

Table 4.2.1 Recommended Farming Practices for Main Crops in the Study Area (1/2)

Farming Practices	Rice	Red Bean	Plantain & Banana
Land Preparation	Adequate land preparation help in controlling weeds, incorporate fertilizers in the soil, reduce deep percolation of water, and facilitate growth of roots. Make deep plowing, harrowing, puddling and land surface leveling.	Adequate land preparation is important in order to obtain high yield of bean. First plowing at 25 cm depth, and two harrowing at intervals of 15 days to finely break the soil aggregates.	One deep plowing and two harrowing are recommended. Make planting holes at distance of 2.5 m by 2.5 m in triangular alignment to attain a planting density of at least 1,600 plants/ha. Field drainage should be adequately provided.
Recommended Varieties	Proseguisa-4 which has a growing period of 120 days and yield of 4.5 ton/ha can be attained. Other varieties recommended are Isa-40, and Juma-55.	The most recommended variety is PC-50, which is tolerant to several diseases, and can produce higher yield in the area. Growing cycle is 80 to 90 days. Yield of 1.5 ton/ha can be attained. Other varieties are CIAS-95, José Betá, and Pompadour Checa.	Recommended varieties are "Macho por Hembra", "Barahonero". Banana varieties are "Cavendish", "Mocha mata", and "Gross Michel".
Planting Method	Use certified seeds. Direct field seeding is generally used in San Juan area. The amount of seeds recommended is 160 kg/ha. Pre-germinate seeds by soaking in water for about 24 hours, and then exposing the soaked seeds in open air for 3 days. Planting rice from May to June. For direct seeding method it is very important to make adequate leveling of land surface.	Plant as early as possible within the period fixed by SEA's regulation, from beginning Nov. to mid Dec. Planting distance 50 cm between rows and 10 cm between plants. Quantity of seeds is 110 kg/ha. Borders stripes should be 2.5 m width and 25 m long in order to make better control of irrigation water.	The use of seedlings grown by tissue culture are recommended to attain pest and disease free planting material. In case of using suckers from other field for planting material, it is necessary to make adequate disinfection. Recommended planting density is 1600 plant/ha. Adequate illumination is necessary for attaining good yield. Fertilizers and insecticides are located on the bottom of the planting holes at the moment of planting.
Fertilization	Soil analysis are necessary. As general guideline the amount of fertilizer recommended is N=180 kg/ha; P=90 kg/ha, and K=90 kg/ha. Do not use nitrate fertilizer on submerged rice field, only ammonium type of nitrogen fertilizer should be used.	Soil analysis should be made to know the specific requirement of fertilizer for each soil series. General recommendation of fertilizer is N= 75 kg/ha; P=95 kg/ha, and K= 40 kg/ha. Apply fertilizers at the moment of planting.	Plantain and Banana require good application of nitrogen and potassium fertilizers. The amount of nutrient fertilizers recommended are N= 250 kg/ha; P=110 kg/ha, and K= 150 kg/ha. Divide the total amount into 2 or 3 applications per year. Soil analysis is recommended to determine specific requirement of nutrients.
Irrigation	Good supply and management of irrigation water is necessary for attaining high yields of rice. A critical period of water requirement is from flowering up to grain filling. Irrigation water have several functions in rice production, such as weed control, diseases control, control of soil temperature, and improvement of chemical condition of soil. Adequate land preparation, including surface leveling is essential for good management of irrigation. Rice field should be drained 25 days after grain filling.	It is necessary to make adequate on-farm management of irrigation water to avoid water lodging and loss of fertilizers due to excessive application of water. The critical period for water requirement are (1) at the moment of planting to ensure germination; (2) At flowering; and (3) grain formation.	Irrigation is required at least once or twice every month. Adequate on-farm water management should be implemented to avoid excessive irrigation, loss of nutrients and drainage problems. Farm drainage should be provided.
Insect Control	Insect attack is a main problem for majority of rice farmers. Main insects are Stink bug, Steam borer, and Grasshopper. Introduction of Integrated Pest management (IPM) is recommended in order to make an effective and economic control to insects. Application of insecticides, such as Karate at rate of 3 lit/ha, divided in two or three applications, are recommended for insect control.	Introduction of Integrated Pest Management (IPM) is necessary for adequate control of insects. For White fly, insecticides Monocrotophos at rate of 1.5 g/l at 14, 21 and 25 days after planting. For control of Empoasca apply Carboaryl at rate of 1 gr per liter; Monocrotophos or Dimetoate at 1.5 ml/lit. Adequate control of weeds help to reduce insects population.	Main insects problem in the study area are "Cosmopolites" and "Trips". Nematode are also considered important problem. Their control can be partially made by introduction of IPM. Installation of simple traps are recommended for control of "Cosmopolites" insects. Insecticides such as "Sistemin" and "Furadan" are recommended at rate of 2 lit/ha.
Disease Control	Main rice diseases are Blast, Stem rot and Brown spot. Introduction of IPM is recommended, including use of resistant varieties, certified seeds, good management of irrigation, adequate level of fertilization, weed and insect control, etc. Combination of IPM with application of fungicides based on Zinc oxides, Dithane or Antracol depending on the disease, at rate of 1 kg/ha could make an adequate and economic control of rice diseases.	First of all, the use of a variety such as PC-50 that is resistant to several plant diseases. Second, introduce IPM practices; Several diseases are transmitted by insects, therefore insect control is important in reducing the incidence of diseases. Application of fungicides at rate of 1 kg/ha divided in several applications.	Foliar diseases are not major problem for plantain and banana in the Study area, but roots diseases can become important. Application of fungicide, such as "Dithane" at rate of 5 kg/ha is recommended. IPM, including good fertilization, control of insect, control of weeds, and adequate water management will help to deduce incidence of roots diseases on plantain and banana.
Weed Control	Main weed species affecting rice production are Sagitaria sp, Cyperus sp, Cynodon sp, and Imperata sp. A combination of herbicides (Propanil at rate of 1.5 lit/ha), mechanical and manual methods for control of weeds is recommended. Adequate management of irrigation water help in the control of weeds.	Leaving an interval of about 15 days between plowing and harrowing help in control of weeds. Do not let weeds plants to produce seeds. Do not make weed control during the flowering stage. Mechanical control of weeds, using either tractor or animal traction is recommended to reduce costs and improve soil condition.	Weed control is very important from planting up to total coverage of soil by plantain and banana, made 3 to 4 times per year. At these stage, a combined control of weeds by mechanical means and use of herbicides is recommended. After the plantation are grown and cover the land, weed control should be manually using machete.
Harvesting	About 40 % of rice farmer harvest by hand, other 40 % harvest using both combines machines and manually, while only about 20 % harvest rice using combine machine only. Rice harvester used in San Juan area are large type combine that can not be used in small farms and are difficult to maintain. The introduction of medium size rice harvesters would help to reduce cost of harvesting in small farms.	Harvest 85 to 90 days after planting. Wait until bean reaches it maturity, indicated by yellowing and dropping of leaves. Harvesting is recommended to be done only on early morning, to avoid opening of pods and drop of grains.	Harvesting begins 8 to 10 months after planting, and thereafter is made every 20 to 30 days. Harvest and handle is made manually. Labor requirement for harvesting one ha is about 21 man-day per year.

Sources of Recommendations: Rice: (1) Rice Production Bulletin, SEA, 1988; (2) Tropical Agriculture Compendium, IICA 1986; (3) Production Costs, Agricultural Bank 1997; Red Bean: (1) Several Bulletins on Bean Production, SEA Proyecto Titulo XII, and FDA, 1977; (2) Tropical Agriculture Compendium, IICA 1986; (3) Handbook on Tropical Legume Cultivation, AICAF, 1995; Plantain & Banana: (1) Tropical Agriculture Compendium, IICA 1986; (2) Tropical Crops, J. W. Pursglove, 1972; (3) Production Costs, Agricultural Bank 1997; (4) Notes of conversation with CIAZA's specialist.

Table 4.2.1 Recommended Farming Practices for Main Crops in the Study Area (2/2)

Farming Practices	Industrial Tomato	Pigeonpea	Sugar cane	Coffee
Land Preparation	Before plowing soil surface should be clean out of leftover from previous crop and grown weeds. Plow at depth between 20 to 30 cm. If hard pan exist, depth of plowing should be 40 to 50 cm. Harrowing is recommended at 35 days interval.	Plow at depth of 15 cm and harrowing once. Prepare ridges to facilitate irrigation and better condition for root growth.	Deep chiseling is recommended to favor vertical movement of water and leaching of salts. Remove stems of previous cane plants. Then, plowing 25 cm deep, followed by harrowing. Make ridges 20 cm deep and separated at 150 cm. Land leveling and ridging.	Land clearing and opening of planting holes are the needed land preparation practices. This are done manually.
Recommended Varieties	Recommended varieties are: Pepto-98, UC 82, Napolis VF, and hybrids Gem Star, Gem Pride, Gem Pear, 960, and 1001.	A new dwarf variety introduced from India. This variety was tested in CIAZA and gave excellent results of high yield in short growing period. Other varieties are UASD, Puerto Rico that are of short growing period and high yielding.	Recommended varieties are B70-89, B76-56, B76-78, B76-196, and BR62-02	"Caturra" is coffee variety recommended to be planted with project condition.
Planting Method	Transplanting method is largely used. Seedling grown in trays kept in shaded areas (spellings) are recommended, in order to reduce damages from insects. Seedling are ready for transplanting 15 to 20 days after planting the seeds. Transplant at distance of 120 cm between rows and 25 cm between plants. Roots of seedlings should be placed about 5 cm deep.	The dwarf variety from India is planted at high population density (80 cm between rows and 20 cm between plants. Amount of seeds required is about 20kg/ha. Seed should be planted at depth of 4 to 5 cm.	Sugar cane is propagated by stem cuttings of immature canes known as "seed-pieces" or "setts". The cane used for "seeds" should be grown specially for this purpose free from insects and disease damages; the "seeds" should be between 8 to 10 months old. "Seed" pieces should be chosen from the upper 1/3 (younger part) of the cane, and should have 2 to 3 buds. The "seed" pieces are planted with 25 % overlapping; planting depth is about 7.5 cm. About 20,000 "seed" pieces are required to plant 1 ha of cane.	Majority of coffee plantation in the study area are old. Planting of new areas or replanting of old coffee plantations is minimal. Seedlings grown in plastic bags are planted to the field at age between 6 to 10 months old. Planting distance is 2.5m by 2.5 m for a population density of 1,600 plants per ha. Planting hole should be made 30 cm in all directions (30cm by 30 cm by 30 cm); holes should be refilled with top soil mixed with organic matter.
Fertilization	Tomato requires relatively large amount of fertilizers in order to produce high yield. At the beginning of growin stage the requirement are lower than at fruit formation stage. The total amount of nutrient recommended are N= 200 kg/ha; P= 90 kg/ha, and K= 150 kg/ha; Apply half of fertilizers at transplanting and the other half before flowering. Make soil analysis to know the exact quantity of fertilizers needed for each soil type.	Pigeonpea do not require high quantity of fertilizers. In many cases the soil can provide the amount of nutrient needed by pigeonpea; In soil of the Study area which are low in nitrogen the amount of fertilizers recommended as general guidance are N=45 kg/ha; P= 45 kg/ha, and K= 30 kg/ha.	Detailed soil analysis and field trial to determine the actual requirement of fertilizers for cane. As general guide N= 250 kg/ha; P=80 kg/ha, and K=300 kg/ha. Phosphate fertilizer should be mixed in the soil at plating time. Nitrogen should be split in two applications, first two weeks after planting, and the second about two months after planting.	Amount of fertilizer are indicated as a general guideline. Soil analysis and trial of different levels of fertilization should be undertaken in the proposed pilot areas in order to determine most accurate recommendations for fertilizer levels. The amount of fertilizer recommended vary with the growing stage of coffee; At development, apply about N=195 kg/ha; P=120 kg/ha, and K= 60 kg/ha. Apply fertilizer in circle around each coffee tree.
Irrigation	Irrigation is essential to attain the target yield. Deficit or excess of soil humidity will cause reduction of yield. Soil humidity should be kept at 70 to 80 % of field capacity. Adequate on-farm water management help reduce incidence of diseases.	Water requirement of recommended varieties are relatively low because the short growing period of these varieties. Irrigation should be provided at intervals of 12 to 15 days.	Adequate irrigation and drainage practice is necessary to attain the target yield of sugar cane. Irrigation water must infiltrate to wet the entire root depth. During the 3 months irrigation intervals should be 2 weeks, after that, intervals are 3 weeks	RAINFED
Insect Control	Large incidence of insects, specially white fly is one of the main problem affecting tomato production. Introduction of IPM is strongly recommended to help in controlling insects. Application of insecticides such as "Nuvacron" are recommended at rate of 6 lit/ha divided in several applications, according to insect population.	Main insect problems are armyworm, green stink bug, white fly, aphid. Control of insects should be based on combination of IPM and use of insecticides, such as "Karate" at rate of 1 lit/ha is recommended. Application of insecticides should be suspended 15 days before harvest of the green pods	Insects attack is not considered a very important problem in the sugar cane plantation within the study area. Stem borer (<i>Diatraea</i> sp.) are the most common insects. Their control is made by application of insecticides at rate of 3 lit/ha, divided in 3 or 4 applications. Introduction of IPM, including use of varieties that are resistant to insects and disease attack.	Insects affecting coffee plantations in the study area include aphids, mealy bug, and hemispherical scale. The introduction of IPM combined with application of systemic insecticides at rate of 2 lit/ha are recommended.
Disease Control	Main disease affecting tomato is the virus transmitted by "white fly". Other diseases are Rhizoctonia, Fusarium, and Alternaria. It is important to control insects, specially white fly in order to prevent the wide spread of diseases. IPM is recommended to reduce incidence of diseases; Important measures include planting date, use of tolerant varieties, planting healthy seedlings, etc.; Fungicides such as "Dithane" at rate of 8kg/ha divided in several applications.	Main diseases affecting pigeonpea in the Study area are "Antracnosis and leaf rust, and some virus diseases. In general the use of fungicide seems to be economically not justified; Application of IPM will reduce diseases problems.	Diseases of importance affecting the sugar cane in the study area are "Roya" and "Carbon". The control is made using cane varieties that are resistant to these diseases.	The main disease affecting coffee in the study area is the "brown leaf circle" caused by <i>Cercospora</i> sp. IPM practices and application of fungicides such as "Benlate" and "Cupravit" at rate of 8 kg/ha and 3 kg/ha respectively.
Weed Control	Effective control of weeds, both inside and around of tomato fields, is one important component of IPM. Control of weed is made mostly manually; average labor used for weed control is 20 man-day/ha.	Pigeonpea should be kept free from weeds during the early growth stages to avoid significant reduction of yield. Weed control can be made mechanically or manually.	Weed control is made by a combination of herbicides and manually. Labor used for weed control is about 15 man-day/ha.	Coffee fields must be kept free from weeds infection in order to avoid reduction of yield. Weed control in coffee area is done manually.
Harvesting	Harvesting of tomato is done manually by all farmers. Labor used for harvesting is about 10 man-day/ha.	Majority of pigeonpea farmers harvest when grains are green (young). Harvesting is made manually. Labor used for harvesting is 8 to 10 man-day/ha.	Harvesting of sugar cane is done manually. Burning-up before harvesting should be reduced or eliminated. The labor is about 5 man-day/ha.	Care harvesting and post-harvest handling of coffee is necessary to attain high quality grains. Coffee bean of different maturity condition should be mixed. Harvesting is done manually. Labor use for harvesting is between 3 to 5 man-day/ha.

