proposed dam reserve the water at dry season? Is there any possibility for dry-up on the proposed dam reservoir?	The specialists of JICA team are studying now based on the meteorological, hydrological geological and engineering viewpoints.
	In order to avoid the dry-up of the reservoir, I recommend you to connect the water of the downstream lake with the proposed reservoir. How do you think of my idea?	We are still studying the proposed project from technical, economical, social and environmental viewpoints. However, we also have to consider the project cost
	Can you make higher dam height more than the proposed height (15m)?	If we raise the dam height, the reservoir water will reach and overtop the road and military land which are located at the downstream side of the proposed reservoir.
	Can the proposed dam shift to the lake in terms of supply of stable water?	We are still studying the proposed project various viewpoints.
	I am worrying about the erosion at the upstream side. How do you think of this issue?	We also consider avoiding such erosion in the planning.
Remera	Will the irrigation water be supplied only to the marshland? Will it be supplied to upland hill?	JICA study team is studying now on the technical and also economical point of view.
	The canal will not be possible because of its location. The canal should be located at more upstream side in terms of providing more beneficiaries.	JICA study team is studying now on the technical and also economical point of view.
	Some farmland will be submerged in the upstream by the project. Does the project developer provide an alternative land?	At that meeting with Sector officers, they answered that the compensation for the submerged farmland will be made by money.
	When will the project start?	Its construction may start next year.
Rurenge	We are worrying about the compensation which will be caused by the project	MINAGRI has a policy for compensation for the affected farmers and has some experiences on compensation in other projects.

Following are the major points discussed at the sessions:

Gashora:

- Basically, farmers need the compensation by money. They need at least 700 Rwf/m² taking the case of consideration of road construction (400 Rwf/m²) into consideration.
- Change of crop types is not a problem for farmers. Cooperative will manage the land allocation. For the lost land, the cooperative will rent a land from farmers and will distribute it to the farmer who has lost a land. As for the issue of landless farmer, the government should take care for them.
- The surplus of the crop products will be sold at the local market. The benefit will be used for health insurance. The benefit will be contributed by the cooperative.

Remera:

- Farmers think that the compensation should be made by money. On other hand, they also think that more guarantee for their lives should be considered. On these points, they think that alternative

lands take priority over the compensation by money.

- Basically, farmers do not have enough lands. They do not think that they can be members of WUA. The marshland is basically government land. If the land is reallocated, all the farmers will have benefit equally. The sector officer should have responsibility for land reallocation. Some part of upland can be exchanged with marshland.
- As for the landless farmers, they will be able to provide their labor forces at construction stage. However, they have no idea for it after construction.

Rurenge:

- Compensation to the land on upstream of the dam should be money to buy other land.
- How to share benefit: for those who do not have land in the irrigation area, paid labor will be given to them.
- Those who do not have land can be engaged in fish culture in the dam.
- The dam lake could be developed as a water park (boat service etc.)

Rugarama:

- The rice cooperative (COPRORIZ Ntende) can help establish new association for water management.
- People are also interested in fish breeding in the dam.

(4) Baseline Survey

Baseline survey was conducted with a questionnaire to around 40 households from each site. After we confirmed the Imidugudu, which are concerned with the project area, on the first day of the socio-economic survey, the enumerators visited the concerned Imidugudu and randomly selected households and carried out individual interviews. Following are the outline of the survey results.

Family Size

Average family sizes of the sample households in Gashora, Remera, Rurenge and Gatsibo are 5.1, 4.9, 4.9 and 6.0 respectively. Those who live alone in Gashora and Remera are all adult men. Number of households whose head is widow is 5 in Gashora, 9 in Remera, 10 in Rurenge and 15 in Rugarama.

Table 2.2.9 Family Size of the Sample Households (Provisional)

Family Size	Gashora		Remera		Rurenge		Gatsibo	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
1	1	3%	2	5%	0	0%	0	0%
2	1	3%	1	3%	3	8%	1	3%
3	5	13%	8	21%	10	27%	0	0%
4	10	25%	7	18%	4	11%	6	16%
5	5	13%	8	21%	9	24%	11	29%
6	8	20%	6	15%	3	8%	9	24%
7	6	15%	3	8%	2	5%	4	11%
8	4	10%	0	0%	2	5%	2	5%
9	0	0%	1	3%	4	11%	3	8%
10 -	0	0%	3	8%	0	0%	2	5%
Average	5.1	100%	4.9	100%	4.9	100%	6.0	100%
Widow headed	5	13%	9	23%	10	27%	15	39%

Present Crop Production

Tables 2.2.10 to 2.2.13 show the share of the households who grow each crop and the average production in kg. Major crops grown commonly in the 4 sites are sorghum, bean, maize, cassava, sweet potato, and banana. Vegetables are comparably grown more in Remera. Rice is also cultivated in Rurenge and Rugarama. But for Rugarama, rice crop is seen in the downstream marshland, where the project cannot cover due to avoid overlapping with the beneficial area of RSSP.

The unit yield of crops is difficult to assess because farmers are not accurately recognizing the size of their cultivated land. However, according to the field investigations, the yield could be presumed low due to unstable rain-fed agriculture. Another aspect is the inter-cropping common in all the sites. The density of crop stands in the inter-cropping is lower than that of mono-cropping, that would result in low unit yield if the data of one crop was taken from the inter-cropped farmland. It may be required to conduct a spot yield survey to obtain accurate unit yield of crops.

Table 2.2.10 No.(%) of Household who grow each crop and Average Production (Gashora)

Crop	Bean	Cassava	Sorghum	Maize	Sweet potato	Banana
No. of HH (%)	93%	83%	80%	80%	50%	35%
Average Harvest (kg)	296	579	300	87	233	130

Table 2.2.11 No.(%) of Household who grow each crop and Average Production (Remera)

Crop	Cassava	Sorghum	S. potato	Bean	Tomato	Maize
No. of HH (%)	62%	56%	51%	41%	23%	15%
Average Harvest (kg)	848	406	382	160	118	59

Table 2.2.12 No.(%) of Household who grow each crop and Average Production (Rurenge)

Crop	Sorghum	Bean	Maize	Rice	Cassava	S. potato	Banana	Cabbage
No. of HH (%)	68%	46%	32%	19%	19%	11%	8%	3%
Average Harvest (kg)	416	273	357	65	101	96	28	157

Table 2.2.13 No.(%) of Household who grow each crop and Average Production (Rugarama)

Crop	Maize	Sorghum	Bean	Banana	Rice	Cassava	S. potato	Cabbage
No. of HH (%)	63%	42%	37%	16%	11%	5%	5%	5%
Average Harvest (kg)	180	248	72	270	53	27	21	13

Issue of Farming

Problems on farming were asked to the interviewees. Interviewees were to pick the first, second and third serious issue from the list of issues. In all the four sites, most of the interviewees ranked “lack of irrigation water” as the most serious issue. This result would be borne to the fact that the project aims

at irrigation development. The answer would have been biased from the intention of the survey. But in Remera some interviewees picked other issues as the most serious one such as “Lack of seeds”, “Lack of storage facilities”, “Lack of fertilizers” etc. “Lack of seeds” were picked as the second serious issue in Remera and Rurenge, while the second serious issue were “Lack of fertilizers” in Rugarama. In Gashora, the number of interviewees who picked Lack of seeds or Lack of fertilizers as second or third was about equal. Incidence of pests and diseases were also found as a significant issue in the four sites.

Conflict over Water

There are few conflicts over water in the 4 sites except for Remera, where conflict incidence was given from 46% of the interviewees. Generally few cases of conflict over water would be due to absence of irrigation. Because of rain-fed agriculture, though farmers are somehow controlling water by terracing and ditches, it would not cause so much conflict among farmers.

Table 2.2.14 Conflict over Irrigation Water

Site	Answer "Yes"		Conflict Incidence
	No.	(%)	
Gashora	1	3%	It was in dry season and people fed the crops with water but they got bad harvests
Remera	18	46%	Negotiation over shortage of rain water, storage of rainwater, water sharing
Rurenge	2	5%	Negotiatino over storages of rain water
Rugarama	0	-	

Farm Household Income

Average annual farm household income in Gashora, Remera, Rurenge and Rugarama is estimated at 146,000Rwf, 425,000Rwf, 241,000Rwf and 135,000Rwf respectively. Out of them income from crop production occupies 81%, 50%, 91% and 75% in Gashora, Remera, Rurenge and Rugarama respectively. Income level in Remera is the highest among the 4 sites and also income from other than crop is high in Remera. Table 2.2.15 below shows the average annual income of the 4 sites.

Farmers allocates significant amount of farm produce for their self-consumption. The monetary value of produce for the self-consumption was also estimated. The value of the annual self-consumption in Gashora, Remera, Rurenge and Rugarama is 158,000Rwf, 155,000Rwf, 118,000Rwf and 73,000Rwf respectively. Total annual farm household income and self-consumption value are estimated at 304,000Rwf in Gashora, 580,000Rwf in Remera, 359,000Rwf in Rurenge and 209,000Rwf in Rugarama.

Table 2.2.15 Average Annual Income of the Sample Households in the Four Sites

Item	Gashora		Remera		Rurenge		Rugarama	
	Rwf	(%)	Rwf	(%)	Rwf	(%)	Rwf	(%)
Crop	118,521	81%	211,351	50%	219,297	91%	101,493	75%
Livestock	17,008	12%	44,282	10%	8,703	4%	18,283	13%
Fishery	0	0%	7,692	2%	0	0%	0	0%
Forest	1,625	1%	82,538	19%	0	0%	0	0%
Farm labor	7,710	5%	0	0%	0	0%	1,389	1%
Other	1,550	1%	79,231	19%	13,108	5%	14,278	11%
Total	146,414	100%	425,094	100%	241,108	100%	135,443	100%
Home Cosumption Value	157,813		155,333		118,068		73,181	
Total Value	304,227		580,427		359,176		208,624	
Crop + Home Consumption	276,334	91%	366,684	63%	337,365	94%	174,674	84%

Table 2.2.16 and Figure 2.2.2 below show the share of the sample households by income group. In this table and figure include the cash income and the value of self-consumption. Share of households under the annual income of 500,000Rwf occupy 90% in Gashora, 62% in Remera, 73% in Rurenge and 92% in Rugarama.

Table 2.2.16 Sample Households in the Four Sites by Income Group

Annual Income + Home consumption Value (Rwf)	Gashora			Remera			Rurenge			Rugarama		
	No.	Share	Acc.	No.	Share	Acc.	No.	Share	Acc.	No.	Share	Acc.
< 100,000	8	20%	20%	6	15%	15%	3	8%	8%	13	36%	36%
100,000 < 200,000	7	18%	38%	5	13%	28%	7	19%	27%	12	33%	69%
200,000 < 300,000	8	20%	58%	4	10%	38%	10	27%	54%	5	14%	83%
300,000 < 400,000	6	15%	73%	6	15%	54%	4	11%	65%	1	3%	86%
400,000 < 500,000	7	18%	90%	3	8%	62%	3	8%	73%	2	6%	92%
500,000 < 600,000	0	0%	90%	3	8%	69%	5	14%	86%	1	3%	94%
600,000 < 700,000	2	5%	95%	1	3%	72%	3	8%	95%	1	3%	97%
700,000 < 800,000	0	0%	95%	3	8%	79%	0	0%	95%	0	0%	97%
800,000 < 900,000	0	0%	95%	0	0%	79%	1	3%	97%	0	0%	97%
900,000 < 1,000,000	1	3%	98%	1	3%	82%	0	0%	97%	0	0%	97%
1,000,000 <	1	3%	100%	7	18%	100%	1	3%	100%	1	3%	100%
Total	40	100%		39	100%		37	100%		36	100%	

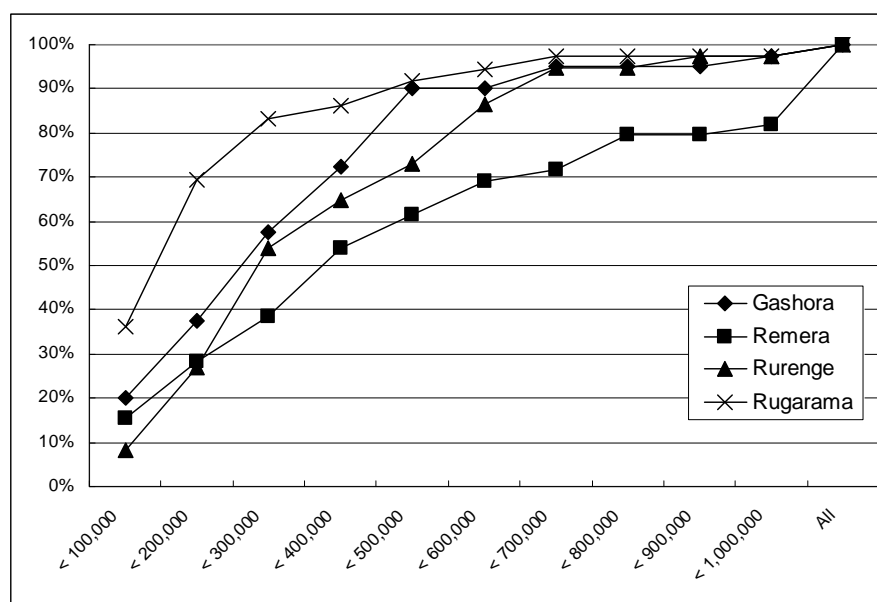


Figure 2.2.2 Sample Households in the Four Sites by Income Group

2.2.3 Field Survey on Japan' s Grant Aid Project (Water Supply)

“The Project for Rural Water Supply” with Japan’s Grant Aid was implemented in Ngoma, Kirehe, Rwagamana and Kayonza Districts. In Phase I of the Project implemented in 2006 in Rwagamana, Kayonza and Ngoma, 4 sites of pipeline water supply and sites of borehole totaling 24 boreholes were constructed and rehabilitated. Phase II was implemented in Kirehe in 2007 and 3 pipeline systems and 1 borehole were constructed. The Project also undertook the capacity building of water users’ organization for O&M of the water facilities.

Also a technical cooperation project called “Water and Sanitation Improvement Project” has been implemented with the period from April 2007 to August 2010. This project is intended to collaborate with the above grant aid project, namely selecting the target sites from the sites developed by the grant aid project and establish the O&M system according to the size and type of the water supply system.

The Study Team collected information on the monitoring system of the administrations and the duty or authority of the water users’ organization at the village level, as well as district level in order to get lessons for the planning of the operation and maintenance system of the LWH Project to be implemented by Japan’s Grant Aid. The Study Team carried out field surveys at the water supply sites in Kayonza District and Ngoma District where the target Project sites are located. Following are the sites investigated.