Source of recommendations:

- Tomato: (1) Tomato Farming, Bulletin 19 of FDA, 1993; (2) Production Costs, Agricultural Bank 1997; (3) Notes from conversation with CIAZA's specialist and manager of tomato paste mill.
- Pigeonpea: (1) Commercial Production of Pigeonpea, FDA, 1999; (2) Handbook of Tropical Legumes Cultivation, AICAF, 1995; (3) Notes from conversation with CIAZA's specialist.
- Sugar cane: (1) Study for Rehabilitation of Irrigation and Drainage system of Barahona sugar Mill, World Bank-CEA, 1986; (2) Annual Performance Report, CEA, 1997; (3) Notes and printout provided by administration of Barahona sugar Mill; (4) Tropical Agriculture Compendium, IICA, 1989.
- Coffee: (1) Coffee Development Plan, SEA 1997; (2) Tropical Agriculture Compendium, IICA 1989; (3) Coffee, by Gordon Wrigley, Tropical Agriculture Series, 1986.

Table 4.2.2 Anticipated Production of Major Crops With Projects Implementation

Crops	Present/Without Project			With Project			Projects Incremental Benefit of Production (ton)
	Area Planted (ha)	Yield (ton/ha)	Production (ton)	Area Planted (ha)	Yield (ton/ha)	Production (ton)	
(1) AZUA Irrigation District							
Plantain	4,048	18	72,860	5,013	23	115,300	42,440
Banana	791	26	20,570	791	36	28,480	7,910
Papaya	144	48	6,910	188	65	12,220	5,310
Ind. Tomato	3,170	25	79,250	3,731	30	111,930	32,680
Corn	970	2	1,940	1,203	2.8	3,370	1,430
Sorghum	862	3.5	3,020	1,068	4.5	4,810	1,790
Cassava	526	9	4,730	659	12	7,910	3,180
Pepper	83	15	1,250	98	18	1,760	510
Pigeon pea	263	1.7	450	366	3	1,100	650
Rice	325	2.5	810	325	4.5	1,460	650
Bean	929	0.9	840	1,329	1.5	1,990	1,150
Sweet potato	149	12	1,790	188	17	3,200	1,410
Eggplant	75	16	1,200	90	20	1,800	600
Melon	35	35	1,230	41	40	1,640	410
Avocado	10	10	100	12	12	140	40
Mango	25	12	300	30	16	480	180
Onion	75	11	830	88	13	1,140	310
Okra	80	12	960	94	15	1,410	450
Tobacco	37	1.6	60	53	2.2	120	60
(2) San Juan Irrigation District							
Bens	9049	1.1	9,950	14517	1.5	21,780	11,830
Rice	7973	3	23,920	7973	4.5	35,880	11,960
Sweet potato	2087	13	27,130	4491	17	76,350	49,220
Corn	1015	2	2,030	2244	2.8	6,280	4,250
Sorghum	735	3.5	2,570	1742	4.5	7,840	5,270
plantain	214	17	3,640	390	23	8,970	5,330
Pigeon pea	320	1.9	610	462	3	1,390	780
Banana	164	24	3,940	164	36	5,900	1,960
Cassava	327	10	3,270	427	12	5,120	1,850
Eggplant	163	17	2,770	214	20	4,280	1,510
Pepper	139	16	2,220	182	18	3,280	1,060
Melon	75	35	2,630	97	40	3,880	1,250
Papaya	218	52	11,340	279	65	18,140	6,800
Orange	25	15	380	32	20	640	260
Mango	20	12	240	25	16	400	160
Avocado	10	10	100	12	12	140	40
Onion	100	11	1,100	171	14	2,390	1,290
Coconut	25	6	150	32	8	260	110
(3) Yaque del Sur Irrigation District							
Plantain	5,655	18	101,790	7,223	23	166,129	64,340
Banana	1,419	26	36,890	1,419	36	51,084	14,190
Coconut	265	6	1,590	338	8	2,704	1,110
Corn	54	1.8	100	70	2.8	196	100
Sorghum	44	3.3	150	45	4.5	203	50
Rice	33	2.2	70	33	4.5	149	80
Bean	62	0.9	60	80	1.5	120	60
Pigeon pea	16	1.3	20	22	3	66	50
Cassava	257	8	2,060	322	12	3,864	1,800
Sweet potato	18	12	220	23	17	391	170
Tomato	61	24	1,460	78	30	2,340	880
Sugar Cane	1,140	30	34,200	760	115	87,400	53,200
(4) Lago Enriquillo Irrigation District							
Sugar cane	7660	30	229,800	3240	115	372,600	142,800
Plantain	700	18	12,600	3401	23	78,223	65,620
Banana	21	26	550	21	36	756	210
Rice	45	2.2	100	45	4.5	203	100
Bean	123	0.9	110	1075	1.5	1,613	1,500
Corn	156	1.8	280	1427	2.8	3,996	3,720
Sorghum	56	3.3	180	1327	4.5	5,972	5,790
Cassava	455	8	3,640	4014	12	48,168	44,530
Sweet potato	40	12	480	294	17	4,998	4,520
Eggplant	10	15	150	328	20	6,560	6,410
Tomato	94	24	2,260	1048	30	31,440	29,180
Pigeon pea	90	1.3	120	90	3	270	150

Table 4.2.3 Infrastructure, Machinery and Equipment Requirement for Coffee Production Improvement Project

	Unit	Quantity
(i) Construction		
Construction of two (2) training centers, including office space and lodging space	m2	330 each
Improvement of rural roads	km	66
Construction of access to nurseries	km	19.5
Construction of Shaded Nurseries	m2	234,000
Water Supply for Nurseries (Pipes of about 10 cm diameter)	m	18,800
Construction of Drying Floors	m2	233,400
Construction of Small Storage	m2	23,000
(ii) Machinery and Equipment		
(a) Machinery and Equipment for Extension, Training and Organization		
Furniture for Training Centers	Chairs	60
	Desks	2
	Cabinets	2
	Blackboards	2
	Beds	40
Power Generators	15 kw	2
Motorcycles for Extension Workers		15
(b) Machinery and Equipment for Coffee Production and Post-harvest Management		
Pulping Machine	units	180
Engines for pulping machine (3 HP)		180
Coffee Huller		180

Table 4.3.1. Rural Development Fund

Detailed Costs

	Unit	Quantity					Total	Unit Cost (US\$000)	Base Cost					Total
		year							year					
		1	2	3	4	5			1	2	3	4	5	
I. Investment Costs														
A. Line of Credit	L.S.							4,000.0	2,000.0	500.0				6,500.0
B. Equipment	No.													
1. Computers	No.	3	2				5	2.5	7.5	5.0	-	-	-	12.5
2. Printers	No.	3	1				4	1.2	3.6	1.2	-	-	-	4.8
3. Fax Machine	No.	1	1				2	0.5	0.5	0.5	-	-	-	1.0
4. Photocopier	No.	1					1	3	3.0	-	-	-	-	3.0
Subtotal									14.6	6.7	-	-	-	21.3
C. Vehicles	No.													
1. Vehicle (4WD)	No.	1					1	20	20.0	-	-	-	-	20.0
2. Motorcycle	No.	3					3	7	21.0	-	-	-	-	21.0
Subtotal									41.0	-	-	-	-	41.0
D. Salaries														
Secretaries	P/M	12	24	24	24	24	108	0.5	6.0	12.0	12.0	12.0	12.0	54.0
Manager	P/M	6	12	12	12	12	54	3	18.0	36.0	36.0	36.0	36.0	162.0
Credit/Accounting staff	P/M	36	72	72	72	72	324	0.8	28.8	57.6	57.6	57.6	57.6	259.2
Credit Officers	P/M	18	36	36	36	36	162	2	36.0	72.0	72.0	72.0	72.0	324.0
Lawyer	P/M	6	12	12	12	12	54	1.5	9.0	18.0	18.0	18.0	18.0	81.0
Accountant	P/M	6	12	12	12	12	54	0.75	4.5	9.0	9.0	9.0	9.0	40.5
External auditing consultant	year								6.0	6.0	6.0	6.0	6.0	30.0
Subtotal									108.3	210.6	210.6	210.6	210.6	950.7
Total Investment Costs									163.9	217.3	210.6	210.6	210.6	1,013.0
II. Recurrent Costs														
A. Operation and Maintenance														
1. Local travel costs	L.S.								3.0	4.0	4.5	4.5	4.5	20.5
2. Supplies	Month	6	12	12	12	12	54	0.25	1.5	3.0	3.0	3.0	3.0	13.5
3. Office rent	Month	6	24	24	24	24	102	0.5	3.0	12.0	12.0	12.0	12.0	51.0
4. Communications	Month	6	12	12	12	12	54	0.9	5.4	10.8	10.8	10.8	10.8	48.6
5. Vehicle Op. & Mainten.	Month	6	12	12	12	12	54	0.5	3.0	6.0	6.0	6.0	6.0	27.0
6. Drivers	P/M	6	12	12	12	12	54	0.4	2.4	4.8	4.8	4.8	4.8	21.6
Total Recurrent costs									18.3	40.6	41.1	41.1	41.1	182.2
TOTAL									182.2	257.9	251.7	251.7	251.7	1,195.2

*P/M : person/month

Table 4.3.2. Fund for the Rural Poor

Detailed Costs

	Unit	Quantity					Total	Unit Cost (US\$000)	Base Cost					Total
									year					
		1	2	3	4	5			1	2	3	4	5	
I. Investment Costs														
A. Line of Credit	L.S.							3,000.0	1,000.0	-	-	-	4,000.0	
B. Equipment	No.													
1. Computers	No.	2				2	2.5	5.0	-	-	-	-	5.0	
2. Printers	No.	1				1	1.2	1.2	-	-	-	-	1.2	
3. Fax Machine	No.	1				1	0.5	0.5	-	-	-	-	0.5	
4. Photocopier	No.	1				1	3	3.0	-	-	-	-	3.0	
Subtotal								9.7	-	-	-	-	9.7	
C. Vehicles	No.													
1. Vehicle (4WD)	No.	1				1	20	20.0	-	-	-	-	20.0	
2. Motorcycle	No.	3				3	7	21.0	-	-	-	-	21.0	
Subtotal								41.0	-	-	-	-	41.0	
D. Salaries														
Secretaries	P/M	6	12	12	12	12	54	0.5	3.0	6.0	6.0	6.0	6.0	27.0
Manager	P/M	6	12	12	12	12	54	3	18.0	36.0	36.0	36.0	36.0	162.0
Credit Officers	P/M	18	36	36	36	36	162	2	36.0	72.0	72.0	72.0	72.0	324.0
External Evaluation	year								-	6.0	-	-	6.0	12.0
Subtotal									57.0	120.0	114.0	114.0	120.0	525.0
Total Investment Costs									107.7	120.0	114.0	114.0	120.0	575.7
II. Recurrent Costs														
A. Operation and Maintenance														
1. Local travel costs	L.S.								3.0	12.0	12.0	12.0	12.0	51.0
2. Supplies	Month	6	12	12	12	12	54	0.25	1.5	3.0	3.0	3.0	3.0	13.5
3. Office rent	Month								-	-	-	-	-	-
4. Communications and Reproduction	L.S.								5.0	10.0	10.0	10.0	10.0	45.0
5. Vehicle Op. & Maintain.		6	12	12	12	12	54	0.5	3.0	6.0	6.0	6.0	6.0	27.0
6. Drivers		6	12	12	12	12	54	0.4	2.4	4.8	4.8	4.8	4.8	21.6
Total Recurrent costs									14.9	35.8	35.8	35.8	35.8	158.1
TOTAL									122.6	155.8	149.8	149.8	155.8	733.8