- 1) Hand pump water supply system (borehole) in Murama Sector, Ngoma District
- 2) Pipeline water supply system in Mukarange Sector, Kayonza District

(1) Hand pump water supply system (borehole) in Murama Sector, Ngoma District

In the sector, five boreholes have been newly constructed and six existing boreholes have been rehabilitated by the Japan’ Grant Aid. The maintenance of the borehole is relatively easy since it uses no power, hence no fuel. By the project, water users’ Organization was established and registered to the Government as a cooperative. A committee within the cooperative has been set and a resident near each and every borehole had been assigned as a custodian of the borehole.



Borehole No.14

The boreholes started the operation in 2007.

Although the hand pumps of the boreholes look dirty due to no housing on them, the pumps are quite in good condition. It was reported that a part of the borehole No. 14 investigated by the Team was broken in December 2008 but they replaced the part with the spare parts. According to the residents, the borehole does not dry throughout the year and supplies enough water to meet the demand and no problem in water quality. The beneficiaries were happy with the solution since they no longer have to go far to fetch water. However, the custodian of the No.14 borehole (woman) said that about half of the beneficiaries are delaying the water fee payment of 500Rwf for every three months decided by the cooperative.

The custodian has been mentally suffered from the issue of the water fee collection. The custodian goes around the houses to collect the water fee but some of them are not willing to pay the fee. When the payment is delayed, the custodian locks the borehole and provides the key to open the borehole for those who have paid the fee. However, those who do not pay give pressure on the custodian by saying outrageously, “this water was not brought by you!”. Then the custodian has to open the key.

This incidence indicates that there are people using the borehole without paying the water fee. The role of the Sector is to monitor the boreholes. They go round the sites every three months. Agronomist in the Sector is in charge of the boreholes and Social Affair Officer is also involved. The cooperative and the Cell officers are the frontline manager of the boreholes. At the District level, the officer in charge of the boreholes is posted in the Economic Development Unit. Basically the District is just to receive the monthly reports from the Sector. MINALOC is providing subsidy to the poor for water fee through the Sector. Last year MINALOC paid water fee for about 100 poor households. When the Team reported the issue that the custodian has been suffering from the delinquent in paying water fee, the Sector officer said that they would take action when such issue was officially reported from the cooperative to the Sector.

(2) Pipeline Water System in Mukarange Sector, Kayonza District

The pipeline system is operated and maintained by Voma Meza Cooperative, which was established in February 2008 when the existing system was rehabilitated by the Japan's Grant Aid. There used to be six public companies for water in Kayonza District. These public companies were privatized and tender was announced for sale of these companies. Among the public water companies, three of them, namely Mukarange, Rukara, and Rwinkwavu were integrated into one company and Voma Meza cooperative contracted with the District to run the integrated one.

The number of the member of the cooperative is nine, who used to work for the public water companies. They made a group and applied for the tender and made contract with the District for the operation and maintenance of the pipeline water supply system. This cooperative is not made of all the water users but rather similar to a private company selling water to customers. However, the members of the cooperative do not receive salary as the employee of the cooperative according to the cooperative law. They can only receive the dividend of the profits. With the JICA



Water tap installed at individual house. Volume of water is recorded by the indicator

Grant Aid Project, two systems of the three (Mukarange and Rwinkwavu) have been rehabilitated.

Water tap has two categories: public and individual. For both public and individual, the custodian of the public tap and the owner of the individual tap pay 680 Rwf/m³ to the cooperative. Then the cooperative pays 15% of them to the District as a tax. The cooperative collects the payment every month from the custodians and individuals. The residents buy water from the public tap at a rate of 20Rwf/20liter. The rate of water price is regulated by the District. Individual taps are used only by the owner families in most case, but some of them also sell the tap of water to the neighbors. Difference between public and individual taps is in the maintenance. The cooperative is responsible for the maintenance of public tap, while the owner of the individual tap has responsibility for ther

maintenance of their tap. The pipeline system covers 163 public taps and 388 individual taps. Officer in charge of the water supply in the District is Infrastructure Officer. A committee has been established within the Infrastructure Unit to oversee the private sector. Electrogaz is supplying power to the pump of the pipeline system. The cooperative pays for power supply to Electrogaz. Damages of the system which is beyond the capacity of the cooperative to repair, the District provides support to the cooperative. There was an incident that two pump sets were broken at the Rukara branch of the cooperative. The District repaired them. The problem the cooperative is facing is the rehabilitation of Rukara branch, which is beyond the capacity of the cooperative to do. Collection of water fee has been showing good performance.

(3) Implication to LWH Project

Basic set-up of the O&M of the water supply system is same as the irrigation project, namely the cooperative is the core of the O&M and any issue beyond the capacity of the cooperative will be intervened by the local administration such as Sector and District. Local administrations are therefore regularly monitoring the water supply facilities and provide funds according to the needs. For the boreholes in Ngoma, the local administration supported the water fee for the poor households and also in Kayonza, the District supported the cooperative to repair the pump. It is encouraging for the cooperative to be able to receive support from the local administrations. However, the budgets of the government is limited and therefore, assisting the cooperative to be independent with their own generation of the fund.

As for the pipeline water supply system in Kayonza, they can measure the volume of water used from each tap and they can also stop the water delivery to the tap of the delinquents without affecting other taps. Therefore, the water fee is almost surely collected (even for the public taps, if the custodian delays the payment, they could stop delivering water to the tap). As for the borehole in Ngoma it is difficult to measure the volume of water used by each person and that would create the feeling of unfairness among the users and discourage some people to pay the water fee. It is the same situation for the irrigation water as it is very difficult to measure the volume of irrigation water used by individual. It is also impossible to stop delivering water to a particular farm plot. In Asian countries, the collection of irrigation water fee shows low. Hence the case of the lessons from the management of the boreholes would be more applicable to the irrigation system management.

Collected water fee in the boreholes in Ngoma has been saved by the cooperative for the payment for the custodians and purchasing of spare parts. At the moment, as they still have the stock of spare parts provided by the Grant Aid, they can repair the boreholes cheaply. However, after the exhaustion of the stock, they will have to buy the spare parts by themselves. Therefore, the collection of the water fee will be critical to the O&M of the boreholes.

As mentioned above, the custodian has been suffering from the water fee collection and the intervention by the committee of the cooperative and officer in charge at the Sector level will be required. To increase the collection efficiency of the water fee, system to collect the fee by not only the custodian alone but with more involvement of the cooperative committee and Sector should be considered. On

the other hand, exemption of the fee for poor households should be considered and the transparency for identify poor should be secured to make others to be convinced.

2.2.4 O&M Cost

O&M for irrigation facilities contains following items;

Daily inspection : Employed janitor carries out daily inspection for embankment, intake facility, water level and water flow condition and controls intake and outlet gates.

Water management : Gate keepers operate valves in conformity with the irrigation plan. One gate keeper will be employed for each block. One block will be about 20 ha.

Maintenance work of facilities : Cleaning and clearing weeds on embankment, repair of maintenance road, clearing of canal will be carried out once a year. Greasing and painting for gates and repair of pipeline will be carried out from time to time.

Assumed typical maintenance cost is estimated as follows;

Item	Content	Quantity	Cost (per year) RWF
Janitor of the reservoir	Daily inspection, Control of intake and outlet gates	1 person	24,000
Gate keeper	Control of discharge valves	4 persons	96,000
Cleaning of embankment	Once a year	50 persons	25,000
Repair of maintenance road	Once a year	50 人	25,000
Cleaning of spillway canal	Once a year	50 人	25,000
Material for maintenance	Grease, Paint	1 L.S	15,000
Repair of pipeline	Valves, Pipes	1 L.S	250,000
Total		1 L.S	460,000

2.2.5 Procurement

(1) Contractors

The study team collected information and data on technical level, staffs and financial state of construction firms and examined the possibility of employing for implementation of the project. Most of main construction firms in Rwanda are branch offices of foreign countries such as Belgium, Germany and Uganda. Most of those firms work for buildings or road construction projects. In RSSP dam project, a local contractor was awarded to the contract recently, however, it is possible to ensure enough personnel. Foreign capital company can prepare experienced engineers for dam construction from their home country. List of construction company is shown in Annex.

(2) Labor, Equipment, Material

The price investigation was carried out on following items.

- Various labor cost
- Various rental cost for equipment
- Import tax
- Custom clearance
- Cost of construction materials

List of price investigation is shown in the Annex.

(3) Availability of electricity, water and telephone

1) Electricity

There is no power lines in the vicinity of all sites and long distance of lead-in cable is required. It is expected that generators will be required.

2) Water supply

There is a spring at the downstream of the Ngoma21 Remera site and it is used as drinking water. It is usable for concrete works. In Ngoma22 Rurenge, there is a stream from upstream spring and it never dry up in the dry season. It is useful as spraying water for embankment material, however, taking care for organics and suspended solids when it is used for concrete works. There is no water source in the vicinity of Bugesera2 Gashora site. Only small stream of running water happens at the time of rain fall. It is necessary to consider possibility of deep well or using lake water 2km downstream.

3) Telephone

International and domestic telephone call can be ensured by cell-phone.

2.2.6 Rwandan Government Organization

(1) MINAGRI: Ministry of Agriculture and Animal Resources

The central administrative functions were shifted to the regional provinces or districts in accordance with the government's decentralized policy in Rwanda since 2002. MINAGRI (Ministry of Agriculture and Animal Resources), who is in charge of establishing agricultural policies and their administration executions and requested the proposed JICA grant aid projec, RADA (Rwanda Agricultural Development Authority), who is a government body under the umbrella of MINAGRI, is in charge of policy-making and monitoring / evaluating of the agricultural projects. While, the regional provinces and districts are in charge of the promotion and implementation of the agricultural projetcs.

A Joint Agriculture Sector Review meeting was held in MINAGRI on March 12th, 2009, and a restructuring plan of MINAGRI was reported. Accroding to the meeting, MINAGRI and its affiliated bodies are scheduled to be restructed, and the new activities by a new organization are estimated to commence on the new fiscal year (July, 2009).

This chapter mentions the current state on the present organization of MINAGRI and the outline of above restructuring plan.

1) Organization Structure of MINAGRI

The organization structure of MINAGRI is shown in Figure 2.2.3. MINAGRI's mission is to plan the modernization of agricultural and livestock industry for the stable food supply. Namely, the policy target of MINAGRI is to promote the agriculture which can reduce adverse effect on environment, bring a spreading effect on national economy and produce cash crop with marketability from the existing subsistence agriculture. The working-level staffs of MINAGRI were shifted to regional provinces and districts, and its major activities were limited only to policy-making for implementation of SPAT (Strategic Plan for Agricultural Transformation), follow-up or evaluation of agricultural projects and preparation of the documents in relation to agriculture development. The actual number of the staffs of MINAGRI was changed to 69 in 2005 and 31 in July, 2006 from 144 in 2001. As a result, the most of actual works are subcontracted to local consultants and the MINAGRI staffs are busy for attending meetings.

2) Annual Budget

Table 2.2.17 shows the transition of annual budget in MINAGRI from 2000 to 2008. The ratio of donors' financial aid to the national budget for project development is shown in Table 2.2.18. The annual budget of MINAGRI has fluctuated between 12 and 13 billion Rwf for the 6 years from 2001 to 2006, while its budget has been increasing as 18 in 2007 and 23 billion Rwf in 2008, respectively. The ratio of the investment cost for project development to the annual budget in MINAGRI is 81 to 84 % for the period of 2000 to 2003, which shows that most of the national budget is allocated to the investment cost for project development in spite of its downward trend during these 5 years. On one hand, as shown in Table 2.2.18., the ratio of the financial aid amount from donors to the total of project development budget exceeds 70 percent, and also the ratio of those amount to its annual budget exceeds 55 percent, which shows that the budget of MINAGRI still continues to be depend on the financial aid from overseas donors.

Table 2.2.17 Transition of Annual Budget of MINAGRI

Year	Operating Expenses			Project Development Investment (B)	Total (A+B=C)	Project Development Investment/Total (B/C)
	Personal Expenses, Allowances, etc.	Expenses excl. Personal Costs	Sub Total (A)			
2000	896	645	1,541	6,747	8,288	81.4
2001	954	1,121	2,075	10,725	12,800	83.8
2002	865	1,247	2,112	10,940	13,052	83.8
2003	1,001	1,368	2,369	7,423	9,792	75.8
2004	904	2,466	3,370	9,915	13,285	74.6
2005	1,128	3,580	4,708	7,959	12,667	62.8
2006	1,564	3,043	4,607	8,658	13,265	65.3
2007	2,035	2,394	4,429	13,517	17,946	75.3
2008	2,047	2,626	4,673	18,687	23,360	80.0

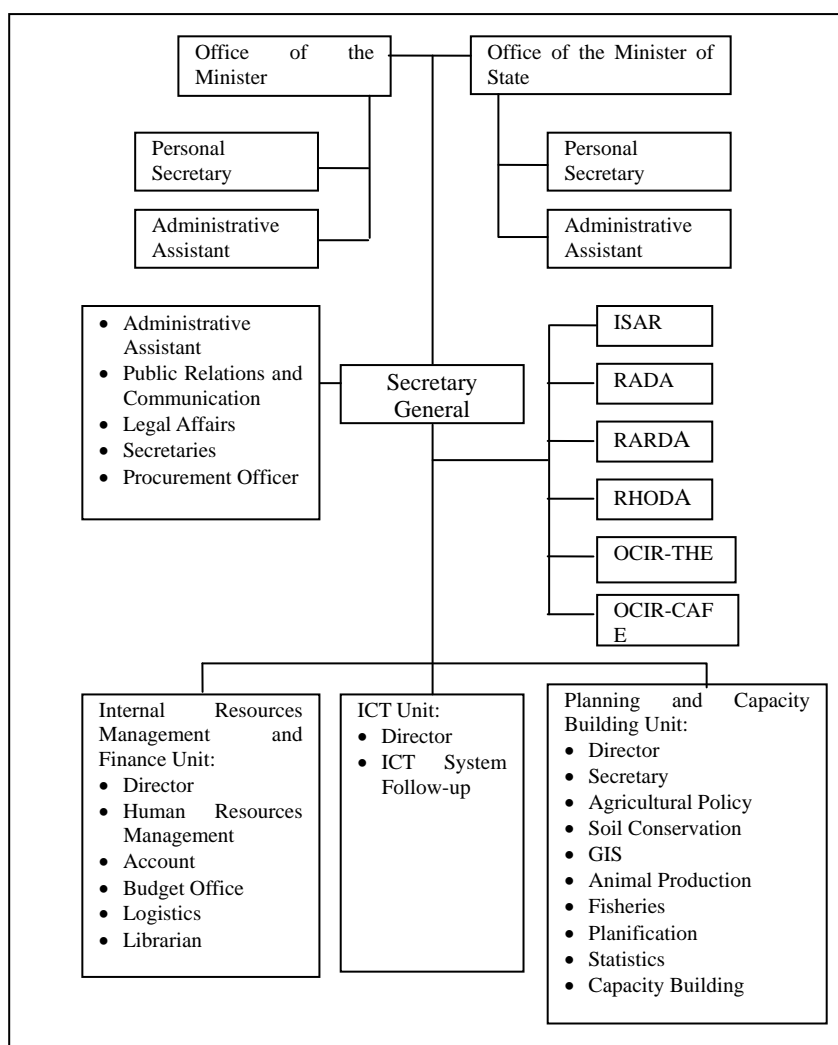
Source: Rwanda Public Expenditure Review Agriculture, Martin Fowler, etc., April 2007, Agriculture Sector Performance Report Fiscal Year 2008, MINAGRI, March 2009