* P/M : person/month

**Table 4.3.3. Lab Equipment Needed to Strengthen CIAZA
(IN US\$)**

ITEM	UNIT	QUANTITY	UNIT COST	TOTAL COST
EQUIPMENT				
ZOOM STEREOMICROSCOPE WITH TRINOCULAR	Unit	1.00	1995.00	1,995.00
BASIC MICROSCOPE	Unit	1.00	1735.00	1,735.00
MICROSCOPE CAMERA	Unit	1.00	326.00	326.00
TISSUE CULTURE ENCLOSURE	Unit	1.00	2800.00	2,800.00
LAMINAL FLOW HOOD CABINET BENCH TOP	Unit	1.00	687.00	687.00
REFRIGERATOR, 6.7 CUBIC FEET	Unit	1.00	1560.00	1,560.00
LAB OVEN, 294 X 20 1/2 W X 16" D	Unit	1.00	673.00	673.00
NICHOLAS ILLUMINATOR	Unit	1.00	192.00	192.00
AUTOCLAVE	Unit	1.00	495.00	495.00
TUTTNAUER STERILIZER/AUTOCLAVE	Unit	1.00	5075.00	5,075.00
CENTRIFUGES	Unit	1.00	439.00	439.00
MICROCENTRIFUGE	Unit	1.00	1985.00	1,985.00
DISSECTION EQUIPMENT	Set	1.00	450.00	450.00
INSECT MOUNTING EQUIPMENT	Set	1.00	650.00	650.00
COLONY COUNTER	Unit	1.00	1900.00	1,900.00
MAGNIFIER WITH GOOSENECK BASE	Unit	2.00	37.78	75.56
HYGROTHERMOGRAPH	Unit	1.00	99.75	99.75
MULLICELL CULTURE PLATES	Pkg.	48.00	25.75	1,236.00
HOT PLATES	Unit	2.00	601.00	1,202.00
STIR PLATE	Unit	2.00	298.00	596.00
BURNERS & ACCESSORIES	Unit	12.00	11.50	138.00
NETS	Unit	10.00	33.75	337.50
GLASSWARE				
GRADUATED ERLIENMEYER	Pkg.	42.00	20.50	861.00
CENTRIFUGE TUBES	Pkg.	30.00	70.00	2,100.00
PETRI DISHES	Pkg.	80.00	17.40	1,392.00
CHARGER FOR KILLING JAR	Unit	3.00	12.95	38.85
SNAP CAP VIALS	Unit	8.00	1100.00	8,800.00
GLASS CHAMBER SLIDES, STERILE	Box	10.00	237.75	2,377.50
PLASTIC CHAMBER SLIDES, STERILE	Box	8.00	271.10	2,168.80
MICROSCOPE SLIDES	Pkg.	6.00	99.20	595.20
GLASS COVER SLIPS	Box	10.00	2.34	23.40
GRADUATED, MOHR-TYPE PYREX PIPET	Pkg.	46.00	36.10	1,666.60
PIPETS	Pkg.	10.00	45.00	450.00
BEAKERS	Unit	6.00	66.75	400.50
GLASS JAR	Pkg.	30.00	17.30	519.00
FLASKS	Pkg.	12.00	32.50	390.00
FURNITURE				
CABINETS	Unit	5.00	548.00	2,740.00
STORAGE DRAWER FOR CORNELL CABINET	Unit	1.00	54.95	54.95
LABORATORY TABLES	Unit	3.00	1088.30	3,264.90
CARDBOARD GLASS-TOPPED EXHIBITION CASE	Case	1.00	62.45	62.45
RIKER MOUNTS	Unit	8.00	6.20	49.60
SUPPLY				
GLAZED PAPER ENVELOPES	Pkg.	6.00	5.65	33.90
POLYETHYLENE BAGS	Pkg.	12.00	8.50	102.00
BOTTLES	Unit	48.00	6.25	300.00
JAR CAPS	Unit	45.00	8.10	364.50
BRUSHES	Unit	18.00	17.75	319.50
BURETS	Unit	3.00	125.00	375.00
FILTERS	Box	24.00	8.45	202.80
TOTAL LAB EQUIPMENT AND SUPPLIES				54,293.26

Table 4.3.4. Strengthening CIAZA Center

Detailed Costs

	Unit	Quantity					Unit Cost (US\$000)	Base Cost					Total	
		year						year						
		1	2	3	4	5		Total	1	2	3	4		5
I. Investment Costs														
A. Trust Fund	L.S.							1,500.0	1,500.0	1,000.0	500.0	500.0		5,000.0
B. Equipment														
1. Lab Equipment ¹	No.							55.0						55.0
2. Computers	No.	6				6	2.5	15.0	-	-	-	-	-	15.0
3. Printers	No.	5				5	1.2	6.0	-	-	-	-	-	6.0
4. Fax Machine	No.	1				1	0.5	0.5	-	-	-	-	-	0.5
5. Photocopier	No.	1				1	3	3.0	-	-	-	-	-	3.0
6. Overhead Projector	No.	1				1	1.5	1.5	-	-	-	-	-	1.5
7. Tractor	No.	2				2	42	84.0	-	-	-	-	-	84.0
8. Plowing	No.	1				1	6	6.0	-	-	-	-	-	6.0
9. Planting machine	No.	1				1	5.4	5.4	-	-	-	-	-	5.4
10. Agricultural Infrastructure	L.S.							80.0	-	-	-	-	-	80.0
Subtotal								256.4	-	-	-	-	-	256.4
B. Training														
1. Local Master Program	No.	2	2	2		6	3.57	7.1	7.1	7.1	-	-	-	21.4
2. Short courses	No.	4	4	4	4	4	20	5.68	22.7	22.7	22.7	22.7	22.7	113.6
3. Workshops	No.	4	4	4	4	4	20	2.37	9.5	9.5	9.5	9.5	9.5	47.4
4. Seminars	No.	6	6	6	6	6	30	0.71	4.3	4.3	4.3	4.3	4.3	21.3
5. Conference	No.	12	12	12	12	12	60	0.29	3.5	3.5	3.5	3.5	3.5	17.4
Field Trip	No.	3	3	3	3	3	15	0.61	1.8	1.8	1.8	1.8	1.8	9.2
Subtotal								48.9	48.9	48.9	41.8	41.8		230.3
D. Vehicles	No.													
1. Vehicle (4WD)	No.	3				3	20	60.0	-	-	-	-	-	60.0
2. Motorcycle	No.	3				3	7	21.0	-	-	-	-	-	21.0
Subtotal								81.0	-	-	-	-	-	81.0
E. Salaries														
Secretaries	P/M	6	12	12	12	12	54	0.5	3.0	6.0	6.0	6.0	6.0	27.0
Manager	P/M	6	12	12	12	12	54	3.2	19.2	38.4	38.4	38.4	38.4	172.8
Researchers	P/M	36	72	72	72	72	324	2.5	90.0	180.0	180.0	180.0	180.0	810.0
External Evaluation	year								-	10.0	-	-	10.0	20.0
Subtotal								112.2	234.4	224.4	224.4	234.4		1,029.8
Total Investment Costs								498.5	283.3	273.3	266.2	276.2		1,597.5
II. Recurrent Costs														
A. Operation and Maintenance														
1. Local travel costs	L.S.							3.0	6.0	6.0	6.0	6.0		27.0
2. Supplies	Month	6	12	12	12	12	54	0.25	1.5	3.0	3.0	3.0	3.0	13.5
3. Reserch Materials	Month	6	12	12	12	12	54	2.85	17.1	34.2	34.2	34.2	34.2	153.9
4. Office rent	Month								-	-	-	-	-	-
5. Subscriptions & Publications	L.S.							5.0	3.0	3.0	3.0	3.0		17.0
Total Recurrent costs								21.6	43.2	43.2	43.2	43.2		211.4
TOTAL								520.1	326.5	316.5	309.4	319.4		1,808.9

* P/M : person/month

Note:

¹ See table 4.3.3 for details

Table 4.3.5. Training Component for Extension Workers

Detailed Costs

Training Activity	Unit	Quantity					Total	Unit Cost (US\$000)	Base Cost					Total
		year							year					
		1	2	3	4	5			1	2	3	4	5	
1. Short Course	No.	12	12	12	12	12	60	5.68	68.19	68.19	68.19	68.19	68.19	340.96
2. Workshops	No.	12	12	12	12	12	60	2.37	28.39	28.39	28.39	28.39	28.39	141.95
3. Seminars	No.	6	6	6	6	6	30	0.71	4.28	4.28	4.28	4.28	4.28	21.40
4. Conference	No.	12	12	12	12	12	60	0.29	3.42	3.42	3.42	3.42	3.42	17.12
5. Field Trips	No.	4	4	4	4	4	20	0.61	2.45	2.45	2.45	2.45	2.45	12.27
TOTAL									106.74	106.74	106.74	106.74	106.74	533.69

Table 4.3.6 Training Center: List of Equipments (in US\$)

Item	Quantity	Unitary Cost	Total Cost
- Computer	10	2,500	25,000
- UPS	10	300	3,000
- Fax	1	500	500
- Printer	4	1,200	4,800
- Overhead Projector	2	1,500	3,000
- Data Show	1	5,400	5,400
- Scanner	2	1,400	2,800
- Photocopier	1	3,000	3,000
- Typewriter	1	700	700
- File Cabinet	10	200	2,000
- Desk	12	190	2,280
- Desk Chairs	12	100	1,200
- Paper holder	2	30	60
- Portable Screen	2	225	450
- Camera	2	300	600
- Video Camera	1	1,700	1,700
- VHS	1	350	350
- Television Set	2	350	700
- Table	4	300	1,200
- Table Chair	48	110	5,280
- Book Case	3	200	600
- Binder	1	250	250
- Power Generator	2	6,000	12,000
Total Equipment			76,870

Table 4.3.7 Training for Extension Workers

Detailed Costs

	Unit	Quantity					Unit Cost (US\$000)	Base Cost					Total	
		year						year						
		1	2	3	4	5		1	2	3	4	5		
I. Investment Costs														
A. Fund	L.S.												-	
B. Equipment														
1. Training Equipment ¹	No.	1					76.87	76.87					76.87	
2. Infrastructure	L.S.							80.00	-	-	-	-	80.00	
Subtotal								156.87	-	-	-	-	156.87	
B. Training														
1. Short courses	No.	12	12	12	12	12	60	5.68	68.16	68.16	68.16	68.16	68.16	340.80
2. Workshops	No.	12	12	12	12	12	60	2.37	28.44	28.44	28.44	28.44	28.44	142.20
3. Seminars	No.	6	6	6	6	6	30	0.71	4.26	4.26	4.26	4.26	4.26	21.30
4. Conference	No.	12	12	12	12	12	60	0.29	3.48	3.48	3.48	3.48	3.48	17.40
5. Field Trip	No.	4	4	4	4	4	20	0.61	2.44	2.44	2.44	2.44	2.44	12.20
Subtotal									106.78	106.78	106.78	106.78	106.78	533.90
C. Vehicles	No.													
1. Vehicle (4WD)	No.	3					3	20	60.00	-	-	-	-	60.00
2. Motorcycle	No.	3					3	7	21.00	-	-	-	-	21.00
Subtotal									81.00	-	-	-	-	81.00
D. Salaries														
Secretaries	P/M	6	12	12	12	12	54	0.5	3.00	6.00	6.00	6.00	6.00	27.00
Manager	P/M	6	12	12	12	12	54	3.2	19.20	38.40	38.40	38.40	38.40	172.80
Trainers	P/M	24	48	48	48	48	216	2.5	60.00	120.00	120.00	120.00	120.00	540.00
External Evaluation	year								-	10.00	-	-	10.00	20.00
Subtotal									82.20	174.40	164.40	164.40	174.40	759.80
Total Investment Costs									426.85	281.18	271.18	271.18	281.18	1,531.57
II. Recurrent Costs														
A. Operation and Maintenance														
1. Local travel costs	L.S.								3.00	6.00	6.00	6.00	6.00	27.00
2. Supplies	Month	6	12	12	12	12	54	0.25	1.50	3.00	3.00	3.00	3.00	13.50
3. Training Materials		6	12	12	12	12	54	1	6.00	12.00	12.00	12.00	12.00	54.00
4. Office rent	Month								-	-	-	-	-	-
5. Subscriptions & Publications	L.S.								3.00	3.00	3.00	3.00	3.00	15.00
Total Recurrent costs									10.50	21.00	21.00	21.00	21.00	109.50
TOTAL									437.35	302.18	292.18	292.18	302.18	1,641.07

* P/M : person/month

Notes:

¹ See table 4.3.6 for details

Table 4.3.8 Estimates of Certified Seeds and Seedlings Multiplication Requirement

Crop	Planting Area With Project (ha)	Unit Requirement Seeds or Seedlings (kg/ha)	Total Seeds Requirement (tons)	Availability of Good Seeds Without Project (tons/year)	Seeds to be Produced By the Project (tons/year)	Required Area For Seeds production (ha)
I. In Azua Zone						
Plantain	4,968	1,600 seedlings	1,589,760	683,597	906,163	(tissue culture)
Banana	586	2,000 seedlings	187,520	80,634	106,886	(tissue culture)
Corn	908	40	36	16	20	10
Sorghum	883	20	18	10	8	2
Pigeonpea	268	20	5	0	5	2
Bean	1,329	125	166	80	86	72
II. In San Juan						
Red Bean	14,517	125	1,815	907	907	756
Rice	7,973	160	1,276	319	957	266
Pigeonpea	462	15	7	1	6	2.5
Corn	2,244	40	90	40	50	24
Sorghum	1,742	20	35	20	15	4
III. Yaque del Sur & Lago Enriquillo						
Plantain	10,000	1,600 seedlings	3,200,000	1,376,000	1,824,000	(tissue culture)
Banana	1,440	2,000 seedlings	460,800	198,144	262,656	(tissue culture)
Corn	1,381	40	55	20	35	17
Sorghum	1,356	20	27	10	17	5
Pigeonpea	31	20	1	0	1	0.5

Table 4.3.9 Infrastructure, Machinery and Equipment Requirement for Seeds and Seedlings Production Plan

I. Requirement for Seeds and Seedlings Production in CIAZA		
	Unit	Quantity
(i) Constructions		
Construction of Storage building (capacity for 130 tons of seeds)	m2	210
Construction of Drying Floor	m2	500
Construction of building for Tissue culture	m2	450
(ii) Machinery and Equipment		
Tractor	45 HP	1
Plowing Attachment	Plow	1
Plowing Attachment	Harrow	1
Seeds Planter		1
Harvester		1
Corn Sheller		1
Seeds Classifier		1
Seed Packaging		1
Weight scale		1
Pesticide Sprayer		2
Power Generator		2
Air Temperature and Humidity control		1
Light Truck		1
(iii) Equipment for Tissue culture Lab		
Low Temperature incubator		2
Tissue culture enclosure		2
Refrigerators	6.7 CF	4
Air conditioner	50 Btu	5
Oven		4
Autoclave		2
Sterilizer		2
Culture Plates		100
Forceps for Dissection		10
Media Bottles		200
Beakers		100
II. Requirement for Seeds Production by San Juan Farmers Association		
(i) Constructions		
Construction of Storage buildings (capacity of about 1900 tons of seeds)	m2	3,000
Construction of Drying Floor	m2	5,000
(ii) Machinery and Equipment		
Tractor	90 HP	4
Plowing Attachment	Plow	4
Plowing Attachment	Harrow	4
Seeds Planter		4
Harvester		4
Corn Sheller		1
Seeds Classifier		4
Seed Packaging		4
Weight scale		4
Pesticide Sprayer		10
Power Generator		4
Air Temperature and Humidity control		4
Truck		4

Table 4.3.10. Strengthening Agricultural Cooperatives

Detailed Costs

	Unit	Quantity					Unit Cost (US\$000)	Base Cost					Total	
		year						year						
		1	2	3	4	5		1	2	3	4	5		
I. Investment Costs														
A. Line of Credit														
1. Computers	No.	5					5	2.8	14.00	-	-	-	-	14.00
2. Printers	No.	2					2	1.2	2.40	-	-	-	-	2.40
3. Fax Machine	No.	1					1	0.5	0.50	-	-	-	-	0.50
4. Photocopier	No.	1					1	3	3.00	-	-	-	-	3.00
5. Overhead Projector	No.	#					-	1.5	-	-	-	-	-	-
Subtotal									19.90	-	-	-	-	19.90
B. Technical Assistance														
1. Organization & Management	P/M	6	12	12	12			3	18.00	36.00	36.00	36.00	-	126.00
2. Market	P/M	6	12	12	12			3	18.00	36.00	36.00	36.00	-	126.00
3. Crop production/post harvest	P/M	6	12	12	12			3	18.00	36.00	36.00	36.00	-	126.00
Subtotal									54.00	108.00	108.00	108.00	-	378.00
C. Training														
1. Short Courses	No.	10	10	10	10	10		5.68	56.80	56.80	56.80	56.80	56.80	284.00
2. Field Trips	No.	6	6	6	6	6		0.61	3.66	3.66	3.66	3.66	3.66	18.30
Subtotal									60.46	60.46	60.46	60.46	60.46	302.30
D. Vehicles														
1. Vehicle (4WD)	No.	2					2	20	40.00	-	-	-	-	40.00
2. Vehicle (2WD)	No.	4					4	10.7	42.80	-	-	-	-	42.80
Subtotal									82.80	-	-	-	-	82.80
E. Salaries														
Secretaries	P/M	6	12	12	12	12	54	0.5	3.00	6.00	6.00	6.00	6.00	27.00
Manager	P/M	6	12	12	12	12	54	3.5	21.00	42.00	42.00	42.00	42.00	189.00
Market technicians	P/M	24	48	48	48	48	216	1.5	36.00	72.00	72.00	72.00	72.00	324.00
External Evaluation	year								-	10.00	-	-	10.00	20.00
Subtotal									60.00	130.00	120.00	120.00	130.00	560.00
Total Investment Costs									277.16	298.46	288.46	288.46	190.46	1,343.00
II. Recurrent Costs														
A. Operation and Maintenance														
1. Local travel costs	L.S.								3.00	6.00	6.00	6.00	6.00	27.00
2. Supplies	Month	6	12	12	12	12	54	0.25	1.50	3.00	3.00	3.00	3.00	13.50
3. Office rent	Month	6	12	12	12	12	54	0.5	3.00	6.00	6.00	6.00	6.00	27.00
5. Subscriptions & Publications	L.S.								-	-	-	-	-	-
Total Recurrent costs									7.50	15.00	15.00	15.00	15.00	67.50
TOTAL									284.66	313.46	303.46	303.46	205.46	1,410.50

* P/M : persn/month

Table 4.3.11. Market Information Systems

Detailed Costs

	Unit	Quantity					Unit Cost (US\$000)	Base Cost					Total	
		year						year						
		1	2	3	4	5		1	2	3	4	5		
I. Investment Costs														
A. Equipment														
1. Computers	No.	6					6	2.8	16.8	-	-	-	-	16.8
2. Printers	No.	5					5	1.2	6.0	-	-	-	-	6.0
3. Fax Machine	No.	5					5	0.5	2.5	-	-	-	-	2.5
4. Photocopier	No.	5					5	3	15.0	-	-	-	-	15.0
5. Scanner	No.	1					1	1.4	1.0	-	-	-	-	1.0
6. Overhead Projector	No.	1					1	1.5	1.5	-	-	-	-	1.5
7. Data Show	No.	1					1	5.4	5.4	-	-	-	-	5.4
Subtotal									48.2	-	-	-	-	48.2
C. Vehicles														
1. Vehicle (4WD)	No.	1					1	20	20.0	-	-	-	-	20.0
2. Motorcycle	No.	4					4	7	28.0	-	-	-	-	28.0
Subtotal									48.0	-	-	-	-	48.0
D. Salaries														
Secretaries	P/M	6	12	12	12	12	54	0.5	3.0	6.0	6.0	6.0	6.0	27.0
Manager	P/M	6	12	12	12	12	54	1.5	9.0	18.0	18.0	18.0	18.0	81.0
System Operators	P/M	30	60	60	60	60	270	0.4	12.0	24.0	24.0	24.0	24.0	108.0
External Evaluation	year								-	6.0	-	-	6.0	12.0
Subtotal									24.0	54.0	48.0	48.0	54.0	228.0
Total Investment Costs									120.2	54.0	48.0	48.0	54.0	324.2
II. Recurrent Costs														
A. Operation and Maintenance														
1. Local travel costs	L.S.								3.0	6.0	6.0	6.0	6.0	27.0
2. Supplies	Month	6	12	12	12	12	54	2	12.0	24.0	24.0	24.0	24.0	108.0
3. Office rent	Month								-	-	-	-	-	-
4. Training	L.S.								30.0	5.0	5.0	5.0	5.0	50.0
5. Subscriptions & Publications	L.S.								10.0	8.0	8.0	8.0	8.0	42.0
Total Recurrent costs									45.0	35.0	35.0	35.0	35.0	227.0
TOTAL									165.2	89.0	83.0	83.0	89.0	551.2

* P/M : person/month

Table 4.4.1 Simulated Water Level of Sabaneta Dam under Proposed Conditions

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1981	640.67	639.39	629.61	625.64	629.99	634.93	643.00	640.67	638.33	636.00	636.00	638.33
1982	640.67	642.15	634.55	632.80	637.09	642.66	643.00	640.67	638.33	636.00	636.00	638.33
1983	640.67	637.54	625.32	618.90	623.71	628.74	633.90	627.69	627.94	631.20	636.00	638.33
1984	640.67	637.47	626.17	619.95	624.85	629.62	631.64	639.00	637.09	635.55	636.00	638.33
1985	640.67	637.54	624.73	616.55	622.18	627.80	630.47	621.90	612.43	611.68	619.60	631.69
1986	640.67	638.53	627.00	620.29	624.93	632.45	639.76	639.26	637.05	636.00	636.00	638.33
1987	640.67	638.18	625.76	617.78	622.20	627.50	631.46	636.00	636.53	636.00	636.00	638.33
1988	640.67	638.85	626.22	615.64	619.50	623.73	623.44	609.00	619.87	620.62	636.00	638.33
1989	640.67	638.34	625.83	615.94	620.77	625.58	629.19	621.83	619.50	632.66	636.00	638.33
1990	640.67	637.12	622.79	609.55	613.31	619.92	615.22	609.00	609.00	620.87	636.00	638.33
1991	640.67	638.53	625.23	613.32	616.39	621.37	628.28	622.28	616.11	617.85	628.79	636.57
1992	640.10	634.30	615.15	609.00	615.13	624.27	639.46	640.67	638.33	636.00	636.00	638.33
1993	640.67	637.89	625.73	616.18	620.37	628.13	639.19	640.67	637.28	636.00	636.00	638.33
1994	640.67	636.33	621.16	609.00	614.85	623.20	632.42	622.21	609.00	609.00	621.50	638.33
Average	640.63	638.01	625.38	617.18	621.81	627.85	632.89	629.35	626.91	628.24	633.30	637.73
Drought of 1 in 5 year	640.67	637.12	622.79	609.55	615.13	623.20	628.28	621.83	612.43	617.85	628.79	638.33
Maximum Operation Level	640.67	643.00	643.00	643.00	643.00	643.00	643.00	640.67	638.33	636.00	636.00	638.33

Note :  Flood periods
 Transition periods
 Normal periods

Table 4.4.2 Simulated Water Level of Sabana Yegua Dam under Proposed Conditions

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1981	384.55	383.52	382.28	380.44	378.82	389.43	392.93	389.47	386.00	386.00	389.47	
1982	392.93	394.56	394.05	393.30	391.75	390.63	395.41	392.93	389.47	386.00	386.00	388.26
1983	388.43	386.61	383.44	380.00	376.05	371.82	373.83	373.69	369.48	371.54	376.10	382.29
1984	383.58	381.34	378.33	374.60	369.46	363.53	362.57	371.94	368.07	363.35	373.92	380.90
1985	381.45	379.36	374.79	369.32	360.84	358.00	368.18	363.02	358.00	358.00	359.68	373.55
1986	382.20	382.34	380.54	378.15	375.53	374.94	380.68	385.36	383.71	385.02	384.83	388.65
1987	390.15	388.35	385.39	382.19	378.56	375.62	381.33	385.39	383.96	383.56	386.00	389.47
1988	392.93	394.80	393.23	391.42	389.95	388.26	388.69	389.03	389.47	386.00	386.00	389.47
1989	391.66	390.35	388.17	386.08	384.72	384.86	387.02	386.79	383.33	386.00	386.00	389.47
1990	390.73	389.91	387.77	385.36	382.71	378.91	374.39	368.45	358.00	358.00	372.91	388.18
1991	392.93	392.78	390.38	386.83	382.60	379.06	382.16	381.61	375.44	374.22	377.51	382.49
1992	382.28	376.96	369.84	359.14	358.00	363.97	385.08	390.78	388.41	386.00	386.00	389.47
1993	392.28	391.79	390.38	388.61	386.13	385.54	396.40	392.93	389.47	386.00	386.00	388.50
1994	388.63	386.00	381.92	378.43	372.43	368.37	378.70	376.31	366.75	358.00	368.35	377.78
Average	388.43	387.12	384.41	381.13	377.80	375.83	381.70	382.23	378.07	376.26	379.66	385.57
Drought of 1 in 5 year	382.28	381.34	378.33	374.60	369.46	363.97	373.83	371.94	366.75	358.00	372.91	380.90
Maximum Operation Level	392.93	396.40	396.40	396.40	396.40	396.40	396.40	392.93	389.47	386.00	386.00	389.47

Note :  Flood periods
 Transition periods
 Normal periods

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (1/19)
in the J. J. Puello Irrigation Area**

10,956 ha

Crop	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
ETo (mm/day)	4.1	4.8	5.4	5.7	5.6	5.9	5.9	5.8	5.1	4.5	4.2	3.8
Beans												
Planting area (ha)	1,579	4,343	4,738	3,158	395							
kc	0.50	0.80	1.10	0.40								
Average kc	0.50	0.65	0.95	0.75	0.40							
CU (mm/day)	2.0	3.1	5.2	4.3	2.2							
CU (mm/month)	61.3	95.8	160.0	119.1	69.6							
Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8							
Net Requirement (MCM)	0.40	3.73	7.04	3.43	0.19							
Rice 1												
Planting area (ha)	105						105	841	1,576	1,681	1,576	841
kc							1.10	1.15	1.20	1.25	1.00	
Average kc	1.00						1.10	1.13	1.15	1.20	1.15	1.00
CU (mm/day)	4.1						6.5	6.5	5.9	5.4	4.8	4.3
CU (mm/month)	122.6						202.9	195.1	182.9	168.8	143.8	133.11
Percolation (mm/month)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
Effective rainfall (mm)	35.2						90.9	52.6	65.9	80.0	94.8	84.5
Land Preparation, 300 mm (MCM)							2.36	2.36				
Net Requirement (MCM)	0.25						2.64	4.82	4.29	4.10	3.14	1.71
Sweet Potato 1												
Planting area			41	123	206	247	206	123	41			
kc			0.45	0.75	1.10	0.75						
Average kc			0.45	0.60	0.77	0.76						
CU (mm/day)			2.44	3.40	4.30	4.51						
CU (mm/month)			75.77	95.25	133.45	135.36						
Effective rainfall (mm)			11	10	22	45						
Net Requirement (MCM)			0.03	0.10	0.22	0.45						
Sweet Potato 2												
Planting area (ha)	850	283						283	850	1,416	1,699	1,416
kc								0.45	0.75	1.10	0.75	
Average kc								0.45	0.75	1.10	0.75	
CU (mm/day)								0.45	0.60	0.77	0.76	
CU (mm/month)								2.60	3.08	3.43	3.18	
Effective rainfall (mm)								78.0	95.4	107.8	95.4	
Net Requirement (MCM)								0.07	0.25	0.39	0.01	
Corn & Sorghum												
Planting area (ha)							164	491	818	932	818	491
kc							0.50	0.80	1.10	0.60		
Average kc							0.50	0.65	0.80	0.75	0.83	0.85
CU (mm/day)							2.96	3.87	4.62	3.85	3.78	3.54
CU (mm/month)							88.8	119.9	138.7	119.3	117.2	106.3
Effective rainfall (mm)							45	91	53	66	80	95
Net Requirement (MCM)							0.07	0.14	0.20	0.52	0.30	0.06
Plantain (ha)	45	45	45	45	45	45	45	45	45	45	45	45
Banana	120	120	120	120	120	120	120	120	120	120	120	120
Papaya	120	120	120	120	120	120	120	120	120	120	120	120
Planting area	295	295	295	295	295	295	295	295	295	295	295	295
kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
CU (mm/day)	3.5	4.1	4.6	4.8	4.8	5.0	5.1	4.9	4.4	3.9	3.5	3.2
CU (mm/month)	104.2	126.5	143.1	134.9	148.0	150.9	156.8	147.4	135.2	119.5	106.3	100.6
Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5
Net Requirement (MCM)	0.20	0.34	0.39	0.37	0.37	0.31	0.19	0.28	0.20	0.12	0.03	0.03
Pasture, Cassava, Pigeon pea, Vegetables, and Others												
Planting area (ha)	755	804	734	496	376	434	836	1,080	1,080	1,080	1,043	880
Average kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
CU (mm/day)	3.27	3.84	4.35	4.54	4.49	4.73	4.76	4.62	4.10	3.63	3.33	3.05
CU (mm/month)	98.1	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	112.5	100.0	94.7
Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5
Net Requirement (MCM)	0.47	0.87	0.91	0.58	0.44	0.47	0.47	0.93	0.66	0.35	0.06	0.09
Total Net Requirements (MCM)	1.72	5.22	8.76	4.48	1.23	1.07	0.95	2.12	1.66	1.71	0.16	0.39
Total Net Requirement for Paddy (MCM)	0.25	0.00	0.00	0.00	0.00	0.00	2.64	4.82	4.29	4.10	3.14	1.71
Overseer Requirement (MCM)	4.37	11.87	19.01	10.18	2.80	2.43	7.06	13.75	11.72	10.24	6.15	4.06

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (2/19)
in the San Juan Irrigation Area including Extension Area**