Table 2.2.18 Financial Aid from Donors to Project Development Investment of MINAGRI

Unit in Million Rwf

Year	National Budget (A)	Donors' Financial Aid (B)	Project Development Investment (C)	Total Budget (D)	(B/C) (%)	(B/D) (%)
2000	440	6,307	6,747	8,288	93.5	76.1
2001	387	10,338	10,725	12,800	96.4	80.8
2002	769	10,171	10,940	13,052	93.0	77.9
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	832	7,825	8,658	13,265	90.4	59.0
2007	3,559	9,958	13,517	17,946	73.7	55.5
2008	-	-	18,687	23,360	-	-

Source: Rwanda Public Expenditure Review Agriculture, MINAGRI, April 2007, Agriculture Sector Performance Report Fiscal Year 2008, MINAGRI, March 2009



Source: Web site of MINAGRI

Figure 2.2.3 Organization Chart of MINAGRI

(2) Government Corporations under Umbrella of MINAGRI

1) RADA

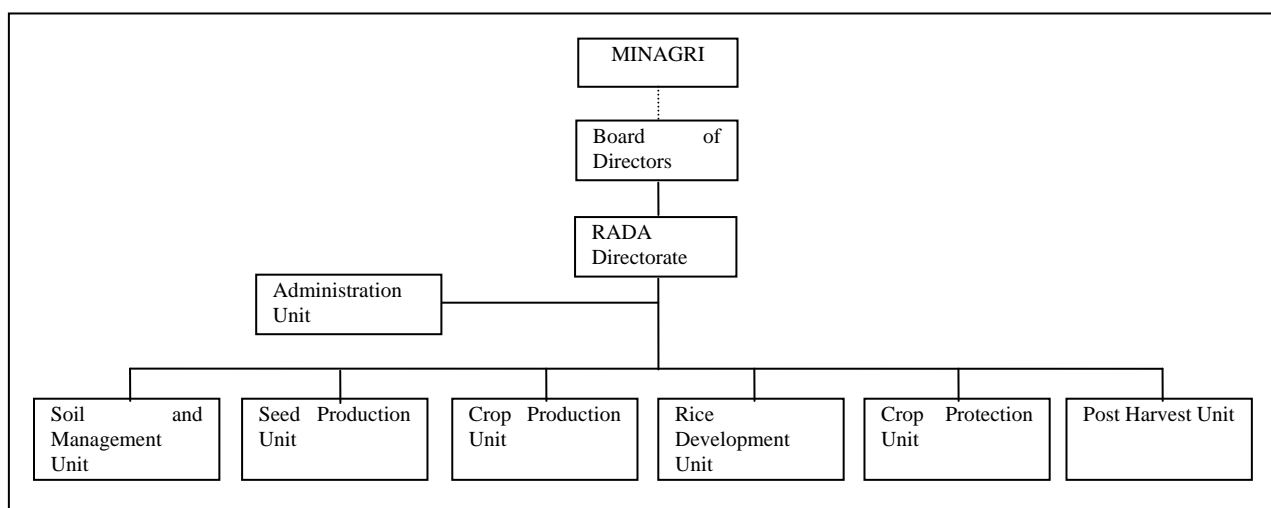
RADA (Rwanda Agricultural Development Authority) is an organization which was established by the cabinet in July 2005 in order to implement the policies of SPAT and policies of agriculture sector in Vision 2000 which is one of national programs. Its establishment purpose is to improve agricultural productivity by using appropriate technology useful for agricultural development, to plan the modernization of agricultural sector and carry out dissemination activity, support to remote area and technical guidance targeting at all authorities in relation to agriculture sector such as regional municipalities, farmers association and private entrepreneurs. Its organization is programmed as to support the product activity indirectly and its service ranges from soil improvement to land cultivation, seeding, pest control, crop growing management and harvesting.

a. Organization Structure and Staffs

The organization structure of RADA is shown in Figure 2.2.4. RADA consists of six (6) technical units and one (1) administrative unit. RADA owns a seed breeding farm in Bugesera district and a farm for vegetative propagation by stem cutting of maize and cassava in Musenyi sector and a farm of same type for cassava in Gashora sector. The proposed staff number was 87 persons in seven (7) units at its initial establishment and it was reduced to 57 persons since its number had to be cut down to 40 to 50 persons on the background of the recent trend toward decentralization.

b. Budget

The magnitude of budget of RADA has not been finalized yet since it is a newly established body. RADA is currently operating in a tentative budget allocation, and RADA requested an annual budget of 3 billion Rwf/year as of 2006.



Source: Web site of RADA

Figure 2.2.4 Organization Chart of RADA

2) ISAR

The original organization body of ISAR (Institut des Sciences Agronomiques du Rwanda: The National Agricultural Research Institute) came into existence in 1930 at Rubona village of Huye district of Southern province under the reign of Belgium. ISAR was established by the legal reform in 1962 and was reorganized to an independent institute in 1982.

a. Role

ISAR takes a mission of 1) breakaway from subsistence to commercial farming, 2) shift to profitable and competitive farming, 3) increase of agricultural productivity and 4) promotion of security of food supply in order to promote scientific development in relation to agriculture and livestock industry.

b. Organization and Staff

ISAR is an independent body under MINAGRI, whose organization is divided into three (3) agroecosystems nationwide Rwanda. ISAR has regional agricultural experimental stations at each agroecosystem and the regional experimental research is currently under development at twelve (12) stations nationwide including its branch offices. The number of total staffs of ISAR is 376 persons as of May 2004, of which the technical staff accounts for 35 percent and the administrative staffs for 65 percent.

c. Research Activities and Budget

ISAR has three (3) research programs of crop production, participatory development in forestry and livestock industries including farming field trial. The budget of 2006 is almost dependent on donors' financial aid and its amount is 2 million US\$ (equivalent to 230 million Japanese Yen). The personal expenses of its staffs is largest in the annual budget and its amount is 400 million Rwf (equivalent to about 80 million Japanese Yen). ISAR is currently facing several problems such as 1) shortage of annual budget for research activities, 2) shortage of researchers, 3) necessity on capacity building (enhancement of human resources development) and 4) difficulties of finding the seed varieties answering regional demands in relation to research development.

3) Outline of Restructuring Plan of MINAGRI

The restructuring of MINAGRI is in progress as mentioned before, and the core unit of MINAGRI is being restructured and its affiliated implementation agencies such as RADA, RARDA, ISAR and RHODA are planned to be reorganized into RAB (Rwanda Agricultural Development Board) and RAEDB (Rwanda Agricultural Export Development Board). The draft law on the establishment of RAB has already passed the cabinet meeting and it is under discussion in the national parliament and its operation is scheduled to start in July 2009.

Above restructuring plan intends to allocate the operation sites of the central agencies in the areas close to regional governments, improve the service delivery in the enhanced collaboration between the central and regional agencies and enhance the support to implementation capacity of regional governments and/or the public sector's support / dissemination services and toward farmers and private sector. Accordingly, RAB is currently planning to allocate zone offices with the staff numbers of 100 to 140 persons in four (4) places nationwide (eastern, northern, west and southern provinces) and operate in four (4) units of "agriculture",

“livestock”, “research / dissemination” and “infrastructure / mechanization”.

The zone office in the eastern province where the target areas of the proposed project is located is scheduled to be established in Nyagatare province as its location of the northern part of the eastern province. The agriculture unit of the eastern province is scheduled to constitute 13 staffs in charge of maize production, 13 staffs for rice, 9 staffs for sorghum, 8 staffs for garden products, 10 staffs for root vegetables, 10 staffs for banana, 13 staffs for beans and 9 staffs for coffee.

Figure 2.2.5 shows the organization structure of MINAGRI after its restructuring.

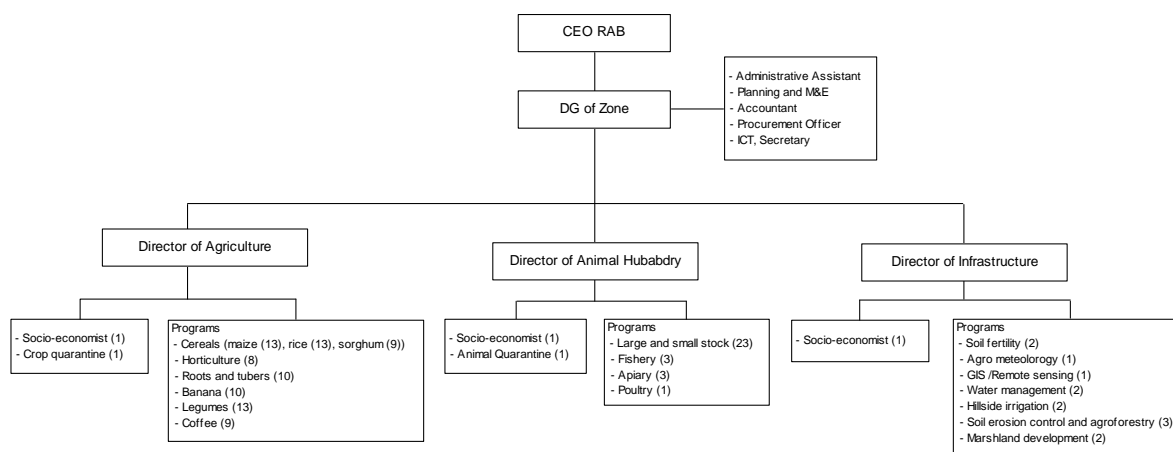
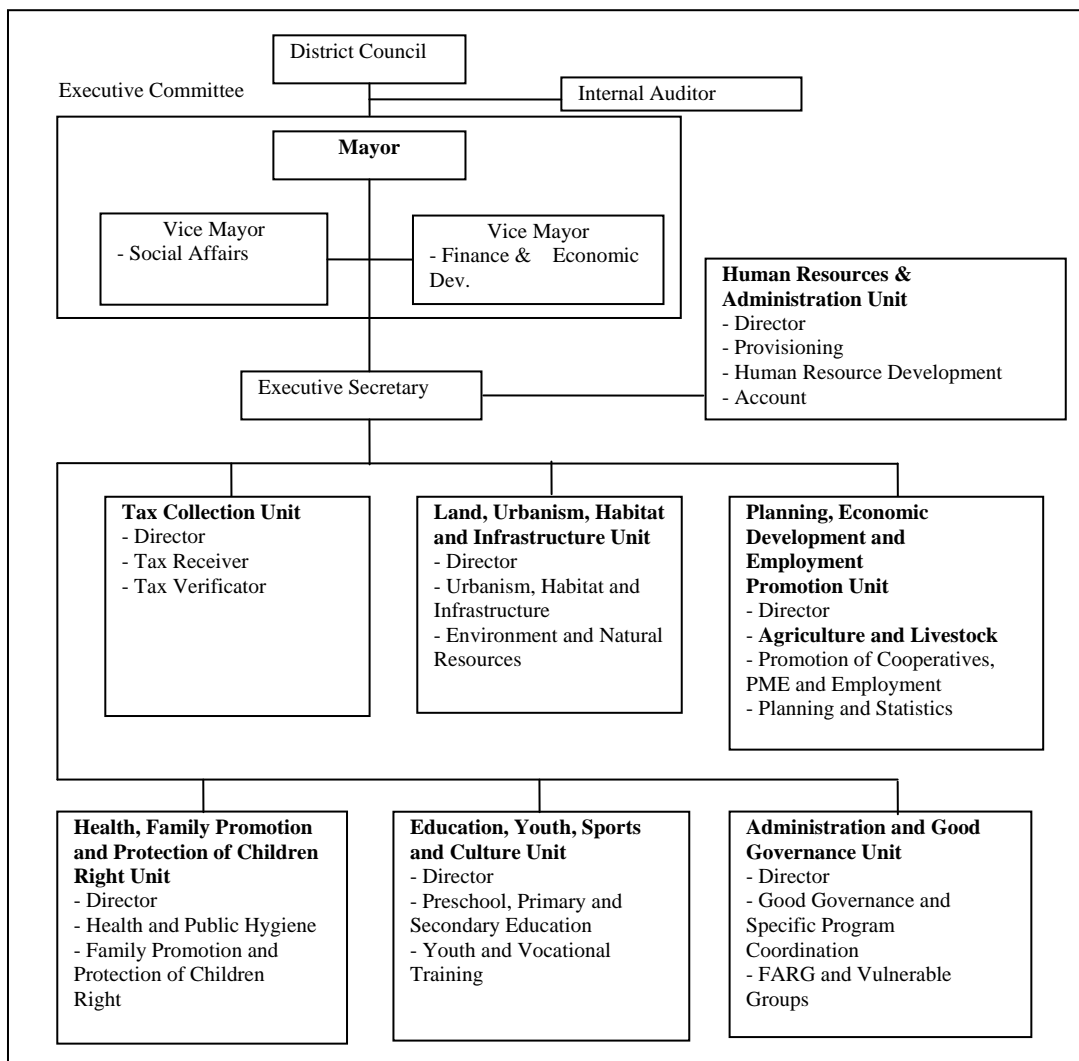


Figure 2.2.5 Organization Structure of Zone Office of MINAGRI

(3) Target Districts of Project Implementation

1) Organization Structure

The project sites are located in three (3) districts of Bugesera, Ngoma and Gatsibo. A district has a role of center of administrative service in regional level in accordance with the decentralization policy of the regional autonomy law (Law No.47/2000, December 19, 2000). The organization structure is basically same in each district as shown in Figure 2.2.6. shows that two (2) vice mayors are allocated under a mayor and it has seven (7) units as working level under the secretary general. The executive committee comprising of a mayor and two vice mayors makes a final decision on the issues which each units cannot solve in their sectors or their units. In relation to agricultural sector, only one agronomist is allocated in the planning, economic development and employment promotion unit. The agronomist prepares a district development plan for each year's release, supports the capacity development of farmers cooperatives within his jurisdiction, negotiates with the persons concerned in sector level when the sector officers cannot solve by themselves and requests an annual budget request for the agricultural development to the central government. The staff number of the target districts of the proposed project is shown in Table 2.2.19.