8,526 ha

Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug.	Sep.	Oct.
	ETo (mm/day)	4.4	4.8	5.4	5.7	5.6	5.9	5.9	5.8	5.1	4.5	4.2	3.8
Beans	Planting area (ha)	1,623	4,454	4,170	3,247	312							
	kc	0.50	0.80	1.10	0.40								
	Average kc	0.50	0.65	0.95	0.75	0.40							
	CU (mm/day)	2.0	3.1	5.2	4.3	2.2							
	CU (mm/month)	61.3	96.8	160.0	119.1	69.6							
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8							
	Net Requirement (MCM)	0.41	3.83	7.24	3.53	0.18							
Rice1	Planting area (ha)	138					138	1108	2077	2215	2077	1108	
	kc						1.10	1.15	1.20	1.25	1.00		
	Average kc	1.00					1.10	1.13	1.15	1.20	1.15	1.13	
	CU (mm/day)	4.1					6.5	6.5	5.9	5.4	4.8	4.3	
	CU (mm/month)	122.6					202.9	195.1	182.9	168.8	143.8	133.11	
	Percolation (mm/month)	150.0					155.0	150.0	155.0	155.0	150.0	155.0	
	Effective rainfall (mm)	36.2					90.9	52.6	65.9	80.0	94.8	84.5	
	Land Preparation, 300 mm (MCM)						3.11	3.11					
	Net Requirement (MCM)	0.33					3.48	6.35	5.65	5.40	4.13	2.26	
	Rice2	Planting area (ha)	8	60	90	90	83	30					
kc		1.10	1.15	1.20	1.25	1.00							
Average kc		1.10	1.13	1.18	1.23	1.13	1.00						
CU (mm/day)		4.5	5.4	6.4	6.9	6.3	5.9						
CU (mm/month)		134.8	167.5	197.8	194.5	195.8	177.5						
Percolation (mm/month)		150.0	155.0	155.0	140.0	155.0	150.0						
Effective rainfall (mm)		36.2	10.9	11.3	10.5	21.8	45.5						
Land Preparation, 300 mm (MCM)		0.14	0.14										
Net Requirement (MCM)		0.15	0.32	0.31	0.29	0.27	0.08						
Sweet Potato 1		Planting area	100	299	398	398	299	100					
	kc	0.45	0.75	1.10	0.75	0.75	0.75						
	Average kc	0.45	0.60	0.77	0.87	0.93	0.75						
	CU (mm/day)	1.8	2.9	4.2	4.9	5.2	4.4						
	CU (mm/month)	55.2	89.3	129.1	137.6	161.0	133.1						
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5						
	Net Requirement (MCM)	0.02	0.23	0.47	0.51	0.42	0.09						
Sweet Potato 2	Planting area (ha)	161						161	484	806	967	806	484
	kc							0.45	0.75	1.10	0.75	0.75	
	Average kc	0.75						0.45	0.60	0.77	0.76	0.87	0.93
	CU (mm/day)	3.1						2.7	3.5	3.9	3.5	3.6	3.5
	CU (mm/month)	91.9						83.0	104.1	121.9	107.2	108.4	109.4
	Effective rainfall (mm)	36.2						90.9	52.6	65.9	80.0	94.8	84.5
	Net Requirement (MCM)	0.09						0.10	0.25	0.45	0.26	0.11	0.12
Corn & Sorghum	Planting area (ha)	303						303	908	1,513	1,815	1,513	908
	kc							0.50	0.80	1.10	0.60	0.60	
	Average kc	0.60						0.50	0.65	0.80	0.75	0.83	0.85
	CU (mm/day)	2.45						2.97	3.76	4.10	3.40	3.47	3.24
	CU (mm/month)	73.5						91.2	112.7	127.2	105.5	104.2	100.6
	Effective rainfall (mm)	36.2						91	53	66	80	95	84
	Net Requirement (MCM)	0.11						0.10	0.55	0.93	0.45	0.13	0.15
Plantain	Planting area (ha)	297	297	297	297	297	297	297	297	297	297	297	297
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3.5	4.1	4.6	4.8	4.8	5.0	5.1	4.9	4.4	3.9	3.5	3.2
	CU (mm/month)	104.2	126.5	143.1	134.9	148.0	150.9	156.8	147.4	135.2	119.5	106.3	100.6
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5
	Net Requirement (MCM)	0.20	0.34	0.39	0.37	0.37	0.31	0.20	0.28	0.21	0.12	0.05	0.05
	Pasture, Cassava, Pigeon pea, Vegetables, and Others	Planting area (ha)	323	323	304	266	247	266	304	323	323	323	323
Average kc		0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
CU (mm/day)		3.3	3.8	4.3	4.5	4.5	4.7	4.8	4.6	4.1	3.6	3.3	3.1
CU (mm/month)		98.4	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	112.5	100.0	94.7
Effective rainfall (mm)		36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5
Net Requirement (MCM)		0.20	0.35	0.37	0.31	0.29	0.26	0.17	0.28	0.20	0.11	0.02	0.03
Total Net Requirement (MCM)		1.03	4.76	8.48	4.71	1.26	0.66	0.37	1.35	1.78	0.95	0.50	0.33
Total Net Requirement for Paddy (MCM)	0.48	0.32	0.31	0.29	0.27	0.08	3.48	6.35	5.65	5.40	4.13	2.26	
Diversion Requirement (MCM)	3.02	10.68	18.56	10.52	3.14	1.54	6.80	13.84	13.53	11.33	7.77	4.63	

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (3/19)
in the Hato de Padre Irrigation Area

2,059 ha

Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	
	E To (mm/day)	4.1	4.8	5.4	5.7	5.6	5.9	5.9	5.8	5.1	4.5	4.2	3.8	
Beans	Planting area (ha)	365	1,004	1,095	730	91								
	Kc	0.50	0.80	1.10	0.40									
	Average Kc	0.50	0.50	0.80	1.10	0.40								
	CU (mm/day)	2.0	3.1	5.2	4.3	2.2								
	CU (mm/month)	61.3	96.8	160.0	119.1	69.6								
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8								
	Net Requirement (MCM)	0.09	0.86	1.63	0.79	0.04								
Rice1	Planting area (ha)	48						48	386	724	772	724	386	
	Kc							1.10	1.15	1.20	1.25	1.00		
	Average Kc							1.10	1.10	1.15	1.20	1.25	1.00	
	CU (mm/day)							6.5	6.5	5.9	5.4	4.8	4.3	
	CU (mm/month)							202.9	195.1	182.9	168.8	143.8	133.11	
	Percolation (mm/mo)							155.0	150.0	155.0	155.0	150.0	153.0	
	Effective rainfall (mm)							90.9	52.6	65.9	80.0	94.8	84.5	
	Land Preparation, 300 mm (MCM)							1.09	1.09					
	Net Requirement (MCM)	0.11						1.21	2.21	1.97	1.88	1.44	0.79	
	Rice2	Planting area (ha)		21	57	62	62	41	5					
		Kc		1.10	1.15	1.20	1.25	1.00						
Average Kc			1.10	1.13	1.18	1.23	1.13	1.00						
CU (mm/day)			5.3	6.1	6.7	6.9	6.7	5.9						
CU (mm/month)			163.7	189.4	186.5	213.2	199.7	184.4						
Percolation (mm/mo)			155.0	155.0	140.0	153.0	150.0	155.0						
Effective rainfall (mm)			10.9	11.3	10.5	21.8	45.5	90.9						
Land Preparation, 300 mm (MCM)			0.09	0.1	0.20	0.21	0.13	0.01						
Net Requirement (MCM)			0.16	0.28	0.20	0.21	0.13	0.01						
Sweet Potato 1		Planting area (ha)	40	28	85	114	114	85	28	90	226	246	156	136
		Kc		0.45	0.75	1.10	0.75	1.10	0.75					
	Average Kc		0.45	0.45	0.45	0.75	1.10	0.75						
	CU (mm/day)		2.2	3.3	4.3	4.9	5.5	4.5						
	CU (mm/month)		66.99	101.02	121.71	150.85	164.21	138.33						
	Effective rainfall (mm)		11	11	10	22	45	91						
	Net Requirement (MCM)		0.02	0.08	0.13	0.15	0.10	0.01						
	Sweet Potato 2	Planting area (ha)	52						52	156	259	311	259	156
		Kc							0.45	0.75	1.10	0.75		
		Average Kc							0.45	0.45	0.75	1.10	0.75	0.75
		CU (mm/day)							2.7	3.5	3.9	3.5	3.6	3.5
CU (mm/month)								83.0	104.1	121.9	107.2	108.4	109.4	
Effective rainfall (mm)								91	53	66	80	95	84	
Net Requirement (MCM)								0.00	0.08	0.15	0.08	0.04	0.04	
Corn & Sorghum		Planting area (ha)	12						12	35	58	70	58	35
		Kc							0.50	0.80	1.10	0.60		
		Average Kc							0.50	0.50	0.80	1.10	0.60	0.60
		CU (mm/day)							3.0	3.8	4.1	3.4	3.5	3.2
	CU (mm/month)							92.2	112.7	127.2	105.5	104.2	100.6	
	Effective rainfall (mm)							91	53	66	80	95	84	
	Net Requirement (MCM)							0.00	0.02	0.04	0.02	0.01	0.01	
	Plantain		13	13	13	13	13	13	13	13	13	13	13	13
		Planting area (ha)	5	5	5	5	5	5	5	5	5	5	5	5
		Kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
		CU (mm/day)	3.5	4.1	4.6	4.8	4.8	5.0	5.1	4.9	4.4	3.9	3.5	3.2
CU (mm/month)		104.2	126.5	143.1	134.9	148.0	150.9	156.8	147.4	135.2	119.5	106.3	100.6	
Effective rainfall (mm)		36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5	
Net Requirement (MCM)		0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.00	
Pasture, Cassava, Pigeon pea, Vegetables, and Others	Planting area (ha)	80	80	72	70	45	70	72	80	80	80	75	80	
	Average Kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
	CU (mm/day)	3.3	3.8	4.3	4.5	4.5	4.7	4.8	4.6	4.1	3.6	3.3	3.1	
	CU (mm/month)	98.1	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	113.5	100.0	94.7	
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5	
	Net Requirement (MCM)	0.05	0.09	0.09	0.08	0.06	0.07	0.04	0.07	0.05	0.03	0.00	0.01	
	Total Net Requirements (MCM)	0.19	0.98	1.82	1.02	0.27	0.19	0.07	0.19	0.24	0.14	0.16	0.06	
Total Net Requirement for Paddy (MCM)	0.11	0.16	0.26	0.20	0.21	0.13	1.23	2.21	1.97	1.88	1.44	0.79		
Division Requirement (MCM)	0.59	2.36	4.35	2.52	0.94	0.62	2.26	4.22	3.91	3.53	2.58	1.47		

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (4/19)
in the Guanito San Juan Area**

1,000 ha

Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	
	ET _o (mm/day)	4.1	4.8	5.4	5.7	5.6	5.9	5.9	5.8	5.1	4.5	4.2	3.8	
Beans	Planting area (ha)	312	857	935	624	78								
	kc	0.50	0.80	1.10	0.40									
	Average kc	0.50	0.65	0.95	0.75	0.40								
	CU (mm/day)	2.0	3.1	5.2	4.3	2.2								
	CU (mm/month)	61.3	95.8	160.0	119.1	69.6								
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8								
	Net Requirement (MCM)	0.08	0.74	1.39	0.68	0.04								
Rice 1	Planting area (ha)						123	368	613	736	613	368	123	
	kc						1.10	1.15	1.20	1.25	1.00			
	Average kc						1.10	1.13	1.15	1.20	1.15	1.13	1.00	
	CU (mm/day)						6.5	6.7	6.6	6.2	5.2	4.7	3.8	
	CU (mm/month)						195.3	207.5	199.4	190.9	161.7	140.7	118.32	
	Percolation (mm/month)						150	155	150	155	155	150	155	
	Effective rainfall (mm)						45.5	90.9	52.6	65.9	80.0	94.8	84.5	
	Land Preparation, 300 mm (MCM)						0.74	0.74	0.74					
	Net Requirement (MCM)						1.10	1.74	2.56	2.06	1.45	0.72	0.23	
Rice 2	Planting area (ha)	13	14	14	9	1							5	
	kc	3.15	1.20	1.25	1.00								1.10	
	Average kc	1.10	1.15	1.20	1.25	1.00								
	CU (mm/day)	4.6	5.6	6.7	6.4	5.6							4.2	
	CU (mm/month)	137.9	174.9	206.3	178.6	174.1							130.1	
	Percolation (mm/month)	150.0	155.0	155.0	140.0	155.0							155.0	
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8							84.5	
	Net Requirement (MCM)	0.05	0.04	0.05	0.03	0.00							0.02	
													0.03	
Sweet Potato	Planting area	23	23	33	38	46	46	40	40	40	56	61	58	
	Average kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
	CU (mm/day)	3.3	3.8	4.3	4.5	4.5	4.7	4.8	4.6	4.1	3.6	3.3	3.1	
	CU (mm/month)	98.1	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	112.5	100.0	94.7	
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5	
	Net Requirement (MCM)	0.01	0.02	0.04	0.04	0.05	0.04	0.02	0.03	0.02	0.02	0.00	0.01	
Corn & Sorghum	Planting area (ha)							49	147	195	195	147	49	
	kc							0.50	0.80	1.10	0.50	0.60	0.60	
	Average kc							0.50	0.65	0.80	0.83	0.85	0.60	
	CU (mm/day)							3.0	3.8	4.1	3.8	3.5	2.3	
	CU (mm/month)							92.2	112.7	127.2	117.2	106.3	71.0	
	Effective rainfall (mm)							90.9	52.6	65.9	80.0	94.8	84.5	
	Net Requirement (MCM)							0.00	0.09	0.12	0.07	0.02	0.00	
Others	Planting area (ha)	28	28	24	16	13	16	24	28	28	28	28	28	
	Average kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
	CU (mm/day)	3.3	3.8	4.3	4.5	4.5	4.7	4.8	4.6	4.1	3.6	3.3	3.1	
	CU (mm/month)	98.1	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	112.5	100.0	94.7	
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5	
	Net Requirement (MCM)	0.02	0.03	0.03	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.00	0.00	
Total Net Requirements (MCM)		0.16	0.79	1.46	0.74	0.11	0.06	0.04	0.15	0.16	0.10	0.02	0.01	
Total Net Requirement for Paddy (MCM)		0.09	0.04	0.05	0.03	0.00	1.10	1.74	2.56	2.06	1.45	0.72	0.26	
Diversion Requirement (MCM)		0.44	1.76	3.19	1.63	0.23	2.03	3.07	4.72	3.90	2.72	1.29	0.47	

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (5/19)
in the Mijo Irrigation Area