Source: JICA Preparatory Study for Rural Water Supply Projects, January 2009

Figure 2.2.6 Organization Structure of District Office

Table 2.2.19 Staff Number of Target Districts of the Proposed Project

District	Bugesera	Ngoma	Gatsibo
Number	37	32	38

Source: Interview with district officers

2) Annual Budget

The revenue of the district budget consists of tax revenue and subsidy from the central government. Table 2.2.20 shows the actual execution amounts of the annual budget of the fiscal year of 2007. The tax collection unit shown in Figure 2.2.6 collects the tax from the district residents. As for the revenues excluding tax, on one hand, as shown in Table 2.2.21 for the case of Ngoma district, the subsidy from MINECOFIN is largest as 43 percent and followed by 20 percent of CDF (Common Development Fund)

and 5 percent of MINALOC. As for agricultural sector, the subsidy from MINAGRI makes up 5 percent of the total revenue excluding tax.

Table 2.2.20 Actual Budget Performance of Districts (2007)

District	Unit in Million Rwf		
	Bugesera	Ngoma	Gatsibo
Budget (Planned)	2,113	2,313	2,070
Budget (Actual Execution)	2,105	2,304	2,069
Execution Rate (%)	99.6	99.6	100

Source: Transfers Execution per District and per Programme 2007

Table 2.2.21 Revenue excluding Tax in Ngoma District (2007)

Year	Source of Finance	Amount in Rwf	%
2006	MINECOFIN	538,611,225	43.0
	INKIKO GACACA	1,476,475	0.02
	MINAGRI	67,666,600	5.0
	OCIR CAFÉ	2,480,000	0.2
	MINALOC	188,046,583	15
	MI NISANTE : POOLING RISK	18,400,000	1.1
	CDLS-MAP	12,373,199	1.03
	SUPPORT TO MUTUAL HEALTH INSURANCE	6,154,511	0.5
	CDLS SPECIAL	60,000	0.1
	TRANSAFERS FROM EX-DISTRICTS	15,932,890	1.0
	MINITERE	8,685,000	1.0
	MINEDUC	31,820,000	3.0
	CDF	242,165,668	20.0
	FDS NATION DI	1,543,200	0.2
	INTRAHEALTH TWUBAKANE	26,731,731	2.0
	RDRP PAIGELAC	51,185,000	4.0
	FARG	29,619,563	2.0
DCDP	15,185,000	1.0	
TOTAL	1,241,576,645	100%	

Source: District Development Plan in Ngoma

(4) Target Sector of the Proposed Project

A sector is an administrative system under a district and its role is to prepare a sector development plan whose data can be used for DDP. The sector body is planned to be reinforced as a core body of the regional public service on the background of the recent trend of decentralization. However, actually, only about five (5) staffs including an executive secretary are operating in each sector. Even in budget allocation, only operating expenses are supplied from the upper district.

2.2.7 Relation with Other Donors

Detail design for 8 sites of 32 sites in the phase 1 of LWH project had been completed and 4 sites of them were in the bidding stage in April 2009. Other 4 sites were planned to be implemented immediately after allocation of budget. They might be funded by World Bank or other donors but it is not decided at present. The additionally requested 2 sites were included in the 4 sites. Whole LWH project is planned to be funded

by the Government of Rwanda USD 30 million, donor (Japan, Canada, China etc.) grant 80 million and 90 million by loan.

Rural Sector Support Program (RSSP) funded by World Bank completed RSSP1 in 2008 and RSSP2 is on going and construction of dams for development of marsh land is already implemented. This project is similar to LWH project and it serves as a good reference on planning, design, construction and O&M of LWH project. Information on design for component of development of marsh land was gathered and the work performance and O&M of the facilities were investigated at the sites. Outline of the investigation is described in 「2.1.4 Operation and Maintenance System」.

Through the hearing to RSSP project office, it was found that 2 dams are scheduled to be constructed in Ntende marsh land which locate downstream of Gatsibo31. As a result of discussion with RSSP, it was confirmed that water from Gatsibo31 is not needed for Ntende paddy area. And, it was found that Gatsibo31 area was included in Gatsibo32 in the detail design stage and coordination between LWH and RSSP was in progress. Exchange of information between LWH and RSSP in MINAGRI was not working and there are cases which need coordination between LWH and RSSP.

In Gashora sector in Bugesera district, sprinkler irrigation system project pumping up water from lake Rumila, which is assisted by Luxemburg is implemented. O&M of this scheme was investigated and described in 「2.1.4 Operation and Maintenance System」 also. It is necessary to confirm the border of this area when the command area of Bugesera2 will be fixed. In the neighboring area of Bugesera2, soil conservation project assisted by World Vision was implemented. Excavating a ditch with the width about 60cm and the depth about 40cm along the contour line, the velocity of runoff water on the surface is reduced and erosion is prevented. It was implemented for about 30 ha and by food for work.

Chapter 3 Recommendations

3.1 Recommendation of on Implementation of Basic Design Study

3.1.1 Basic policy of Basic Design Study

(1) Confirmation of Rationale, Objective, Contents and Position to the Upper Level Plans

- 1) Review the results of the First Preparatory Study and confirm the rationale, objective and contents of the Project, and position of the Project to the upper level plans. Then study any changes or areas to add more information.
- 2) Confirm the components and priority of the Project identified by the First Preparatory Study, and again study the necessity and priority of the Project with confirmation of detail amount and scale.

(2) Plan of Facilities

- 1) Plan the appropriate facilities in scale and contents due considering the cost – benefit aspects and sustainable use of the facilities.
- 2) Plan the facilities, which farmer organization is able to operate and maintain from the technical and financial points of view.
- 3) Confirm the necessity of acquiring permission of construction from the laws of Rwanda and its procedure if required, and assist the C/P for the procedure.
- 4) Study for optimal alternative considering the cost, effects of Project, social and environmental impacts, etc.

(3) O&M Set-up

- 1) Confirm the O&M set-up for each facility (organization, staffing, budget, etc.). Also confirm the plan of the O&M set-up for the facilities to be constructed by the Project with C/P and study the feasibility of the plan.

(4) Plan of Implementation

Prepare for appropriate implementation plan considering relative laws and regulations, supply of electricity and water, climate conditions, etc.

(5) Investigation on Construction Work and Procurement

- 1) Confirm the circumstances of construction and procurement of construction materials and spare parts in Rwanda in order to plan economic and sustainable O&M of the facilities.
- 2) Investigate the possibility of procurement from third country.

(6) Necessity of Technical Assistance

Review the results of the First Preparatory Study on Technical Assistance and conduct additional survey and prepare the plan of technical assistance.

(7) Socio-economic Survey

Review the results of the First Preparatory Study and conduct additional survey to be a baseline of the Grant Aid Project.

(8) Social and Environmental Consideration

Monitor and assist the C/P to conduct Environmental Impact Assessment and study on avoidance and mitigation measures against the negative impacts of the Project to the environment.

(9) Study on the Activities of Donors and International Institutions in Agriculture Sector

Review the results of the First Preparatory Study and conduct additional survey

(10) Study on the Relevance, Scope and Basic Policy of the Grant Aid Project

Review the results of the First Preparatory Study and conduct additional survey

3.1.2 Contents of the Basic Design Study

(1) Confirmation of Rationale, Objective, Contents and Position to the Upper Level Plans

- 1) Review the results of the First Preparatory Survey together with MINAGRI and RADA to confirm the rationale, objective, contents and position to the upper level plans of the Project and conduct additional survey for updating the change and supplementing the information.
- 2) Confirm the components and priority of the Project identified by the First Preparatory Study together with MINAGRI and RADA, and again study the necessity and priority of the Project with confirmation of detail amount and scale.

(2) Plan of Facilities

- 1) Conduct the detail topographic survey and design the most economical dam body, catchments and irrigation service area based on the survey. Also consider the existing water supply facilities and springs in designing the facilities in order not to harm such water sources. Affects to the existing crossing roads or bridges at the bottom of the valleys will be considered in the Study and in case of removal of such existing structures, alternatives shall be studied. Conduct geological survey for the additionally requested two (2) sites to confirm the strength of basement and spillway, permeability of basement, and form of fault. Conduct soil survey on the planned borrow pits for studying the materials of dam body. Confirm the fault, landslides, and necessity of land protection work by field investigation. It is considered that there are four (4) and three (3) households in Bugesera 3 and Bugesera 4 respectively, which would be affected by designing of the reservoirs in the Project. Design will take into at most consideration the residents, but when the resettlement is found necessary, contents and procedure of the compensation will be confirmed.
- 2) Conduct additional survey on O&M practices of reservoir, canal, pipeline, etc. in other projects, and design the structures and facilities, which can be managed by farmer organization from technical and financial points of view.
- 3) Confirm the necessity of acquiring permission of construction from the laws of Rwanda and its procedure if required, and assist the C/P for the procedure.

- 4) Study for optimal alternative considering the cost, effects of Project, social and environmental impacts, etc.

(3) O&M Plan

1) Basic Framework

Based on the decentralized policy of the government of Rwanda, practices of the on-going projects and the economic activities in the rural areas, It is a basis that farmer beneficiaries are primarily responsible for the O&M of irrigation facilities to be constructed by the Project. Farmer beneficiaries are therefore organized to become a cooperative through the Project. In Rwanda, generally agriculture cooperative, which will deal with from procurement of inputs to marketing of products, is established and it will manage the irrigation facilities. Farmers organization (Cooperative) will manage the irrigation facilities by their own responsibility and when the issue arisen is beyond the capacity of the cooperative, Sector office will intervene the cooperative and if the issue is beyond the capacity of the Sector, the issue is carried forward to the District. This is the basic framework of O&M of irrigation facilities. District and Sector plays a role for supporting the O&M of the irrigation facilities and agriculture extension in the irrigation schemes. Also project management organizations like RSSP keeps monitoring & assistance to the farmer organization until it become s stable.

The central government, MINAGRI and MINALOC are implementing programs such as poverty reduction and promotion of chemical fertilizers and improved seeds through the set-up of the local administration – cooperative. For example, MINALOC is providing subsidy to the poor for compensation of water fee for boreholes through District and Sector. MINAGRI is providing subsidy for fertilizers and hybrid seeds of maize through the local administration for modernization of agriculture. The O&M of the irrigation facilities to be constructed by the Project will follow this basic framework of the set-up, namely establishment of cooperative for primary O&M body and issues arisen beyond the capacity of the cooperative will be forwarded to the local administration. The Project itself will provide technical assistance to the farmer organization and local administration in collaboration with other Japanese schemes for a certain period (technical assistance is detailed in Chapter 2.1.7).

2) Water Users Association or Agriculture Cooperative

In Rwanda, it is common that agriculture cooperative organizes water management committee within the cooperative and manages the irrigation facilities. Donor assisted project such as RSSP or Lux-development are also following the same way as they assist in establishing agriculture cooperative by the farmer beneficiaries, which will be the body of O&M of the facilities. On the other hand, the officer in charge of LWH told the Study Team in a meeting that MINAGRI has made a policy that cooperative to manage the irrigation facilities should be separated from agriculture cooperative in order for the cooperative to concentrate on the O&M of the irrigation facilities.

As mentioned above, the government of Rwanda has been promoting cooperative to realize the economic growth and poverty reduction and the establishment of agriculture cooperative would be effective to activate the irrigated agriculture in the Project site. It is, therefore, proposed that the Project would assist in both establishing water users association as a cooperative and agriculture

cooperative. Then it is suggested that the government side and farmer beneficiaries should have a consultation on farmer organization and decide whether to establish water users association solely dealing with irrigation water management and agriculture cooperative separately or integrate both bodies (agriculture cooperative and water management committee in its institutional set-up) or other ways based on the intention of the farmer beneficiaries.

3) Enhancing the Existing Cooperative or New Establishment of Cooperative

As it has been mentioned in Chapter 2, 2.1.4, there are existing cooperatives in Bugesera 2 and Ngoa 22 sites. It is necessary to confirm the overlapping of the beneficiaries of the Project and the members of the existing cooperative. Based on the situation, re-setting of existing cooperative should be taken into consideration plan the O&M organization set-up. In other sites, it will be necessary to establish new cooperative (water users association or agriculture cooperative and water management committee inside its structure).

(4) Plan of Implementation

Confirm the access to the quarry site, borrow pits, deposit area, and construction sites. Since the Project sites are many, it may not be possible to commence the construction at all the site at the same time due to difficulty of procuring heavy machineries. Therefore, implementation plan will be taken into consideration dividing the construction period by site. Also prepare the implementation plan considering relative laws and regulations, supply of electricity and water, climate, etc.

(5) Investigation on Construction Work and Procurement

Confirm the circumstances of construction and procurement of construction materials and spare parts in Rwanda in order to plan economic and sustainable O&M of the facilities. It is expected that at the commencement of the Basic Design Study four (4) sites of LWH Project and a site of RSSP will be starting the construction work. Therefore, the quality of the contractors, staffing, and procurement of the heavy machineries for these project sites will be investigated for the reference of the B/D Study. Also because the procurement of the materials would be limited in Rwanda, possibility of procuring materials in the third country will also be investigated.

(6) Plan for Technical Assistance

Technical assistance by the Grant Aid Project is planned with three categories: 1) assistance for farmer organization, 2) trainings on O&M of irrigation facilities, and 3) trainings on irrigated farming. The detail of the technical assistance will be designed as the form of farmer organization in each site is decided and cropping pattern with Project is designed at the Basic Design Stage of the Project. Following table summarizes the outline of the technical assistance.

Table 3.1 Outline of the Technical Assistance by the Grant Aid Project

Technical Assistance	Form of Farmer Organization		Cropping Plan	
	Agriculture cooperative + water management committee	Water users association as a cooperative	Upland crop	Paddy crop
Assistance for farmer organization	Assist water management committee set-up within the agriculture cooperative	Assist in establishing water users association and register as a cooperative	Orientation for cropping plan	Orientation for cropping plan (selection of variety)
Trainings on O&M of the irrigation facilities	Trainings to committee members and representatives of irrigation blocks	Trainings to committee members and representatives of irrigation blocks	Training on rotational irrigation	Training on rotational irrigation
Trainings on irrigated farming	Trainings to farmer beneficiaries	Trainings to farmer beneficiaries	On-farm irrigation (furrow irrigation and basin irrigation), upland farming with irrigation	Trainings of paddy cultivation

(7) Socio-economic Survey

Review the results of the First Preparatory Study and conduct supplementary survey. The Survey will be conducted by the Agriculture / Farmer Organization expert. Survey will be carried out with interviews to farmer groups. Especially in Bugesera 3 and 4 sites, which were additionally requested, workshops to explain the Project, discuss the farming practice and organization, and understand the farmers' intention will be held.

(8) Environmental and Social Consideration

The following works will be necessary for the assistance of Rwandan EIA works and the process of land acquisition at the Basic Design Study. Above assistance will require discussions or negotiation with the authorities concerned based on the results of environmental and social considerations in this study.

1) Assistance in Application of EIA Process

It will be necessary for the project developer of the proposed project to apply to REMA for EIA process as mentioned in this report. The project developer needs to prepare a Project Brief and submit it to REMA for his screening. The Basic Design Team will assist him for preparation of the Project Brief. A strong collaboration with the project developer will be necessary to obtain the relevant data / information to prepare the project brief since the Team has to confirm his opinions toward the actual

mitigation measures, its possibilities, the land acquisition of the project sites and required compensation measures for the affected land owners.