2,300 ha

Crop	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
ETo (mm/day)	4.1	4.8	5.4	5.7	5.6	5.9	5.9	5.8	5.1	4.5	4.2	3.8
Beans	Planting area (ha)	394	1,084	1,182	788	99						
	kc	0.50	0.80	1.10	0.80	0.40						
	Average kc	0.50	0.65	0.85	0.75	0.40						
	CU (mm/day)	2.0	3.1	5.2	4.3	2.2						
	CU (mm/month)	61.3	98.8	160.0	119.1	69.6						
	Effective rainfall (mm)	35.2	10.9	11.3	10.5	21.8						
	Net Requirement (MCM)	0.10	0.93	1.76	0.86	0.05						
Rice	Planting area (ha)	417	52					Max. area = 417	833	1250	1198	839
	kc						1.10	1.15	1.20	1.25	1.00	1.00
		1.00					1.10	1.10	1.15	1.20	1.25	1.25
	Average kc	1.25	1.00				1.10	1.13	1.15	1.18	1.15	1.15
	CU (mm/day)	1.43	1.00				6.5	6.5	5.9	5.3	4.8	4.4
	CU (mm/month)	4.6	4.8				202.9	195.1	182.9	165.3	143.8	136.1
	Percolation (mm/month)	137.9	148.9				155.0	150.0	155.0	150.0	150.0	155.0
	Effective rainfall (mm)	150.0	155.0				90.9	52.6	65.9	80.0	94.8	84.5
	Land Preparation, 300 mm (MCM)	36.2	10.9				1.20	1.20	1.20			
	Net Requirement (MCM)	1.05	0.15				1.34	2.42	3.46	2.88	2.38	1.72
Sweet Potato 1	Planting area (ha)	25	74	98	98	74	25					
	kc	0.45	0.75	1.10	0.75	0.75						
		0.45	0.75	1.10	0.75	1.10	0.75					
	Average kc	0.45	0.60	0.77	0.87	0.93	0.75					
	CU (mm/day)	1.84	2.88	4.16	4.91	5.19	4.44					
	CU (mm/month)	55.16	89.32	129.08	137.59	161.01	133.14					
	Effective rainfall (mm)	36	11	11	10	22	45					
	Net Requirement (MCM)	0.00	0.06	0.12	0.12	0.10	0.02					
Sweet Potato 2	Planting area (ha)					30	91	152	182	152	91	30
	kc					0.45	0.75	1.10	0.72			
						0.45	0.75	1.10	0.72			
	Average kc					0.45	0.60	0.77	0.75	1.10	0.72	0.72
	CU (mm/day)					2.7	3.6	4.4	3.9	3.9	3.8	2.7
	CU (mm/month)					79.9	110.7	133.0	120.1	120.5	113.8	85.2
	Effective rainfall (mm)					45	91	53	68	80	95	84
	Net Requirement (MCM)					0.01	0.02	0.12	0.10	0.06	0.02	0.00
Corn & Sorghum	Planting area (ha)				47	140	234	281	234	140	47	
	kc				0.50	0.80	1.10	0.60				
					0.50	0.80	1.10	0.60				
	Average kc				0.50	0.65	0.80	0.75	0.83	0.85	0.60	0.60
	CU (mm/day)				2.8	3.8	4.8	4.3	4.3	3.9	2.5	
	CU (mm/month)				87.0	115.4	147.6	130.1	132.5	119.5	75.0	
	Effective rainfall (mm)				21.8	45.5	90.9	52.6	65.9	80.0	94.8	
	Net Requirement (MCM)				0.03	0.10	0.13	0.22	0.16	0.06	0.00	
Plantain		0	0	0	0	0	0	0	0	0	0	0
Banana		30	30	30	30	30	30	30	30	30	30	30
Papaya		21	21	21	21	21	21	21	21	21	21	21
sub-total	Planting area (ha)	51	51	51	51	51	51	51	51	51	51	51
	Average kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3.47	4.08	4.62	4.82	4.77	5.03	5.06	4.91	4.36	3.66	3.24
	CU (mm/month)	104.19	126.53	143.12	134.94	147.95	150.90	156.78	147.42	135.20	119.55	100.57
	Effective rainfall (mm)	36.18	10.93	11.30	10.49	21.84	45.50	90.94	52.58	65.89	79.97	94.75
	Net Requirement (MCM)	0.03	0.05	0.06	0.06	0.06	0.05	0.03	0.04	0.03	0.02	0.00
Others	Planting area (ha)	449	449	416	349	316	349	416	449	449	449	449
	Average kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	CU (mm/day)	3.3	3.8	4.3	4.5	4.5	4.7	4.8	4.6	4.1	3.6	3.1
	CU (mm/month)	98.1	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	112.5	100.0
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8
	Net Requirement (MCM)	0.28	0.49	0.51	0.41	0.37	0.34	0.24	0.39	0.28	0.15	0.02
Total Net Requirements (MCM)		0.44	1.53	2.45	1.44	0.61	0.51	0.42	0.77	0.56	0.28	0.05
Total Net Requirement for Paddy (MCM)		1.05	0.15	0.00	0.00	0.00	0.00	1.34	2.42	3.46	2.88	2.38
Diversion Requirement (MCM)		2.68	3.51	5.20	3.07	1.29	1.09	3.19	5.80	7.17	5.56	3.08

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (6/19)
in the Other Small Irrigation Systems served by San Juan River

1,848 ha

Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	
	ETo (mm/day)	4.1	4.8	5.4	5.7	5.6	5.9	5.9	5.8	5.1	4.5	4.2	3.8	
Beans	Planting area (ha)	459	1,263	1,378	919	105								
	kc	0.50	0.80	1.10	0.90									
	Average kc	0.50	0.65	0.95	0.75	0.80								
	CU (mm/day)	2.0	3.1	5.2	4.3	2.2								
	CU (mm/month)	61.3	96.8	160.0	119.1	69.6								
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8								
	Net Requirement (MCM)	0.12	1.08	2.05	1.00	0.05								
Rice 1	Planting area (ha)	58					58	463	867	925	857	453		
	kc						1.10	1.15	1.20	1.25	1.00			
	Average kc	1.00					1.10	1.13	1.15	1.20	1.15	1.13		
	CU (mm/day)	4.1					6.5	6.5	5.9	5.4	4.8	4.3		
	CU (mm/month)	122.6					202.9	195.1	182.9	168.8	143.8	133.11		
	Percolation (mm/month)	150.0					155.0	150.0	155.0	155.0	150.0	155.0		
	Effective rainfall (mm)	36.2					90.9	52.6	65.9	80.0	94.8	84.5		
	Land Preparation, 300 mm (MCM)						1.30	1.30						
	Net Requirement (MCM)	0.14					1.46	2.65	2.36	2.26	1.73	0.91		
	Rice 2	Planting area (ha)		4	30	45	41	15						
kc			1.10	1.15	1.20	1.25	1.00							
Average kc		1.10	1.13	1.18	1.23	1.13	1.00							
CU (mm/day)		5.3	6.1	6.7	6.9	6.7	5.9							
CU (mm/month)		163.7	189.4	186.5	213.2	199.7	184.4							
Percolation (mm/month)		155.0	155.0	140.0	155.0	150.0	155.0							
Effective rainfall (mm)		10.9	11.3	10.5	21.8	45.5	90.9							
Land Preparation, 300 mm (MCM)			0.07	0.07										
Net Requirement (MCM)		0.08	0.17	0.14	0.16	0.13	0.04							
Sweet Potato 1		Planting area	19	56	93	112	93	56	19					
	kc	0.45	0.75	1.10	0.75									
	Average kc	0.45	0.60	0.77	0.76	0.87	0.93	0.75						
	CU (mm/day)	1.8	2.9	4.2	4.3	4.9	5.5	4.5						
	CU (mm/month)	55.2	89.3	129.1	121.1	150.9	164.2	138.3						
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9						
	Net Requirement (MCM)	0.00	0.04	0.11	0.12	0.12	0.07	0.01						
Sweet Potato 2	Planting area (ha)	42					42	127	211	253	211	127		
	kc						0.45	0.75	1.10	0.75				
	Average kc	0.38					0.45	0.60	0.77	0.76	0.87	0.925		
	CU (mm/day)	1.5					2.7	3.5	3.9	3.5	3.6	3.5		
	CU (mm/month)	46.0					83.0	104.1	121.9	107.2	108.4	109.4		
	Effective rainfall (mm)	36.2					90.9	52.6	65.9	80.0	94.8	84.5		
	Net Requirement (MCM)	0.00					0.00	0.07	0.12	0.07	0.05	0.03		
Corn & Sorghum	Planting area (ha)	68					68	205	341	410	341	205		
	kc						0.50	0.80	1.10	0.60				
	Average kc	0.60					0.50	0.65	0.80	0.75	0.83	0.85		
	CU (mm/day)	2.5					3.0	3.8	4.1	3.4	3.5	3.2		
	CU (mm/month)	73.5					92.2	112.7	127.2	105.5	104.2	100.6		
	Effective rainfall (mm)	36.2					90.9	52.6	65.9	80.0	94.8	84.5		
	Net Requirement (MCM)	0.03					0.00	0.12	0.21	0.10	0.03	0.03		
Plantain Banana Subtotal	Planting area (ha)	52	52	52	52	52	52	52	52	52	52	52	52	
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	
	CU (mm/day)	3.5	4.1	4.6	4.8	5.0	5.1	4.9	4.4	3.9	3.5	3.2		
	CU (mm/month)	104.2	126.5	143.1	134.9	143.0	150.9	156.8	147.4	135.2	119.5	106.3	100.6	
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5	
	Net Requirement (MCM)	0.04	0.07	0.08	0.08	0.08	0.06	0.04	0.04	0.04	0.03	0.03	0.01	
	Pasture, Cassava, Pigeon pea, Vegetables, and Others	Planting area (ha)	61	61	57	42	28	30	58	84	89	89	86	72
		Average kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
		CU (mm/day)	3.3	3.8	4.3	4.5	4.5	4.7	4.8	4.6	4.1	3.6	3.3	3.1
		CU (mm/month)	98.1	119.1	134.7	127.0	139.2	142.0	147.6	138.7	127.2	112.5	100.0	94.7
Effective rainfall (mm)		36.2	10.9	11.3	10.5	21.8	45.5	90.9	52.6	65.9	80.0	94.8	84.5	
Net Requirement (MCM)		0.04	0.07	0.07	0.05	0.03	0.03	0.03	0.07	0.05	0.03	0.03	0.01	
Total Net Requirement (MCM)		0.23	1.26	2.31	1.25	0.28	0.16	0.08	0.32	0.42	0.23	0.07	0.08	
Total Net Requirement for Paddy (MCM)	0.14	0.08	0.17	0.14	0.16	0.13	1.49	2.65	2.36	2.26	1.73	0.91		
Diversion Requirement (MCM)	0.72	2.83	5.20	2.90	0.86	0.56	2.75	5.25	4.97	4.37	3.13	1.80		

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (7/19)
in the Area of Vallejuelo Irrigation Systems

		495 ha											
Crop	ETo (mm/day)	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug.	Sep.	Oct.
Beans	Planting area (ha)	361	241	30								120	331
	kc	1.10	0.40									0.50	0.80
		0.80	1.10	0.40									0.50
	Average kc	0.95	0.75	0.40								0.50	0.65
	CU (mm/day)	3.9	3.6	2.2								2.1	2.5
	CU(mm/month)	116.4	111.6	67.3								63.5	76.9
	Effective rainfall (mm)	36.2	10.9	11.3								94.8	84.5
	Net Requirement(MCM)	0.29	0.24	0.02								0.00	0.00
Corn (1)	Planting area (ha)						35	104	139	139	104	35	
	kc						0.50	0.80	1.10	0.60			
							0.50	0.80	1.10	0.60			
	Average kc						0.50	0.65	0.80	0.83	0.85	0.60	
	CU (mm/day)						3.0	3.9	4.6	4.3	3.9	2.5	
	CU(mm/month)						88.8	119.9	138.7	132.5	119.5	75.0	
	Effective rainfall (mm)						45.5	90.9	52.6	65.9	80.0	94.8	
	Net Requirement(MCM)						0.02	0.03	0.12	0.09	0.04	0.00	
Corn (2)	Planting area modified	139	139	104	35							35	104
	kc	1.10	0.60									0.50	0.80
		0.80	1.10	0.60									0.50
	Average kc	0.50	0.80	1.10	0.60							0.50	0.65
	CU (mm/day)	3.27	4.00	4.62	3.40							2.08	2.48
	CU(mm/month)	98.1	124.0	143.1	95.3							62.5	76.9
	Effective rainfall (mm)	36.2	10.9	11.3	10.5							94.8	84.5
	Net Requirement(MCM)	0.09	0.16	0.14	0.03							0.00	0.00
Onion (1)	Planting area (ha)								31	85	93	85	31
	kc								0.50	0.80	1.00	1.00	
									0.50	0.80	1.00	1.00	
	Average kc								0.50	0.65	0.90	1.00	
	CU (mm/day)								6.3	5.8	5.4	5.2	4.8
	CU(mm/month)								188.4	179.2	168.5	155.1	149.3
	Effective rainfall (mm)								52.6	65.9	80.0	94.8	84.5
	Net Requirement(MCM)								0.04	0.10	0.08	0.05	0.02
Onion (2)	Planting area			31	85	93	85	31					
	kc			0.50	0.80	1.00	1.00						
				0.50	0.50	0.80	1.00	1.00					
	Average kc			0.50	0.65	0.90	1.00	1.00					
	CU (mm/day)			2.8	3.6	5.3	5.9	5.8					
	CU(mm/month)			79.4	113.1	159.8	184.4	173.4					
	Effective rainfall (mm)			10.5	21.8	45.5	90.9	52.6					
	Net Requirement(MCM)			0.02	0.08	0.11	0.08	0.04					
Pigeon pea (1)	Planting area (ha)								23	46	46	23	
	kc								0.60	1.00	0.80		
									0.60	0.60	1.00	0.80	
	Average kc								0.60	0.80	0.90	0.80	
	CU (mm/day)								3.6	4.6	4.6	3.6	
	CU(mm/month)								110.7	138.7	143.1	112.5	
	Effective rainfall (mm)								90.9	52.6	65.9	80.0	
	Net Requirement(MCM)								0.00	0.04	0.04	0.01	
Pigeon pea (2)	Planting area (ha)	23										23	46
	kc	0.80										0.60	1.00
		0.80										0.60	1.00
	Average kc	0.80										0.60	0.80
	CU (mm/day)	3.3										2.7	3.3
	CU(mm/month)	98.1										84.4	100.0
	Effective rainfall (mm)	36.2										80.0	94.8
	Net Requirement(MCM)	0.01										0.00	0.00
Sweet Potato	Planting area (ha)	28	21	7								7	21
	kc	0.75										0.45	0.75
		1.10	0.75									0.45	1.10
	Average kc	0.75	1.10	0.75								0.45	0.75
	CU (mm/day)	3.5	4.4	4.1								2.0	2.5
	CU(mm/month)	106.2	137.7	126.3								63.3	75.0
	Effective rainfall (mm)	36.2	10.9	11.3								80.0	94.8
	Net Requirement(MCM)	0.02	0.03	0.01								0.00	0.00
Cassava	Planting area (ha)	19	19	15	9	3			3	9	15	19	19
	kc	1.12	0.82						0.45	0.45	0.75	0.80	0.80
		1.12	1.12	0.82					0.45	0.45	0.45	0.75	0.80
	Average kc	0.80	0.80	1.12	1.12	0.82			0.45	0.45	0.45	0.45	0.75
	CU (mm/day)	3.9	4.6	5.5	5.5	4.6			2.7	2.6	2.8	2.8	2.9
	CU(mm/month)	117.7	143.6	171.7	154.0	142.7			83.0	78.0	87.5	86.1	87.5
	Effective rainfall (mm)	36.2	10.9	11.3	10.5	21.8			90.9	52.6	65.9	80.0	94.8
	Net Requirement(MCM)	0.02	0.02	0.02	0.01	0.00			0.00	0.00	0.00	0.00	0.00
Total Net Requirements (MCM)		0.42	0.45	0.12	0.06	0.08	0.12	0.11	0.24	0.23	0.13	0.05	0.04
Total Net Requirement for Paddy (MCM)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diversions Requirement (MCM)		0.90	0.95	0.50	0.14	0.17	0.26	0.24	0.51	0.43	0.28	0.11	0.08

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (8/19)
in the Area directly served by YSURA Head Race**

		1,100 ha												
Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	
Plantain Banana Papaya Sub-total	ETo (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0	
	(ha)	470	470	470	470	470	470	470	470	470	470	470	470	
		43	43	43	43	43	43	43	43	43	43	43	43	
		37	37	37	37	37	37	37	37	37	37	37	37	
	kc	549	549	549	549	549	549	549	549	549	549	549	549	
	CU (mm/day)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	
	CU (mm/month)	38721	38003	40333	45768	51612	53255	50025	53627	57898	55135	48924	42308	
Effective rainfall (mm)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	145.8	131.2		
Net Requirement(MCM)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6		
		0.49	0.58	0.60	0.65	0.77	0.74	0.56	0.68	0.85	0.62	0.41	0.27	
Corn&Sorghum Corn&Sorghum	Planting area modified	37							37	110	183	220	183	110
	kc								0.50	0.80	1.10	0.60	0.60	0.60
									0.50	0.80	1.10	0.60	0.60	0.60
	Average kc	0.60							0.50	0.65	0.80	0.75	0.83	0.85
	CU (mm/day)	2.7							2.9	4.1	5.4	4.9	4.8	4.2
	CU (mm/month)	82.0							91.2	123.0	168.9	150.8	143.9	131.2
	Effective rainfall (mm)	26.7							52.6	37.5	25.3	57.6	72.1	81.6
Net Requirement(MCM)	0.02							0.01	0.09	0.26	0.20	0.13	0.05	
Cassava	Planting area (ha)	92	92	76	46	15		15	46	76	92	92	92	
	kc	1.12	0.82					0.45	0.45	0.75	0.80	0.80	1.12	
		1.12	1.12	0.82					0.45	0.45	0.75	0.80	0.80	
		0.80	1.12	1.12	0.82				0.45	0.45	0.45	0.75	0.80	
		0.80	0.80	1.12	1.12	0.82			0.45	0.45	0.45	0.45	0.75	
	Average kc	0.96	0.97	1.02	0.97	0.82			0.45	0.45	0.55	0.61	0.70	0.87
	CU (mm/day)	4.4	4.3	4.8	5.2	5.0			2.6	2.8	3.7	4.0	4.0	4.3
CU (mm/month)	131.2	133.8	149.7	146.2	154.3			82.1	85.2	116.1	123.2	120.9	133.9	
Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8			52.6	37.5	25.3	57.6	72.1	81.6	
Net Requirement(MCM)	0.10	0.11	0.10	0.06	0.02			0.00	0.02	0.07	0.06	0.04	0.05	
Pigeon pea	Planting area (ha)	20					20	39	39	20	20	39	39	
	kc						0.60	1.00	0.80		0.60	1.00	0.80	
							0.60	0.60	1.00	0.80		0.60	1.00	
	Average kc	0.80					0.60	0.80	0.90	0.80	0.60	0.80	0.90	
	CU (mm/day)	3.6					3.8	4.7	5.7	5.4	3.9	4.6	4.5	
	CU (mm/month)	109.3					112.8	146.0	170.3	168.9	120.6	138.1	138.9	
	Effective rainfall (mm)	26.7					25.0	52.6	37.5	25.3	57.6	72.1	81.6	
Net Requirement(MCM)	0.02					0.02	0.04	0.05	0.05	0.01	0.03	0.02		
Sweet Potato	Planting area (ha)	4	11	18	21	18	11	4						
	kc	0.45	0.75	1.10	0.75	1.10	0.75							
			0.45	0.75	1.10	0.75	1.10	0.75						
				0.45	0.75	1.10	0.75	1.10	0.75					
	Average kc	0.45	0.60	0.77	0.76	0.87	0.93	0.75						
	CU (mm/day)	2.0	2.7	3.6	4.1	5.3	5.8	4.4						
	CU (mm/month)	61.5	83.2	112.5	115.0	163.1	173.9	132.4						
Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6							
Net Requirement(MCM)	0.00	0.01	0.02	0.02	0.03	0.02	0.00							
Beans	Planting area (ha)	141	388	423	282	32								
	kc	0.50	0.80	1.10	0.40									
			0.50	0.80	1.10	0.40								
	Average kc	0.50	0.65	0.95	0.75	0.40								
	CU (mm/day)	2.3	2.9	4.5	4.0	2.4								
	CU (mm/month)	68.3	90.2	139.4	113.1	75.3								
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8								
Net Requirement(MCM)	0.06	0.30	0.53	0.29	0.02									
Tobacco	Planting area (ha)	4	13	18	18	9	1							
	kc	0.40	0.70	1.10	1.00									
			0.40	0.70	1.10	1.00								
				0.40	0.70	1.10	1.00							
	Average kc	0.40	0.55	0.73	0.93	1.05	1.00							
	CU (mm/day)	1.8	2.5	3.5	5.0	6.4	6.3							
	CU (mm/month)	54.7	76.3	107.6	150.7	197.6	188.0							
Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0								
Net Requirement(MCM)	0.00	0.01	0.02	0.02	0.02	0.00								
Other Crops (ha)		0	0	0	0	0	0	5	11	11	11	11	5	
	kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0	
	CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4	
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6	
	Net Requirement(MCM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.00	
		0.68	1.01	1.26	1.06	0.85	0.78	0.63	0.86	1.22	0.91	0.62	0.40	
Net Requirement for Upland (MCM)	0	0	0	0	0	0	0	0	0	0	0	0		
Net Requirement for Paddy (MCM)	0	0	0	0	0	0	0	0	0	0	0	0		
Diversion Requirement (MCM)	1.46	2.16	2.69	2.25	1.81	1.65	1.33	1.83	2.60	1.93	1.32	0.85		

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (9/19)
in the Area Irrigated by YSURA Canal and Extension Area**

Crop	7,732 ha											
	Extension area						1,138 ha					
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.
ETo (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Plantain	3,407	3,407	3,407	3,407	3,407	3,407	3,407	3,407	3,407	3,407	3,407	3,407
Banana	543	543	543	543	543	543	543	543	543	543	543	543
Papaya	60	60	60	60	60	60	60	60	60	60	60	60
Sub-total	4,010	4,010	4,010	4,010	4,010	4,010	4,010	4,010	4,010	4,010	4,010	4,010
kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
Net Requirement (MCM)	3.59	4.24	4.40	4.77	5.62	5.40	4.11	4.95	6.18	4.54	3.00	1.99
Tomato												
Planting area modified	2,322	3,482	3,482	2,322	290							290
kc	0.80	1.10	0.60									0.50
Average kc	0.65	0.80	0.83	0.85	0.60							0.50
CU (mm/day)	3.0	3.6	3.9	4.6	3.6							2.5
CU (mm/month)	88.8	111.0	122.3	128.2	112.9							77.2
Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8							81.6
Net Requirement (MCM)	1.44	3.44	3.73	2.76	0.27							0.00
Corn & Sorghum												
Planting area modified				373	1,119	1,492	1,492	1,119	373			
kc				0.50	0.80	1.10	0.60					
Average kc				0.50	0.65	0.80	0.83	0.85	0.60			
CU (mm/day)				2.69	3.95	5.01	4.90	5.36	4.09			
CU (mm/month)				75.4	122.4	150.4	152.0	160.9	126.7			
Effective rainfall (mm)				9.1	19.8	25.0	52.6	37.5	25.3			
Net Requirement (MCM)				0.25	1.15	1.87	1.48	1.38	0.38			
Rice												
Planting area (ha)	3						11	34	45	45	42	23
kc							1.10	1.15	1.25	1.25	1.00	
Average kc	1.00						1.10	1.13	1.17	1.22	1.17	1.13
CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
CU (mm/month)	136.7						200.7	212.9	244.4	244.6	201.5	173.9
Percolation (mm/moon)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
Effective rainfall (mm)	26.7						52.6	37.5	25.3	57.6	72.1	81.6
Land Preparation, 300 mm (MCM)	0.01						0.07	0.07	0.10	0.17	0.13	0.06
Net Requirement (MCM)	0.01						0.10	0.18	0.17	0.15	0.12	0.06
Other crops												
kc	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
Net Requirement (MCM)	0.70	0.86	0.84	0.79	0.58	0.56	0.71	1.33	1.77	1.28	0.77	0.43
Net Requirement for Upland (MCM)	5.73	8.55	8.97	8.49	7.67	2.83	6.31	7.66	8.34	5.82	3.77	2.42
Net Requirement for Paddy (MCM)	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.18	0.17	0.15	0.12	0.06
Diversion Requirement (MCM)	13.04	19.43	20.39	19.29	17.33	17.80	14.52	17.73	19.26	13.51	8.78	5.59

**Table 4.5.1 Estimate of Irrigation Water Requirements under Present Condition (10/19)
in the Extension Area irrigated by Groundwater**

Crop	ETo (mm/day)	Extension area 1,035 ha											
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Plantain		4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Banana		236	236	236	236	236	236	236	236	236	236	236	236
Papaya		40	40	40	40	40	40	40	40	40	40	40	40
Sub-total		6	6	6	6	6	6	6	6	6	6	6	6
	kc	281	281	281	281	281	281	281	281	281	281	281	281
	CU (mm/day)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/month)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
	Effective rainfall (mm)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
	Net Requirement (MCM)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement (MCM)	0.25	0.30	0.31	0.34	0.39	0.38	0.29	0.35	0.43	0.32	0.21	0.14
Tomato	Planting area modified	163	244	244	163	20							20
	kc	0.80	1.10	0.60									0.50
	Average kc	0.50	0.80	1.10	0.60								0.50
	CU (mm/day)	0.65	0.80	0.83	0.85	0.60							0.50
	CU (mm/month)	3.0	3.6	3.9	4.6	3.6							2.5
	Effective rainfall (mm)	88.8	111.0	122.3	128.2	112.9							77.2
	Net Requirement (MCM)	26.7	12.1	15.0	9.1	19.8							81.6
	Net Requirement (MCM)	0.10	0.24	0.26	0.19	0.02							0.00
Corn & Sorghum	Planting area modified				20	60	79	79	60	20			
	kc				0.50	0.80	1.10	0.60					
	Average kc				0.50	0.80	1.10	0.60					
	CU (mm/day)				2.69	3.95	5.01	4.90	5.36	4.09			
	CU (mm/month)				75.4	122.4	150.4	152.0	160.9	126.7			
	Effective rainfall (mm)				9.1	19.8	25.0	52.6	37.5	25.3			
	Net Requirement (MCM)				0.01	0.06	0.10	0.08	0.07	0.02			
Rice	Planting area (ha)	3						11	34	45	45	42	23
	kc							1.10	1.15	1.25	1.25	1.00	
	Average kc	1.00						1.10	1.10	1.15	1.25	1.25	1.00
	CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
	CU (mm/month)	136.7						200.7	212.9	246.4	246.6	201.5	173.59
	Percolation (mm/moon)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
	Effective rainfall (mm)	26.7						52.6	37.5	25.3	57.6	72.1	81.6
	Land Preparation, 300 mm (MCM)							0.07	0.07				
	Net Requirement (MCM)	0.01						0.10	0.18	0.17	0.15	0.12	0.06
Other crops	kc	130	130	123	103	83	86	116	143	150	150	147	138
	CU (mm/day)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	CU (mm/month)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
	Effective rainfall (mm)	109.3	111.0	117.4	120.6	150.6	150.4	145.0	151.4	168.9	160.9	138.1	123.4
	Net Requirement (MCM)	0.11	0.13	0.13	0.11	0.11	0.11	0.11	0.16	0.22	0.16	0.10	0.06
	Net Requirement for Upland (MCM)	0.46	0.67	0.70	0.66	0.58	0.59	0.45	0.58	0.67	0.47	0.31	0.20
	Net Requirement for Paddy (MCM)	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.18	0.17	0.15	0.12	0.06
	Diversion Requirement (MCM)	0.90	1.28	1.34	1.26	1.12	1.13	1.02	1.40	1.55	1.15	0.78	0.47

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (11/19)
in the Area from Villarpando and Los Guiros upstream