2) Discussions on TOR for EIA and Its Assistance

The establishment of TOR which is an actual scope for EIA works which will affect on the actual schedule of EIA and implementation of the proposed project, and the discussion with REMA will be important. The Basic Design Study Team will assist the project developer at the establishment of above TOR on the following works to be required for TOR;

- Arrangements of REMA's site visit
- Provision of data / information on project plan, environmental and social considerations to REMA
- Confirmation of the opinions of the project developer on the mitigation measures and their possibilities of actual implementation

3) Confirmation on Process on Rwandan Land Acquisition

To secure a project site by a project developer is a basic requirement for implementation of a project. In this study, the study team confirmed that the actual execution of the process of land expropriation is done by PSCU (The Project Support and Coordination Unit) in central level, the District Land Bureau and Land Commission in regional levels. In the meanwhile, the accurate information on the land tenure at each project site was not obtained.

The following works will be necessary at Basic Design Study;

- Confirmation on the land tenure at project sites (land owners, presence of private lands, land size, etc.)
- Confirmation on the contents of actual compensation plan by the project developer (methods, amount, schedules, etc.)
- Confirmation on the notice to affected farmers, meetings and methods toward the agreements
- Confirmation on the mitigations for the affected landless farmers

(9) Study on the Activities of Donors and International Institutions in Agriculture Sector

Review the results of the First Preparatory Study and conduct supplementary survey. Confirm the situation and schedule of the LWH Project and RSSP and relation with the Grant Aid Project. Especially on-going projects around the Bugesera 4 site, which was added to the Study will be investigated in detail to confirm the relation with the Grant Aid Project.

(10) Study on the Relevance, Scope and Basic Policy of the Grant Aid Project

Identify baseline of the Project based on the results of the First Preparatory Study and supplementary survey in order to monitor the effects of the Project.

(11) Basic Design of Facilities and Equipments for the Grant Aid Project, Project Plan, Cost Estimate and O&M Plan Formulation

1) Basic Design for the Grant Aid will be carried out with comparative study from technical, economic and O&M points of view. Following are taken into consideration: natural conditions

(geological condition, soil condition, climate, river discharge, silting, etc.), socio-economic conditions (land use, access to the site, supply of water / electricity, irrigation status, water rights, farmer organization, activities of other donors, etc.), O&M set-up (staffing, O&M methods, O&M cost, technology level, etc.), procurement (specification, date of delivery, price, after care, etc.).

2) Prepare the Project implementation plan after the basic design study including preparation of tender, bidding, construction, and technical assistance.

3) Project cost to be borne by the Government of Japan at basic design level will be estimated based on the guideline of JICA. Degree of accuracy of the cost at basic design level should be of the difference within $\pm 10\%$ from the cost to be estimated at the detail design level.

4) Prepare O&M plan listing the required items for O&M of the facilities, and considering the staffing / structure of the farmer organization (water users association), scheduling of O&M activities and O&M cost.

(12) Recommendations on O&M after the Completion of the Grant Aid Project

Make recommendations toward sustainable O&M of the facilities. The recommendations would include enlightening farmer beneficiaries, strengthening water users association (cooperative), collection of water fee and its management, improvement of on-farm irrigation, etc.

(13) Recommendations on the Components to Borne by the Government of Rwanda

Based on the results of the Basic Design Study, Clarify the components, for which the Government of Rwanda should be responsible, such as securing the supervisors of the construction, slope protection work in the catchments, etc. taking into consideration the status of the government.

(14) Recommendations on Evaluation of the Effects of the Grant Aid Project, Criteria of the Evaluation, Issues to Be Considered and Implementation

Based on the results of the field work, make recommendations on 1) evaluation of the Grant Aid Project, 2) Issues to Be Considered and 3) Implementation and discuss them with the C/P.

(15) Other Issues to Be Considered

3.1.3 Team Composition of the Basic Design Study

The Team Leader of the Team should be civil engineer and well experienced with agriculture and rural development, since the Project would consist on construction of irrigation and drainage facilities as the core and technical assistance such as farmer organization for irrigation water management and introduction of irrigated agriculture.

Since the major component of the Project is construction of facilities and they vary such as dam body, spillway, intake facilities, pipelines, drainage, etc., it is required to assign two (2) design engineers. One design engineer will be in charge of designing dam body, foundation, and spillway and the other will be in charge of designing intake facilities, ancillary facilities and pipelines.

Required natural condition surveys include topographic survey. Also the technical assistance in the Project is an important component and therefore assignment of an expert / specialist for assisting farmer organization is necessary. Also an expert / specialist for social and environmental assessment should be assigned to assist the C/P to undertake EIA procedure. An engineer to be in charge of implementation plan and cost estimate should be assigned, as well.

Team Composition (Draft)

Chief Engineer / Irrigation and Drainage Facilities

Facility Design (1)

Facility Design (2) / Natural Condition Surveys

Social and Environmental Consideration

Agriculture / Farmer Organization

Implementation Plan / Procurement Survey / Cost Estimate

3.1.4 Contents of the Surveys by Sub-contracting

Following are the required surveys to be carried out by sub-contractors during the Basic Design Study.

(1) Survey on Natural Conditions

1) Topographic Survey

Table 3.2 Topographic Survey Plan

Site	Item, Quantity
Bugesera2 Gashora	Topographic Survey for the reservoir and beneficiary area : 100ha Longitudinal and cross sectional survey for the reservoir : 700m Longitudinal and cross sectional survey for spillway and canal : 2.3km Longitudinal and cross sectional survey for pipeline : 2.7km
Bugesera3 Rilima	Topographic Survey for the reservoir area : 20ha Longitudinal and cross sectional survey for the reservoir : 600m Longitudinal and cross sectional survey for dam axis : 400m Longitudinal and cross sectional survey for spillway and canal : 2.0km Longitudinal and cross sectional survey for pipeline : 2.7km
Bugesera4 Musenyi	Topographic Survey for the reservoir and beneficiary area : 25ha Longitudinal and cross sectional survey for the reservoir : 700m Longitudinal and cross sectional survey for dam axis : 500m Longitudinal and cross sectional survey for spillway and canal : 2.3km
Ngoma21 Remera	Topographic Survey for the reservoir and beneficiary area : 80ha Longitudinal and cross sectional survey for the reservoir : 500m Longitudinal and cross sectional survey for spillway and canal : 2.6km Longitudinal and cross sectional survey for pipeline : 3.5km
Ngoma22 Rurenge	Topographic Survey for the reservoir and beneficiary area : 220ha Longitudinal and cross sectional survey for the reservoir : 800m Longitudinal and cross sectional survey for spillway and canal : 5.0km Longitudinal and cross sectional survey for pipeline : 8.0km

Bugesera3 : Existing plan of beneficiary area is available.

Bugesera4 : Existing plan of beneficiary area and longitudinal and cross sectional map is available.

4) Geological Survey (Borehole)

Table 3.3 Geological Survey Plan

Site	Item, Quantity
Bugesera3 Rilima	Borehole at proposed dam axis : 35m (left bank 10m, riverbed 15m, right bank 10m) Standard Penetration Test : 35 Nos. (left bank 10Nos., riverbed 15nos., right bank 10Nos.) Permeability Test : 7Nos. (left bank 2Nos., riverbed 3Nos., right bank 2Nos.)
Bugesra4 Musenyi	Borehole at proposed dam axis : 55m (left bank 15m, riverbed 25m, right bank 15m) Standard Penetration Test : 55 Nos. (left bank 15Nos., riverbed 25nos., right bank 15Nos.) Permeability Test : 11Nos. (left bank 3Nos., riverbed 5Nos., right bank 3Nos.) Borehole at fault : 60m (riverbed 30m x 2) Borehole at old dam axis : 35m (left bank 10m, riverbed 15m, right bank 10m) Standard Penetration Test at old dam axis : 35 Nos. (left bank 10Nos., riverbed 15nos., right bank 10Nos.) Permeability Test at old dam axis : 7Nos. (left bank 2Nos., riverbed 3Nos., right bank 2Nos.)
Ngoma21 Remera	Borehole at proposed dam axis and upstream : 40m (10m x 4)

3) Impervious Material Soil Test

Following soil tests shall be done for each site.

Physical test, Compaction test, Compaction test, Triaxial compression test, Consolidated shear test, Permeability test.

3.1.5 Collaboration with Other Schemes such as Technical Cooperation Project

Technical assistance of the Project is considered not only implementing as a component of the Grant Aid Project but also collaborating with other schemes of Japanese Official Development Assistance (ODA) such as technical cooperation project and Japanese Overseas Cooperation Volunteer (JOCV). Technical assistance as a component of the Grant Aid is planned to implement at the end period of the construction work. As for the collaboration with other schemes, a technical cooperation project in the Eastern Province for agriculture development is schedule to commence in 2009 and this project could be a candidate to collaborate with the Grant Aid Project during and after the construction period. Dispatching JOCV could be considered when the irrigation facilities are constructed and start for use probably around mid 2011. JOCV could work together with the Sector and Cell officers for effective use of the facilities to be constructed.

(1) Collaboration with Technical Cooperation Project

Assistance for Establishing Farmers Organization and its Operation:

It is desirable that some assistance should follow after the construction of the irrigation facilities and

establishment of farmers organization for enhancing the sustainable benefit realization with the Project. RSSP project also implements follow-up activities as in Kanyonyomba site. As of 2009 RSSP is still supporting the agriculture cooperative established in 2006 to make them stable for their self-reliance. Concentration of resources of ODA on one site will reduce the efficiency of the resource allocation, but minimum support as follow-up in a certain defined period would be effective to assure the realization of the benefit of the Project.

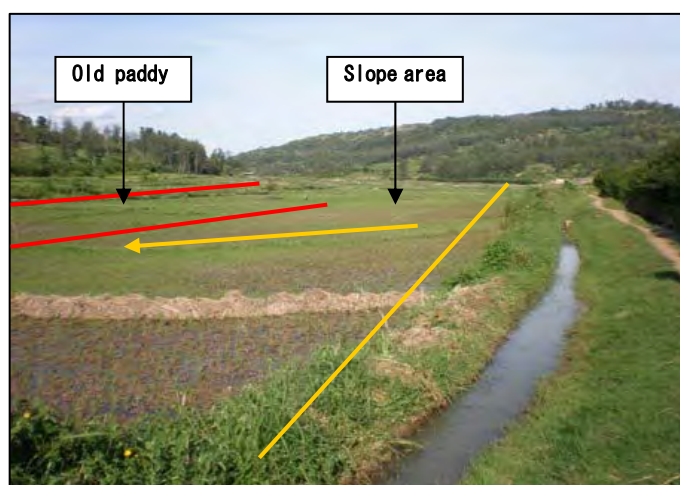
After the relevance of the Project is confirmed and decision is made to implement the Project, collaboration with the Japan's technical cooperation project in Eastern Province for the establishment and operation of the farmers organization (agriculture cooperative) is considered. Agriculture cooperative / water users association will be established for the O&M of the irrigation facilities. Cooperative is an organization to make economic benefit not only operating and maintaining the irrigation facilities, whether the water management committee inside the agriculture cooperative or the water users association as a cooperative, the cooperative is expected to engage in economic activities such as procurement of farm inputs for the members, collecting the farm produce from the members and marketing the produce, etc. The technical cooperation project would be able to assist in establishing such cooperative which covers from the procurement of inputs to marketing of the produce.

The contents of the assistance are envisaged as: assisting the local administration officers (District, Sector and Cell) to organize the farmer beneficiaries. Study tour for advanced cooperatives for the local administration officers and farmer beneficiaries, planning the business plan of the cooperative, minimum provision of inputs to the cooperative, etc.

Promotion of Nerica Rice:

Slope area in the irrigation service area of the Project can be used for introducing Nerica rice, upland rice. It is required to construct a terrace to apply paddy crop in slope area, but another option is to introduce upland rice, such as Nerica. According to former Mayor of Rusizi District (he is also a former staff of MINAGRI), Nerica rice was introduced to Rwanda from WARDA (West Africa Rice Development Association) through a new and improved variety promotion program (2202 to 2004) funded by the African Development Bank. ISAR (Agriculture Research Institute) of MINAGRI was also involved in the program and 11 varieties of rice were selected as a result of the trials. The selected varieties included Nerica No.8 and No.9. Nerica rice recorded high yield and the cultivation of Nerica has been expanded in Bugarama Sector in Rusizi District.

Seeds of Nerica could be purchased from



Paddy field in RSSP Agasasa Site:

Before the project, farmers were irrigating from the stream at the bottom of the valley. After the project, the main canals run at the edge of the slope and slope changed to paddy field. However, because the slope was left as it is, water cannot be retained. Nerica can be grown in such slope area.

the rice cooperative in Bugarama. However, the shop to sell Nerica rice in Kigali has been closed due to mismanagement. It needs, therefore, to confirm the availability of the seeds from the cooperative. According to the progress report of “Increasing Rice Productivity in Marshlands through Integrated Input Management (Feb. 2008)”, which has been implemented by RADA funded by RSSP, 61 varieties of rice have been tested and 14 varieties have been selected as suitable for the Rwandan marshlands, though it is still preliminary result. Nerica rice was not selected in these 14 varieties. Introducing Nerica rice (Nerica No.8 and No.9) can be carried out as pilot basis at the sites of the Grant Aid Project in discussion with MINAGRI / RADA.

(2) Collaboration with JOCV

Dispatching JOCV is another possibility of collaboration. There are even now JOCV who are working near the Project areas such as Ruha Sector in Bugesera District, Kibungo Sector in Ngoma District, Karangazi Sector in Nyagatare District etc. Their assignments are food crop cultivation, rice cultivation, horticulture crop and rural development. The conditions in the Project areas to dispatch JOCV will have no problem. According to a JOCV working in Kibungo indicated that the means of transportation is a constraint in his activities though the living conditions are good. Although the Project sites are located relatively near the main roads, the irrigation site is in the bottom of the valley so the one has to go down to the site through the branch road. Therefore, the issue of transportation for JOCV has to be taken into consideration.

Installing irrigation system by the Project will enable to expand rice and vegetable cultivation, which are more profitable. However, Farmers in the Project sites are currently depending on rain fed farming with drought tolerant crops such as sorghum and cassava. It would, therefore, be required a technical assistance for agriculture extension. Especially it needs careful attention for vegetable crop to avoid injury by continuous cropping. In Ngoma 22 Rurenge site, some farmers have already been cultivating paddy and paddy crop would be expanded after the Project. But as far as observing the current practice of paddy cultivation in the site, there are rooms to improve the crop husbandry like leveling the paddy field, converting random transplanting to line transplanting, etc. From these observations, it would be suggested to dispatch JOCV with expertise of vegetable and rice cultivation.

As for assisting agriculture cooperative, it should be carefully considered that the activity of JOCV and the work of the above mentioned technical cooperation project does not overlap. For example, JOCV could help for agro-processing of farm products. A JOCV in Kibungo Sector is helping the activities of the cooperatives in the area. Activities are trial of powdering fruit juice, soap making, marketing of handcrafts. JOCV in charge of rural development could be attached to the agriculture cooperative to assist in engaging in agro-processing.

Example of activities of JOCV in Kibungo Sector (Rural development) :

He was dispatched to the Kibungo Sector upon the request from the Sector to assist a cooperative to improve quality of pineapple wine. However, the cooperative members were satisfactory with the current quality of the wine and seemed their motivation was low. Then he started his work with diversification of income sources of the cooperative and assisting other cooperative (COVEPAK), which buys the pineapple wine from the above cooperative and sells them at their shop.

As of April 2009, he is assisting following three cooperatives:

- 1) COVEPAKI cooperative (in Kibungo town): they are engaged in various activities such as sewing, bill board making, stamp making, welding, laundry, and handcraft. They also sell juice which are made by the other cooperatives with 10% of commission. He is building a home page of this cooperative to expand their handcraft business. He is also planning to sell the handcrafts to the tourists visiting nearby national park. At the same time of selling handcrafts, he is planning to sew a traditional cloth at once in front of the customer.
- 2) Cooperative making juice (in Kibungo town): the cooperative is making tree tomato juice, pineapple juice, and passion fruit juice. Tree tomato juice is quite popular as it is sold at UNDO office, as well. The cooperative has ambition to make powder of this juice. He has researched Japanese companies through internet. As a result a food company in Osaka, Japan responded to him and the company is going to introduce tree tomato juice at an expo in Tokyo. The company is also trying to get donation to send a powdering machine to Rwanda. The embassy of Rwanda in Japan is also helping the project.
- 3) Cooperative located 30 minutes away from Kibungo by bus: the cooperative is making pineapple wine. This is a different cooperative from the one he was initially engaged. The members of this cooperative are also satisfactory with the quality of the wine. Instead, they are trying to make soap with aroma of pineapple.

(3) Assumed Schedule and Inputs

1) Schedule

The technical cooperation project in Eastern Province is scheduled to commence within 2009 ahead of the Grant Aid Project. Considering the schedule, it is expected that the technical cooperation project would assist in establishing agriculture cooperative in the sites in which the establishment of agriculture cooperative is decided. Technical assistance by the Grant Aid Project will follow at the end period of the construction work to support to establish water management committee within the agriculture cooperative or water users association as a cooperative. After the completion of the construction work, trainings on O&M of irrigation facilities and irrigated farming will be carried out under the category of the technical assistance by the Grant Aid Project. After the trainings, the technical cooperation project will be engaged in monitoring and evaluation activities of the farmers organization.

As for JOCV, suppose they commence their activities when the irrigation facilities are started for use (assumed mid 2011), recruitment should be in summer or autumn of 2010. Following summarizes the proposed schedule:

Chapter 4 Records

4.1 Member List of the Study Team

Job Title	Name	Occupation
Team Leader	JIN Kimiaki	Director, East Africa Division 2, Africa Department, JICA
Agriculture Program Planning	SUZUKI Fumihiko	Program Manager, JICA Rwanda Office
Planning Management	KOINUMA Masato	Program Officer, Arid and semi-arid Farming Area Division1(South and East Africa), Rural Development Department, JICA
Chief Consultant/Irrigation Facilities	CHIBA Nobuaki	Senior Engineer, Project Operation Division2, Sanyu Consultants Inc.
Topographic / Geological Survey	SENDA Tsutomu	Advisor, Project Operation Division2, Sanyu Consultants Inc.
Socio-economic/ Social and Environment consideration	NAKANISHI Sampei	Senior Engineer, Engineering Division2, NJS Consultants Inc.
Economic Analysis	HATA Akihiko	Senior Engineer, Project Operation Division1, Sanyu Consultants Inc.

4.2 Study Schedule

		JICA Mission	Chief Consultant / Irrigation Facility (Mr. Nobuaki CHIBA)	Land Survey / Geological Features Survey (Mr. Tsutomu SENDA)	Economic Analysis (Mr. Akihiko HATA)	Social Economics/Environmental Consideration (Mr. Sanpei NAKANISHI)
Feb.	27	Fri	2040 Haneda → 2315 Kansai →			
	28	Sat	1455 Dubai → 1900 Nairobi → 2240 Kigali			
Mar.	1	Sun	Preparation of the Study			
	2	Mon	(AM RADA) 11:00 Courtesy call to JICA Rwanda Office 15:00 Mr. Songa (MINAGRI LWH Procurement officer)			
	3	Tue	AM. Preparation of the Study 14:00-15:00. MINAGRI (Briefing and Discussion on IR)			
	4	Wed	9:00 Bugesera District Site Survey with District staff 17:00 Meeting at JICA Rwanda Office			
	5	Thu	11:00 Mtg with Gatsibo Vice-mayor Site survey with District staff (15:00 Mtg with Eastern Province Governor)			
	6	Fri	10:00 Mtg with Ngoma Vice-mayor Site survey with District & Sector staff			
	7	Sat	Site Survey (Spare Day)			
	8	Sun	Preparation for the local contract	Site Survey (Spare Day)		
	9	Mon	Preparation for the local contract (Land survey/Geological features survey)			
	10	Tue	Collection & analysis on existing data and materials (National policy, etc.)	Collection & analysis on existing data and materials (topography, water quality, water flow, etc.)		
	11	Wed	Site survey in existing irrigation and farm fields	Land & geological features survey (Instruction to local consultants)	Cairo → Kigali	
	12	Thu	Site survey in existing irrigation and farm fields	Land & geological features survey (Instruction to local consultants)	Site survey	
	13	Fri	Survey on facility management and maintenance	Survey on climate, water flow, river Supervising on local consultant activities	Site survey	
	14	Sat	Survey on facility management and maintenance	Survey on climate, water flow, river Supervising on local consultant activities	Site survey	
	15	Sun	Narita → Bangkok → → Addis → 1340 Kigali	Materialization, Internal Meeting	Site survey	
	16	Mon	(ET811) 1600 Meeting at JICA Office	16:00Mtg at JICA office	Land & geological features survey Supervising local consultant activities	Site survey
	17	Tue	Briefing on the contents, Discussion on the draft MM	Briefing on the contents, Discussion on the draft MM	Survey on climate, water flow, river Supervising local consultant activities	Site survey
	18	Wed	Discussion on Draft MM	Discussion on Draft MM	Survey on climate, water flow, river Supervising local consultant activities	Site survey
	19	Thu	MM signing and Report to JICA Rwanda Office	MM signing and Report to JICA Rwanda Office	Land & geological features survey Supervising local consultant activities	Site survey
	20	Fri	Spare day for MM signing and Report to JICA Rwanda Office	Spare day for MM signing and Report to JICA Rwanda Office	Survey on climate, water flow, river Supervising local consultant activities	Site survey
	21	Sat	1345 Kigali - 16:15 Nairobi	Survey on last Grant Aid Project (Water-supply)	#	2040 Haneda → 2315 Kansai → 1455 Dubai → 1900 Nairobi → 2240 Kigali
	22	Sun	Materialization, Internal Meeting			
	23	Mon	Site Survey	Site Survey	Site survey	Site Survey
	24	Tue	Supervising local consultant activity	Topographic Survey	Supervising local consultant activity	Supervising local consultant activity
	25	Wed	Supervising local consultant activity	Topographic Survey	Supervising local consultant activity	Supervising local consultant activity
	26	Thu	Supervising local consultant activity	Topographic Survey	Supervising local consultant activity	Supervising local consultant activity
	27	Fri	Supervising local consultant activity	Topographic Survey	Supervising local consultant activity	Supervising local consultant activity
	28	Sat	Supervising local consultant activity	Topographic Survey	Supervising local consultant activity	Supervising local consultant activity
	29	Sun	Arrangement of data	Arrangement of data	Arrangement of data	Arrangement of data
	30	Mon	Topographic Survey	Topographic Survey	Supervising local consultant activity	Supervising local consultant activity
	31	Tue	Investigation of irrigation facilities	Geotechnical Survey	Supervising local consultant activity	Supervising local consultant activity
Apr.	1	Wed	Investigation of irrigation facilities	Geotechnical Survey	Supervising local consultant activity	Supervising local consultant activity
	2	Thu	Survey on procurement	Geotechnical Survey	Socio-economic survey	Socio-economic survey
	3	Fri	Survey on procurement	Geotechnical Survey	Socio-economic survey	Socio-economic survey
	4	Sat	Geotechnical Survey	Geotechnical Survey	Socio-economic survey	Socio-economic survey
	5	Sun	Arrangement of data	Arrangement of data	Arrangement of data	Arrangement of data
	6	Mon	Investigation of irrigation facilities	Geotechnical Survey	Survey on environment	Survey on cropping
	7	Tue	Investigation of irrigation facilities	Geotechnical Survey	Survey on environment	Survey on cropping
	8	Wed	Survey on procurement	Survey on RSP Sites	Survey on environment	Survey on cropping
	9	Thu	Survey on procurement	Survey on RSP Sites	Survey on environment	Survey on cropping
	10	Fri	Survey on existing water supply system	Survey on RSP Sites	Survey on social consideration	Survey on existing water supply system
	11	Sat	Survey on existing water supply system	Arrangement of data	Survey on social consideration	Survey on existing water supply system
	12	Sun	Arrangement of data	Arrangement of data	Arrangement of data	Arrangement of data
	13	Mon	Survey on other donors	Arrangement of data	Arrangement of data	Survey on other donors
	14	Tue	Survey on other donors	Reporting	Reporting	Survey on other donors
	15	Wed	Survey on other donors	Reporting	Reporting	Survey on other donors
	16	Thu	Reporting	Reporting	Reporting	Economic analysis
	17	Fri	Reporting	Reporting	Reporting	Economic analysis
	18	Sat	Arrangement of data	Arrangement of data	Arrangement of data	Economic analysis
	19	Sun	Arrangement of data	Arrangement of data	Arrangement of data	Arrangement of data
	20	Mon	Reporting	Reporting	Reporting	Reporting
	21	Tue	Reporting	Reporting	Reporting	Reporting
	22	Wed	Reporting	Reporting	Reporting	Reporting
	23	Thu	Reporting	Reporting	Reporting	Reporting
	24	Fri	Report to JICA Rwanda Office	Report to JICA Rwanda Office	Report to JICA Rwanda Office	Report to JICA Rwanda Office
	25	Sat	Arrangement of data			
	26	Sun	Arrangement of data	Materialization	Kigali - Cairo	Materialization
	27	Mon	Arrangement of data	Kigali - Nairobi - Nairobi - Dubai -		Kigali - Nairobi - Nairobi - Dubai -
	28	Tue	Reporting	- Kansai		- Kansai - Haneda
	29	Wed	Reporting			
	30	Thu	Arrangement of geological survey			
	31	Fri	Arrangement of geological survey			
May	1	Sat	Arrangement of geological survey			
	2	Sun	Geological Survey			
	3	Mon	Geological Survey			
	4	Tue	Materialization			
	5	Wed	Kigali - Nairobi - Nairobi - Dubai -			
	6	Thu	- Kansai - Haneda			

4.3 list of Parties Concerned in the Republic of Rwanda

1. MINAGRI

(Ministry of Agriculture and Animal Resources)

Mathilda Agnes Kalibata	State Minister
Ernest Ruzindaza	Permanent Secretary
Epimaque Nsanzabaganwa	Director, Planning Unit
Silvin Songa	Contract Manager, LWH
Prime	Head of Soil and Water management nit, RADA
Ntirivamunda Fabien	Crop Production, RADA
Cyubahiro Edouard	Rice Production
Erick Kabayiza	Head of Horticulture Production, RHODA

2. Ngoma District

Francois Nyotwagira	Mayor
Charles Ntageruka	Vice mayor
Gilbert	Agriculture Officer, Ngoma District
Narcisse Ntabana	Environmental Officer, Ngoma District
Mudenge	Agriculture Officer, Rurenge Sector
Claudine	Agriculture Officer, Remera

3. Gatsibo District

Vianney Murego	Mayor
Jean Claude Butera	Agriculture Officer, Gatsibo District
John Mushumba	Executive Secretary, Rugarama Sector
Alexis	Agriculture Officer, Rugarama Sector

4. Bugesera District

Gaspard Musonera	Mayor
Julius	Vice Mayor
Jean de Dieu	Agriculture Officer, Bugesera District
Benoit Gatebuka	Agriculture Officer, Gashora Sector

5. JICA Rwanda Office

Hiroshi Murakami	Resident Representative
Eita Narita	Deputy resident representative
Fumuhiko Suzuki	Program Manager

4.4 List of Data Collected

No.	Title	Data Type Book, Videotape, Map & Photo	Original/Copy	Data Source	Year
1					
1	DDP NGOMA DISTRICT (English)	E-File	Copy	NGOMA DISTRICT	2008
2	Annual Economic Report 2006	E-File	Copy	MINECOFIN	2007
3	Annual Economic Report 2005	E-File	Copy	MINECOFIN	2006
4	District Transfers Execution 2007	E-File	Copy	MINECOFIN	2008
5	SYSTEM OF MONITORING AND EVALUATION FOR IMPLEMENTATION OF BUGESERA DEVELOPMENT DISTRICT PLAN 2008-2012	E-File	Copy	BUGESERA DISTRICT	
6	Annex II -6 : PROJECTS PER MINISTRY AND PER PROGRAMMES 2008	E-File	Copy	GOR	2008
7	REVISED FINANCE LAW – RECURENT BUDGET – FISCAL YEAR 2007	E-File	Copy	GOR	
8	Revenues 2008 Annex-1	E-File	Copy	GOR	
9	SPAT	E-File	Copy	MINAGRI	2004
10	SYNTHESE BUDGET 2008 REVISED	E-File	Copy		
11	Embrionment Protection Law	E-File	Copy	GOR	2005
12	National Rice Production Program 2006-2016	E-File	Copy	MINAGRI	
13	LWH FRAMEWORK (DRAFT)		Copy	MINAGRI	
14	Summary of NRP	E-File	Copy	MINAGRI	2008
15	Integreated Development Program-Crop	E-File	Copy	RADA	2007
16	DDP Gatsibo DISTRICT (French)	E-File	Copy	Gatsibo District	2008
19	LWH PROJECT F/S	E-File	Copy	MINAGRI	2007
20	LWH Detailed Survey and Design Sruudy	E-File	Copy	MINAGRI	2008
21	RSSP 2 Appraisal Report	E-File	Copy	WORLD BANK	2008
22	RSSP 2 Project Information Document concept	E-File	Copy	WORLD BANK	2008
23	RSSP 2 Project Information Document appraisal	E-File	Copy	WORLD BANK	2008
24	RSSP Resettlement Policy Framework	E-File	Copy	MINAGRI	2008
25	Inception Report 8 sites	Report	Copy	MINAGRI	2008
26	RSSP Etude Geotechnique Barrage sur la branche Kikiba	Report	Copy	MINAGRI	2007
27	RSSP Memoire Technique Etude d'execution de l'amenagement hydro-agricole du marais	Report	Copy	MINAGRI	2007
28	RSSP Etude Geotechnique Barrage sur la branche Ntende@Rwagitima	Report	Copy	MINAGRI	2007
29	RSSP Memoire Technique Etude d'execution de 2 retenues sur la riviere Ntende-Rwagitima et sur la riviere Kiliba	Report	Copy	MINAGRI	2007
32	Document de Synthese des Donnees Sismiques sur le Rwanda		Copy	Emmanuel Bizimana	1999
33	Meteorological data	E-File	Copy	Meteo Rwanda	2009
37	EIA GUIDELINE	Report		REMA	2006
40	Map 1/50,000 No.11 GABIRO	E-File	Copy	Ministry of Pubric works and Energy	
41	ADMINISTRATIVE MAP OF RWANDA 1/3,000,000	Map	Original	National Institute of Statistics of Rwanda	2006
42	INTERNATINAL TRAVELMAP	Map	Original	International Travel	
43	RWANDA	Book	Original	Bradt	2006

Appendix

- 1 . Record of Meetings
- 2 . Socio-Economic Study
- 3 . Topographic Survey
- 4 . Geotechnical Survey
- 5 . Water Quality Test
- 6 . Geological Survey
- 7 . Preliminary Scoping on Study Area
- 8 . Economic Analysis
- 9 . Procurement

1 . Record of Meetings

Appendix – 1 Record of Meetingsw

- 1) 2nd March 2009 : Meeting with Mr. Silvin Songa, LWH Procurement Manager
- 2) 3rd March 2009 : Meeting with Mr. Ernest Ruzindaza, MINAGRI Permanent Secretary
- 3) 6th March 2009 : Meeting with officials in NGOMA District
- 4) 5th March 2009 : Meeting with officials in GATSIBO District
- 5) 18th March 2009 : Meeting with officials in GASHORA Sector
- 6) 6th April 2009 : Meeting with MINAGRI and JICA
- 7) 22nd April 2009 : Meeting with MINAGRI
- 8) 19th March 2009 : MINAGRI Minutes of Meeting

1. MEETING WITH LWH Procurement Manager

Date: 2nd march 2009

Venue: Mr. Songa's office (HIDA Premises)

Attendants: Mr. Songa Silvin, LWH Procurement Manager

Mr. Suzuki, JICA Rwanda office

Mr. Chiba, JICA Study Team

Mr. Senda, JICA Study Team

Mr. E. Rwigira, Translator

About money disbursement by the World Bank

All conditions for money disbursement are met, the MINAGRI LWH Procurement Officer is waiting for approval by the World Bank meanwhile advertisement for the four sites (Gatsibo, Kayonza, Karongi and Gashora 3) has been launched. A call for international advertisement has been made but selection has not yet carried out, the tender books are being bought from the Rwanda Procurement Authority. The deadline for tender submission is fixed to 3 April 2009. The MINAGRI LWH Procurement Officer invited JICA to interest Japanese Companies to bid for this tender although Japanese Companies consider risky to do business in African countries

Feasibility Study

The TOR for the feasibility Study have been prepared.

Mr Songa promised to give to JICA Team the EIA that have already been approved by REMA, thus no need to go back to REMA as those EIA can be applied to all sites.

Social Safeguard

World Bank regulation guidelines are applied. For further details on harmonizing safeguard policies, the World Bank Website needs to be visited.

Pre qualification

No prequalification has been done; all tenders submit their documents to the Rwanda Procurement Authority.

Other progress

The MINAGRI LWH Procurement Officer informed the JICA Team that a visit is planned to the 1st four sites on 3 March 2009 and the JICA Rural Development Officer let know to participants that he had already visited all the four sites. Among the problems, he mentioned difficulty to access to certain sites since some local officers do not know the site location.

Feasible Report From Doctor Azarias.

The MINAGRI LWH Procurement Officer handed in to the JICA Team a feasible report on eight sites that was conducted during four months. Mr Songa observed that the consultant had to work under pressure to complete the report in such short time. The same way, he hopes the JICA Team will be able to carry out their study for four sites in two months. In an effort to learn each other, Mr Songa expressed his interest in the JICA Study hoping they might come up with something better.

Team Board

A Team Board comprised of 3 members is to be put in place. The board will address all issues concerning LHW. Mr Songa promised to connect the JICA Team to concerned people.

Concerning dam's construction by RSSP in Bugesera

Mr Songa admitted the dams are not technically efficient and for further details he referred the JICA Team to Mr. Gaspard (0788559622) in RSSP

Extension services

In addition to construction of the irrigation facilities, extension services are envisaged. Farmers need to be trained on how to add value to their agricultural products in order to export them. Extension is to be done by service providers at District level.

2. Meeting with the Permanent Secretary in the MINAGRI (Mr RUZINDAZA Ernest)

Date 3rd March 2009

Venue: MINAGRI Meeting Room

Attendants: Mr. Ernest Ruzindada, Permanent Secretary, MINAGRI

Mr. Suzuki, JICA Rwanda Office

Mr. Chiba, JICA Study Team

Mr. Senda, JICA Study Team

Mr. Rwigira, Translator

- **To start** the JICA Team handed in to the Permanent Secretary copies of the Inception Report both in English and French.

The MINAGRI Permanent Secretary enquired why the Title of the Study has been changed and required the title should highlight the LWH project.

The Team presented the content of the Study by highlighting the objectives of the Study including the feasibility study on the four reservoir construction, the technical cooperation programme envisaged by JICA and the necessary data and information on the technical support for sustainable rice production development in Bugesera district.

The JICA Team finds the selected 4 sites relevant but they have to check their conditions in the feasibility study.

- **Comments by the MINAGRI Permanent Secretary**

First of all the Permanent Secretary appreciated the JICA implication in LWH project since from the results of the previous JICA Sustainable and Rural Development Study, impact on food security and poverty reduction is achieved when water issue in crop irrigation is addressed.

Concerning the study specifically, he complained that a lot of time and resources are allotted to studies. A number of studies have been carried out on LWH, he thus recommended to look out on what has been left out for the sake of complementarity. He pointed out we should rather concentrate on LWH implementation

- **Common framework for engagement in LWH Project**

JICA Rwanda expressed they will to align on the framework and Mr Songa, RADA and ISAR can work together with the JICA Team.

Various stakeholders need to share available project documents from World Bank and from others. The permanent Secretary observed that a lot of skills are being mobilized for one Project (LWH), thus there is a need for harmonization to minimize the cost.

- **Soft component**

It was observed that the end result of the project is not to have water reservoir but the aim is to put in

place a system that works

➤ **Comments by the JICA Rural Development Officer (Mr Suzuki)**

Mr. Suzuki acknowledged that implementation is really needed and that the current JICA Team study is simply a feasibility study to help implementation.

He let know that the common framework is underway and JICA hope to contribute to existing efforts of the World Bank in the project for example.

Concerning the soft component, the Study Team needs to identify needed training. Soft component can be done in parallel with construction works even at the sites of other stakeholders.

The permanent Secretary informed the Study Team that in addition to Mr Songa, Mr NGABONZIZA Prime of RADA can avail himself for the mission and he knows well the the four site location.

He further announced to JICA that the Joint Sector Review will be held respectively on 11th and 12 March.

➤ **Criteria or technical standards for dam construction**

The Permanent Secretary said hillside irrigation is new and talked about the existence of an Irrigation Master Plan and he hopes that the 2nd part of this master plan will come up with the standards.

➤ **Topo Map**

The Permanent Secretary referred the JICA Team to the MINAGRI GIS Center for Topo Map information. Contact person: Daniel Tel: 0788593489

➤ **A letter to the JICA Team Mission**

MINAGRI accepted to issue an official letter to the Study Team. JICA has to draft the letter and bring it to MINAGRI for signature.

➤ **EIA**

Criteria are established by REMA. The JICA Team will have to contact Mme Aimé or Mme Rose (the Director of REMA).

3. Meeting with the Vice Mayor in Ngoma District

Date: 6 March 2009

Venue: Ngoma District

Attendants: Mr. Suzuki, JICA Rwanda Office

Mr. Alexis, JICA Rwanda Office

Mr. Chiba, JICA Study Team

Mr. Senda, JICA Study Team

Ms. Shimaoka, JICA Study Team for Evaluation of Agriculture and Rural Development Program

Mr. Rwigira, Translator

Mr Charles : Vice Mayor in charge of Economic Development (0788530056/0783212202)

Mr Gilbert : In charge of Agriculture and Development in the District (0788475592)

Mr Mudenge: Agricultural Officer in Rulenge Sector (0788844325)

Ms Claudine: Agricultural Officer in Remera Sector (0788555409)

Introducing the JICA Team and the Study, the JICA Staff Mr Suzuki introduced the MINAGRI LHW project that aims to construct 101 valley dams countrywide and that will cost millions of Rwandan Francs. During phase one, 32 sites have already identified countrywide and the District of Ngoma has two sites namely Remera and Rulenge. Both sites have been taken by JICA for the feasibility study. Thus the JICA Study team has been dispatched for two months to carry out a field survey after which a report will be written. Basing on the report , the Government of JAPAN will look into the possibilities of a technical cooperation to implement the construction works.

The JICA Study Team handed in copies of the inception report to the Vice Mayor and requested the support from the District Officer, particularly the District Agricultural Officer and those of Remera and Rulenge Sectors.

The vice Mayor let know that the study is needed to know the required budget for the valley dam construction and whether farmers are happy or not with the project.

The JICA Team said that the above issues will be addressed since during the feasibility study both the technical side and the social aspect are envisaged.

The meeting was followed by the site visit at Remera and Rulenge sites under the guidance of the District agricultural officer and Remera and Rulenge agricultural officers.

4. Meeting with officials in Rugarama Site in Gatsibo District

Date: 5 March 2009

Venue: Gatsibo District

Attendants: Mr. Suzuki, JICA Rwanda Office

Mr. Alexis, JICA Rwanda Office

Mr. Chiba, JICA Study Team

Mr. Senda, JICA Study Team

Ms. Shimaoka, JICA Study Team for Evaluation of Agriculture and Rural Development Program

Mr. Rwigira, Translator

Mr Mushumba John (Tel 0788457044), Executive Secretary, Rugarama Sector

Mr Manzi Alexis: Agricultural officer of Rugarama Sector (0788476295)

Mr Jean Claude: Agricultural Officer, Gatsibo District (0788507206).

Rugarama Site is a very long and deep gully that has been worked out by intensive erosion over the years. Thus, the site needs a particular feasibility study as it will require sophisticated civil engineering construction works during implementation phase.

At the end of the site visit, the JICA Team **introduced and explained the study** to the Rugarama Executive Secretary: Mr Mushumba John (Tel 0788457044). The Executive Secretary received as well copies of the Inception Report.

During the meeting with the Rugarama, the JICA Consultant, Ms Shimaoka focused on **Cooperative organizations** in the Sector and the Executive Secretary informed him that there is a maize growing cooperative in the Sector. Further, organization of cooperatives is spearheaded by the MINICOM (Ministry of Commerce and Mines). There are cooperative guidelines prepared by the MINICOM each cooperative has to comply to.

Concerning **extension services** at the sector level, the consultant sought to know what the Sector provides in terms of extension services to sustain new technologies. The executive secretaries said that Study tours organized by farmers themselves are encouraged.

He let know that no budget is provided for to the sector within the decentralization process to support extension activities. In fact the physical decentralization stops for the moment at District level but it is meant to go down at sector level in the future.

Meeting the Vice Mayor in Gatsibo District, **the JICA Staff Mr. Suzuki introduced the JICA Team and the MINAGRI LHW project** that aims to construct 101 valley dams countrywide among which JICA will construct 4. So far, the first 32 sites to start with have been identified by the MINAGRI.

The District Officer **pledged his total support to the team** whenever they need it. The JICA Team particularly requested the support from the District Agricultural Officer and the Agricultural Officer of Rugarama and such support was assured.

5. Meeting with the officials in Gashora Sector

Date: 18 March 2009

Venue: Gashora Sector

Attendants: Mr. Senda, JICA Study Team

Mr. Rwigira, Translator

The JICA Team expert discussed with the Gashora Executive Secretary and Agricultural Officer on the possible location of the valley dam site. Two possible options were proposed: construction of a relatively small valley dam like the one proposed on site no 2 within LWH project or construct a bigger reservoir.

For the first case the irrigation area would be of small scale but would involve few movement of the population and the submerged area would be not significant. On the contrary for the second, large movement of the population would take place and the farmers in the submerged area could not benefit from the reservoir water for irrigation due to expropriation.

The Study Team expert let know that JICA may prefer the small valley dam since JICA does not want that construction involves large movement of the farmers from their farmlands and the aid scheme of the Government of Japan is quite limited. However, the Executive Secretary is afraid that water would not be sufficient especially in case of irrigation of paddy fields. Thus, he suggests the JICA Study Team would explore the two possibilities including construction of the small reservoir and that of big reservoir and present the two options to the government of Japan for comparison and consideration.

Concerning expropriation, the Executive Secretary ensured the Government Authorities would talk to farmers. Either farmers would be compensated by other fields or they would receive money for expropriation.

6. Meeting with MINAGRI and JICA

Date: 6th April 2009

Venue: JICA Rwanda Office

Attendants: Mr. Suzuki, JICA Rwanda Office

Mr. Silivin Songa, LWH Contract Manager

Mr. Prime, Head of Soil Dept. RADA

Mr. Chiba, JICA Study Team

Mr. Senda, JICA Study Team

Mr. Nakanishi, JICA Study Team

Mr. Hata, JICA Study Team,

Mr. Rwigira, Translator

1) Site Selection Criteria

- On Common Site Selection Criteria : MINAGRI is wrapping up Resettlement Policy (Action Plan) employing a consultant, through site investigation for 8 sites. The report will be submitted in the middle of May.
- MINAGRI is arranging employing a consultant for Environmental Criteria. The report is expected to be submitted in the middle of June.
- The guideline for Economic Criteria has not been completed. The economic analysis shall be done using general method and referring TOR of LWH.
- The bidding for LWH 4 sites (Gatsibo No.8 and No.32, Kayonza No.15, Karongi No.13) was held on 3rd April. The evaluation is on going. One firm can awarded for maximum 2 lots.

2) Location of dam and irrigable area of each site

- Rough estimation of irrigable area is shown in the table below. The study team will raise the precision of estimation.

Site	Capacity(m ³)	Irrigable Area(ha) : upland cropping
No.2 Case I	500,000~800,000	130~210ha
No.2 Case II	1,000,000~1,600,000	260ha~420ha
No.21	600,000	162ha
No.22	1,000,000	260ha
No.31	—	No.31 will not supply water to the down stream paddy field. It will be done by the RSSP dam. It is difficult to ensure 50 ha of beneficiary area in the upstream hillside area.

Upland cropping : 370,000m³/100ha、paddy field : 740,000/100ha

- No.2 shall be designed not to overlap the beneficiary area of No.3. The design of No.3 shall not be changed.
- The reservoir area of Case II of No.2 shall be planned not to overlap the beneficiary area of No.3.
- In case of main objective of the dam is flood mitigation, No.31 is possible to be adopted even if the beneficiary area is less than 50 ha.

3) Others

- MINAGRI is responsible to compensation posed by the project. The methodology of compensation will be achieved from the result of Resettlement Action Plan.
- In case of change of land use is required by the project, it is possible to execute the farmland consolidation work by MINAGRI. However, layout of the field shall be proposed by the consultant through site survey. It shall be considered that LWH focuses on horticultural crop. (Mr. Suzuki discussed with PS and they agreed that in case that the site is suitable for paddy field, rice cropping can be introduced.)
- Currently, cooperatives carry out O&M of irrigation facilities and water management However, MINAGRI aims to separate water users' association from cooperative. MINAGRI consider it better that cooperative concentrate on agricultural production and water users' association concentrate on O&M of irrigation facilities and water management. (MINAGRI would like to introduce general style in foreign countries)
- It is recommended to interview to Mr. Francena (CIB coordinator) about cooperative.

4) Further Schedule

- Site visit on 15th and 16th April. No.21, 22 and 31 on 15th. No.2 on 16th.
- Progress report on 23rd April.
- Outline of site survey (dam site, outline of dam plan, irrigable area) will be presented using power point.

7. Meeting with MINAGRI

Date 22nd April 2009

Venue: MINAGRI Meeting Room

Attendants: Mr. Ernest Ruzindada, Permanent Secretary, MINAGRI
Mr. Prime, Soil and Water Management Unit, MINAGRI
Mr. Murakami, JICA Rwanda Office
Mr. Suzuki, JICA Rwanda Office
Mr. Chiba, JICA Study Team
Mr. Senda, JICA Study Team
Mr. Nakanishi, JICA Study Team
Mr. Hata, JICA Study Team
Mr. Rwigira, Translator

The Study Team presented the technical, socio-economical and environmental findings. During the discussion, the following issues were raised.

1. Gatsibo 31 is not feasible as the irrigation command area is small.

- The Permanent Secretary in MINAGRI pointed out the site is not economically viable and should therefore be left out and replaced by another site.

- JICA suggested to find another site among the already surveyed sites in Eastern Province possibly in Bugesera District.

- MINAGRI reminded that initially 5 sites were envisaged. JICA said this can be considered if MINAGRI gives two more sites in Bugesera i.e. Bugesera 3 and Bugesera 4. The first priority should be Bugesera 3 and second priority Bugesera 4 (in Musenyi sector). MINAGRI accepted to look into this possibility.

2. The Permanent Secretary sought to know when the basic design study will be carried out.

- The JICA Study Team explained that the final report including geological data will be issued in June and the basic design study will be scheduled late July or in August.

- JICA representative ensured he will push this phase to be started as soon as possible.

3. Concerning the project developer.

- The Permanent Secretary said that MINAGRI will be the project developer and Districts will take part in the project execution process.

**MINUTES OF THE MEETING
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES
OF THE REPUBLIC OF RWANDA
ON
JAPAN'S COOPERATION PROGRAM FOR RURAL DEVELOPMENT
IN EASTERN PROVINCE
IN
THE REPUBLIC OF RWANDA**

The Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Study Team (hereinafter referred to as "the Team"), headed by Mr. Kimiaki JIN, to the Republic of Rwanda from February 28 to March 19, 2009, for the purpose of discussing the framework of the Japan's Cooperation Program for Rural Development in Eastern Province, Rwanda (hereinafter referred to as "the Program"), the Technical Cooperation Project for Sustainable Rice Production Development in Bugesera District (hereinafter referred to as "the Project"), and the Grant Aid Project for Land Husbandry, Water Harvesting and Hillside Irrigation (LWH) (hereinafter referred to as "the Grant Aid Project").


During its stay in Rwanda, the Team carried out interviews, field surveys and discussions on the Program and two Projects with the Ministry of Agriculture and Animal Resources (hereinafter referred to as "MINAGRI") of the Republic of Rwanda.

As a result of these studies, the Team and the MINAGRI agreed on the document attached hereto.

Kigali, March 19, 2009



Mr. Kimiaki JIN
Team Leader,
Preparatory Study Team,
Japan International Cooperation Agency,
Japan



Mr. Ernest RUZINDAZA
Permanent Secretary,
Ministry of Agriculture and Animal Resources,
Republic of Rwanda

THE ATTACHED DOCUMENT

ACRONYMS AND ABBREVIATIONS

C/P	Counterpart
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JOCV	Japan Overseas Cooperation Volunteers
GoJ	Government of Japan
GoR	Government of Rwanda
MINAGRI	Ministry of Agriculture and Animal Resources
M/M	Minutes of Meeting
PDM	Project Design Matrix
PO	Plan of Operation
R/D	Record of Discussions
TSI	Tentative Schedule of Implementation

I. BACKGROUND

In Rwanda, actually, agriculture is a key livelihood which occupies about 90% of the labor force and 42% of the GDP (World Bank 2005 data). The promotion of agriculture in Rwanda is priority issue for economic development and poverty alleviation in “Vision 2020” which indicates long term national development vision and “Economic Development and Poverty Reduction Strategy: EDPRS 2008-2012”. The GoR has adopted “National Agricultural Policy (NAP)” and “Strategic Plan for Agricultural Transformation (SPAT)” and is implementing comprehensive agriculture development measures.

However, production of main exporting crops, such as tea and coffee, are not stable due to change of climate and fluctuation of international market price. Majority of agriculture crops such as sorghum, beans, maize, and potatoes are not produced by the commercial farming but small-scale subsistence farming. Low productivity, low income and high price of agriculture inputs, such as fertilizers and pesticide, make farmers remain in traditional farming. During rainy season, extreme soil erosion in many hilly fields causes low soil fertility and low productivity. Lack of food and nutrition crisis are significant in all through the nation in drought period.

Therefore, commercialized agriculture through increasing of productivity, improving of market access by infrastructure development, and reactivation/diversification of economic activities in rural area, are necessary for improving livelihood throughout the nation.

In these circumstances, Japan’s ODA Task Force drafted “Japan’s Cooperation Program for Rural Development in Eastern Province, Rwanda”, based on multi-sector approach, covering agriculture/rural development and improvement of water supply and sanitation in the Province.

In 2007, GoR requested GoJ for a Technical Cooperation Project, the “Sustainable Rice Production Development in Bugesera District in Rwanda” and in 2008, the Grant Aid Project for the “Land Husbandry, Water Harvesting and Hillside Irrigation (LWH)”.

In response, GoJ dispatched the Team to discuss the framework of the Program, its components and long term strategic scenario focusing on rural development in Rwanda.

II. TERMS OF REFERENCE OF THE PREPARATORY STUDY TEAM

The Team has been dispatched in order to study the following issues and to prepare and sign M/M as a result of the study.

- 1.-1 The components of the "Japan's Cooperation Program for Rural Development in Eastern Province, Rwanda", and their inputs, activities, outputs, etc.
- 1.-2 The relevance of proposed project master plan of the "Sustainable Rice Production Development in Bugesera District in Rwanda", and preferable activities, outputs, etc.
- 1.-3 The feasibility of the "Grant Aid Project for Land Husbandry, Water Harvesting and Hillside Irrigation (LWH)", including necessity, relevance, effectiveness, efficiency, sustainability, etc.

III. MAJOR POINTS DISCUSSED AND AGREED UPON BY BOTH SIDES

1. Japan's Cooperation Program for Rural Development in Eastern Province, Rwanda

1.-1 Program Concept

- a. The Program shall be implemented within the Rwandan policy framework of food security and poverty alleviation relating to NAP, SPAT II, and other policies. Therefore, it shall be expected to directly contribute to the increase of agricultural production, productivity, and farmers' income in Eastern Province in Rwanda.
- b. The Program shall be implemented to deepen and scale-up the outputs gained from the past JICA projects, by using the technical cooperation and the grant aid of GoJ, as well as resources of GoR, and other relevant stakeholders.
- c. The overall objective of the Program is to improve living standards and increase income generation of the people, especially in Eastern Province.
- d. The Program shall be implemented in order to create synergy of JICA's various schemes for rural development, such as the assignment of experts and JOCV volunteers, technical cooperation project, grant aid cooperation, trainings, technical information exchange with other countries, etc.

1.-2 Target Groups

The target groups of each Project in the Program shall be selected among stakeholders, such as (i) officers of MINAGRI, its related organizations, and local governments, (ii) service providers, (iii) farmers, (iv) community based groups, (v) NGOs, etc..

1.-3 Target Area

The target area of the Program is the Eastern Province of Rwanda. Each project site will be selected by each JCC or authorized committees, according to criteria which will be set by both Rwandan and Japanese sides in the planning stage.

1.-4 Program Implementation

The Team and MINAGRI agreed upon the above Program outline as shown in Annex I of the M/M, as a draft. The Program will be finalized by GoR and Japan's ODA Task Force. MINAGRI plays important role to supervise the strengthening of linkage among stakeholders for rural development in Eastern Province, Rwanda.



2. Technical Cooperation Project

- 2-1 Both sides agreed to change the Project purpose to support farmers organizations which are established and are to be established in Eastern Province through human resource development,] provision of equipment, construction of related facilities, etc.. The Project title will be changed to "Capacity Development Project for Farmers Organizations in Eastern Province, Rwanda (tentative)" instead of "Sustainable Rice Production Development in Bugesera District in Rwanda".
- 2-2 Based on the result of the discussions, both sides have confirmed the tentative frame work of the Project as shown in Annex II. Both sides agreed that the further details will be studied in the next Preparatory Study which will be dispatched if the Project was officially approved by the GoJ.
- 2-3 The R/D will be prepared and signed as a project agreement between GoR and JICA, after completion of the next preparatory study and other necessary internal arrangement, such as budgetary matters.

3. The Grant Aid Project

- 3-1 Framework of the Grant Aid Project
Both sides confirmed a framework of the Grant Aid Project as shown in Annex III and Rwandan side understood Japan's Grant Aid Scheme shown in Appendix 2 in Annex III.
- 3-2 Feasibility Study
The Team side explained that the feasibility study for 4 candidate irrigation scheme sites in Eastern Province has been implemented by Japanese Consultant Team since 28th February. The brief study report would be submitted to Rwandan side by 24th April, and the final report will be submitted in June, 2009, after whole data analysis completed. If all or some of the 4 candidate irrigation schemes are found to be feasible by the Study, JICA will send Basic Design Study Team for further study, later.
- 3-3 Environment and Social Issues
Rwandan side explained that EIA (Environmental Impact Assessment) and IEE (Initial Environmental Examination) will be necessary for the implementation of Japan's Grant Aid Project, and it will be conducted by Rwandan authorities concerned.

IV. ISSUES TO BE FURTHER DISCUSSED

Appropriate staffing and budgeting is one of the critical matters for the implementation of the Program. Both sides agreed that MINAGRI will take necessary measures on this matter and report the progress to JICA Rwanda Office.

<ANNEXES>

- I. JAPAN'S COOPERATION PROGRAM FOR RURAL DEVELOPMENT IN EASTERN PROVINCE, RWANDA
- II. TENTATIVE MASTER PLAN OF THE TECHNICAL COOPERATION FOR "CAPACITY DEVELOPMENT PROJECT FOR FARMERS ORGANIZATIONS IN EASTERN PROVINCE, RWANDA (Tentative)"
- III. TENTATIVE FRAMEWORK FOR THE GRANT AID PROJECT FOR "LAND HUSBANDRY AND HILLSIDE IRRIGATION"

**ANNEX I. JAPAN'S COOPERATION PROGRAM FOR RURAL DEVELOPMENT IN
EASTERN PROVINCE, RWANDA**

1. Program Name:

Japan's Cooperation Program for Rural Development in Eastern Province, Rwanda

2. Program Period

Five years (2008 - 2012)

3. Overall Objective:

To improve living standards and increase income generation of the people, especially in Eastern Province

4. Components:

4-1 Technical Cooperation Project

4-2 Grant Aid Project

4-3 Dispatch of Volunteer

The Rolling Plan of the Program was attached in the M/M of Midterm Review Meeting of Policy Dialogue held on 19 January 2009, signed between the Embassy of Japan and the Ministry of Foreign Affairs and Cooperation, Rwanda.

Rolling Plan

[Focal Area of Assistance] Rural Development		[Purpose]									
Program	Project Title	Type of Assistance	Status	Proposed Priority	Implementing Duration (Japanese FY: April to March)					Cost Estimation (100Mn.JPY)	Remarks
					2008	2009	2010	2011	2012		
Agriculture and Community Development Program for Rural Development in the Eastern Province	Rural Water Supply Phase-I	Grant	On-going							18	Rwamagana, Kayonza, Ngoma and Kirehe Districts
	Rural Water Supply Phase-II	Grant	Under Screening	A						(18)	
	Rural Water Supply Phase-III	Grant	Future Plan							-	
	Improvement of Water Supply and Sanitation in the Eastern Province	TC	On-going							2.6	Capacity Building in Rwamagana, Kayonza, Ngoma and Kirehe Districts
	Development Study for the Improvement of Rural Water Supply in Rwanda	TC	On-going							2.5	All districts in Eastern Province
	The Study on Sustainable Rural and Agriculture Development in Bugesera District	TC	On-going							3.2	
	Rural and Agriculture Development Project	TC	Under Screening	A						(4)	F/S study team will come on Feb, 2009
	LWI Project	Grant	Under Screening	A						(12)	F/S study team will come on Feb, 2009
	2006 Grant Assistance for Underprivileged Farmers (ZRR)	Grant	On-going							1.3	Provision of Fertilizer
	2008 Grant Assistance for Underprivileged Farmers (ZRR)	Grant	Under Screening							(3)	Provision of Fertilizer
	2010 Grant Assistance for Underprivileged Farmers (ZRR)	Grant	Future Plan							(6)	Provision of Fertilizer
	2007 Food Aid through WFP (RR)	Grant	On-going							1	
	2009 Food Aid through WFP (RR)	Grant	Under Consideration							(2)	
Japan Overseas Cooperation Volunteers (JOCV)	Volunteer	On-going								-	Areas of agriculture and community development
					Program Total					28.60	*indicative figure
					Program total (m.l USD)					28.60	USD = 100JPY

*TC : Technical Cooperation
 #Future Plan >> Under Consideration >> Proposed >> Under Screening >> Approved >> On-going