		2,266 ha											
Crop		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
	ETo (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Plantain	(ha)	847	847	847	847	847	847	847	847	847	847	847	847
Banana		160	160	160	160	160	160	160	160	160	160	160	160
Papaya		73	73	73	73	73	73	73	73	73	73	73	73
Sub-total		1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
	CU (mm/month)	116.2	117.9	124.7	128.2	150.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement (MCM)	0.97	1.14	1.18	1.29	1.51	1.45	1.11	1.33	1.67	1.22	0.81	0.54
Corn & Sorghum	Planting area (ha)	73	0	0	0	0	0	73	220	367	440	367	220
	kc							0.50	0.80	1.19	0.60		
	Average kc	0.60						0.50	0.65	0.80	0.75	0.83	0.85
	CU (mm/day)	2.7						2.9	4.1	5.4	4.9	4.8	4.2
	CU (mm/month)	82.0						91.2	123.0	168.9	150.8	143.9	131.2
	Effective rainfall (mm)	26.7						52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement (MCM)	0.04						0.03	0.19	0.53	0.41	0.26	0.11
Cassava	Planting area (ha)	183	183	153	92	31	0	31	92	153	183	183	183
	kc	1.12	0.82					0.45	0.45	0.75	0.80	0.80	1.12
	Average kc	0.80	0.80	1.12	1.12	0.82		0.45	0.45	0.45	0.45	0.45	0.75
	CU (mm/day)	4.4	4.3	4.8	5.2	5.0		2.6	2.8	3.7	4.0	4.0	4.3
	CU (mm/month)	131.2	133.8	149.7	146.2	154.3		82.1	85.2	116.1	123.2	120.9	133.9
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8		52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement (MCM)	0.19	0.22	0.21	0.13	0.04		0.01	0.04	0.14	0.12	0.09	0.10
Pigeon pea	Planting area (ha)	39	0	0	0	0	39	78	78	78	78	78	78
	kc						0.55	0.55	0.55	0.75	0.85	0.95	0.75
	Average kc	0.75					0.55	0.55	0.55	0.55	0.75	0.95	0.55
	CU (mm/day)	3.4					3.4	3.2	3.5	4.4	5.5	5.5	4.2
	CU (mm/month)	102.5					103.4	100.3	104.1	137.3	170.9	164.0	131.2
	Effective rainfall (mm)	26.7					25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement (MCM)	0.03					0.03	0.04	0.05	0.09	0.09	0.07	0.04
Sweet Potato	Planting area (ha)	7	21	35	42	35	21	7	0	0	0	0	0
	kc	0.45	0.75	1.10	0.75								
	Average kc	0.45	0.60	0.77	0.76	0.87	0.93	0.75					
	CU (mm/day)	2.0	2.7	3.6	4.1	5.3	5.8	4.4					
	CU (mm/month)	61.5	83.2	112.5	115.0	163.1	173.9	132.4					
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6					
	Net Requirement (MCM)	0.00	0.02	0.03	0.04	0.05	0.03	0.01					
Beans	Planting area (ha)	212	635	847	776	423	53	0	0	0	0	0	0
	kc	0.50	0.80	1.10	0.40								
	Average kc	0.50	0.65	0.80	0.77	0.75	0.40						
	CU (mm/day)	2.3	2.9	3.8	4.1	4.6	2.5						
	CU (mm/month)	68.3	90.2	117.4	115.6	141.2	75.2						
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0						
	Net Requirement (MCM)	0.09	0.50	0.87	0.83	0.51	0.03						
Tobacco	Planting area (ha)	9	26	35	35	18	2	0	0	0	0	0	0
	kc	0.40	0.70	1.10	1.00								
	Average kc	0.40	0.55	0.73	0.93	1.05	1.00						
	CU (mm/day)	1.8	2.5	3.5	5.0	6.4	6.3						
	CU (mm/month)	54.7	76.3	107.6	140.7	197.6	183.0						
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0						
	Net Requirement (MCM)	0.00	0.02	0.03	0.05	0.03	0.00						
Rice	Planting area (ha)							2	5	7	7	7	4
	kc							1.10	1.15	1.25	1.25	1.00	
	Average kc	1.00						1.10	1.15	1.25	1.25	1.00	
	CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
	CU (mm/month)	136.7						200.7	212.9	246.4	244.6	201.5	173.59
	Percolation (mm/month)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
	Effective rainfall (mm)	26.7						52.6	37.5	25.3	57.6	72.1	81.6
	Land Preparation, 300 mm (MCM)							0.01	0.01				
	Net Requirement (MCM)	0.00						0.02	0.03	0.03	0.02	0.02	0.01
Other Crops (ha)		0	0	0	0	0	2	9	14	14	14	12	5
	kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
	CU (mm/month)	109.3	111.0	117.4	129.6	150.6	150.4	144.0	151.4	168.9	160.9	138.1	123.4
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement (MCM)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.01	0.01	0.00
Total Net Requirement for Upland (MCM)		1.32	1.90	2.32	2.33	2.15	1.55	1.20	1.63	2.44	1.86	1.24	0.78
Total Net Requirement for Paddy (MCM)		0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.02	0.02	0.01
Domestic Requirement (MCM)		4.13	5.94	7.26	7.28	6.72	4.84	3.77	5.17	7.68	5.86	3.92	2.45

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (12/19) in the Area of Amiana Gomez and Biafara Project

		2,160 ha											
Crop	ET0 (mm/day)	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Plantain & Banana	(ha)	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080
Cassava		42	42	42	42	42	42	42	42	42	42	42	42
Sub-total		1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122
	Planting area modified	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
	CU(mm/month)	118.2	117.9	124.7	138.2	160.0	159.8	155.1	160.9	179.5	170.9	148.8	131.2
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement(MCM)	1.00	1.19	1.23	1.34	1.57	1.51	1.15	1.38	1.73	1.27	0.84	0.56
Corn&Sorghum		60	20						90	250	312	250	90
Corn&Sorghum		36						36	108	179	215	179	108
	kc							0.50	0.80	1.10	0.60		
	Average kc	0.60						0.50	0.65	0.80	0.75	0.83	0.85
	CU (mm/day)	0.60						2.9	4.1	5.4	4.9	4.8	4.2
	CU(mm/month)	18.0						91.2	123.0	168.9	150.8	143.9	131.2
	Effective rainfall (mm)	26.7						52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement(MCM)	0.02						0.01	0.09	0.26	0.20	0.13	0.05
Cassava	Planting area (ha)	130	130	130	110	83			40	65	90	130	130
	kc	65	65	54	33	11			11	33	54	65	65
	kc	1.12	0.82					0.45	0.45	0.75	0.80	0.80	1.12
	Average kc	0.80	1.12	0.82	0.82	0.82		0.45	0.45	0.55	0.45	0.45	0.75
	CU (mm/day)	0.80	0.80	1.12	1.12	0.82		0.45	0.45	0.55	0.81	0.70	0.87
	CU(mm/month)	4.4	4.3	4.8	5.2	5.0		2.6	2.8	3.7	4.0	4.0	4.3
	Effective rainfall (mm)	131.2	133.8	149.7	145.2	154.3		82.1	85.2	116.1	123.2	120.9	133.9
	Net Requirement(MCM)	0.07	0.08	0.07	0.04	0.01		0.00	0.02	0.05	0.04	0.03	0.03
Pigeon pea	Planting area (ha)	22					10	40	55	55	55	45	15
	kc	0.80					0.60	1.00	0.80	0.80	0.60	1.00	0.80
	Average kc	0.80					0.60	0.80	0.90	0.80	0.60	0.80	0.90
	CU (mm/day)	3.6					3.8	4.7	5.7	5.4	3.9	4.6	4.5
	CU(mm/month)	109.3					112.8	145.0	170.3	168.9	120.6	138.1	138.9
	Effective rainfall (mm)	26.7					25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement(MCM)	0.02					0.02	0.05	0.06	0.03	0.01	0.03	0.02
Sweet Potato 1	Planting area (ha)	5	33	26	26	26	20	10					
	kc	11	33	54	65	54	33	11					
	kc	0.45	0.75	1.10	0.75	0.75	1.10	0.75					
	Average kc	0.45	0.60	0.77	0.76	0.87	0.93	0.75					
	CU (mm/day)	2.0	2.7	3.6	4.1	5.3	5.8	4.4					
	CU(mm/month)	61.5	82.2	112.5	115.0	163.1	173.9	132.4					
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6					
	Net Requirement(MCM)	0.00	0.02	0.05	0.02	0.08	0.05	0.01					
Sweet Potato 2	Planting area (ha)	11							11	33	54	65	54
	kc								0.45	0.75	1.10	0.75	1.10
	Average kc	0.75							0.45	0.60	0.77	0.76	0.87
	CU (mm/day)	0.38							0.45	0.60	0.77	0.76	0.87
	CU(mm/month)	1.5							2.25	3.22	4.44	4.20	4.24
	Effective rainfall (mm)	43.6							69.8	96.5	137.6	130.3	127.2
	Net Requirement(MCM)	0.00							0.01	0.03	0.02	0.18	0.07
Tomato	Planting area modified	30	45	45	30	4							4
	kc	0.80	1.10	0.60									0.50
	Average kc	0.50	0.80	1.10	0.60	1.10	0.60						0.50
	CU (mm/day)	0.65	0.80	0.83	0.85	0.80							0.50
	CU(mm/month)	3.0	3.6	3.9	4.6	3.6							2.5
	Effective rainfall (mm)	88.8	111.0	122.3	128.2	112.9							77.2
	Net Requirement(MCM)	26.7	12.1	15.0	9.1	19.8							81.6
Tomato	Planting area (ha)	17	51	68	67	34							
	kc	0.40	0.70	1.10	1.00	1.00							
	Average kc	0.40	0.55	0.73	0.93	1.05							
	CU (mm/day)	1.6	2.5	3.5	5.0	6.4							
	CU(mm/month)	54.7	76.3	107.6	154.7	197.6							
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8							
	Net Requirement(MCM)	0.00	0.04	0.06	0.18	0.06							
Vegetables (ha)		215	215	215	215	215	215	215	215	215	215	215	215
	kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
	CU(mm/month)	109.3	111.0	117.4	130.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
	Effective rainfall (mm)	26.7	12.1	15.0	9.1	19.8	25.0	52.6	37.5	25.3	57.6	72.1	81.6
	Net Requirement(MCM)	0.18	0.21	0.22	0.24	0.28	0.27	0.30	0.24	0.31	0.22	0.18	0.09
Net Requirement for Upland (MCM)		1.31	1.59	1.69	1.81	2.09	1.86	1.42	1.79	2.38	1.75	1.17	0.76
Diversion Requirement (MCM)		2.80	3.38	3.59	3.84	4.28	3.95	3.01	3.82	5.06	3.72	2.49	1.61

Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (13/19)
in the Irrigation Area from Los Guiros to Santana upstream

		2,791 ha											
Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
	ETo (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Plantain	(ha)	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080
Banana		470	470	470	470	470	470	470	470	470	470	470	470
Coconut		88	88	88	88	88	88	88	88	88	88	88	88
Sub-total		2,638	2,638	2,638	2,638	2,638	2,638	2,638	2,638	2,638	2,638	2,638	2,638
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3,872.1	3,803	4,023.3	4,576.8	5,161.2	5,325.5	5,002.5	5,362.7	5,789.8	5,513.5	4,892.1	4,230.8
	CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	145.8	131.2
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	2.54	2.78	3.17	3.23	3.95	3.69	2.99	3.18	4.33	3.47	2.82	2.39
Corod/Sorghum	Planting area modified								11	33	44	44	33
	kc								0.50	0.80	1.10	0.60	
	Average kc								0.50	0.80	1.10	0.60	
	CU (mm/day)								2.94	4.10	5.45	5.41	4.89
	CU (mm/month)								91.2	123.0	168.9	167.6	145.8
	Effective rainfall (mm)								41.9	40.2	15.4	39.3	39.9
	Net Requirement (MCM)								0.01	0.03	0.07	0.06	0.04
Rice	Planting area (ha)	1							3	8	10	10	9
	kc								1.10	1.15	1.25	1.25	1.00
	Average kc	1.00							1.10	1.15	1.25	1.25	1.00
	CU (mm/day)	4.6							6.5	7.1	7.9	7.9	6.7
	CU (mm/month)	136.7							200.7	212.9	246.4	244.6	201.5
	Percolation (mm/month)	0.0							0.0	0.0	0.0	0.0	0.0
	Effective rainfall (mm)	20.0							41.9	40.2	15.4	39.3	39.9
	Land Preparation, 300 mm (MCM)								0.02	0.02	0.02	0.02	0.02
	Net Requirement (MCM)	0.00							0.02	0.03	0.02	0.02	0.01
Beans	Planting area (ha)	7	20	22	15	2							
	kc	0.50	0.80	1.10	0.40								
	Average kc	0.50	0.50	0.80	1.10	0.40							
	CU (mm/day)	2.3	2.9	4.5	4.0	2.4							
	CU (mm/month)	68.3	90.2	139.4	113.1	75.3							
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1							
	Net Requirement (MCM)	0.00	0.02	0.03	0.02	0.00							
Pasture & Other Crops (ha)		106	116	94	45	12	22	69	96	99	99	99	98
	kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
	CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	0.09	0.11	0.11	0.06	0.02	0.03	0.02	0.11	0.15	0.12	0.10	0.08
Total Net Requirement for Upland (MCM)		2.63	2.91	3.30	3.30	3.97	3.72	3.06	3.32	4.55	3.65	2.95	2.48
Total Net Requirement for Paddy (MCM)		0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.02	0.02	0.02	0.01
Diversion Requirement (MCM)		5.61	6.18	7.03	7.02	8.45	7.90	6.55	7.11	9.72	7.80	6.31	5.28

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (14/19)
in the Santana Irrigation Area**

12,000 ha

Crop	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
ET _p (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Sugar cane (ha)	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240
kc	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15	1.15	1.15
	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15	1.15
	1.15	1.15	0.85	0.80	0.65	0.90	0.80	0.95	1.10	1.15	1.15	1.15
	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15
	1.15	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10
	1.10	1.15	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95
Average kc	1.10	1.06	0.99	0.89	0.84	0.81	0.81	0.85	0.90	0.97	1.06	1.11
CU (mm/day)	5.01	4.73	4.67	4.81	5.12	5.10	4.75	5.36	6.13	6.30	6.13	5.55
CU (mm/month)	150.3	146.6	144.6	134.6	158.7	153.1	147.3	160.9	190.0	195.3	183.8	171.9
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	4.22	4.34	4.54	4.17	4.81	4.31	3.42	3.91	5.66	5.06	4.66	4.26
Plantain (ha)	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786
Banana	21	21	21	21	21	21	21	21	21	21	21	21
Coconut	0	0	0	0	0	0	0	0	0	0	0	0
Sub-total	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807
kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	2.70	2.55	3.37	3.44	4.21	3.92	3.18	3.39	4.61	3.70	3.00	2.55
Corn & Sorghum												
Planting area modified	0	0	0	0	0	0	656	1,967	2,622	2,622	1,967	656
kc							0.50	0.80	1.10	0.60		
							0.50	0.80	1.10	0.60		
							0.50	0.80	1.10	0.60		
Average kc							0.50	0.65	0.80	0.83	0.85	0.30
CU (mm/day)							2.94	4.10	5.45	5.41	4.89	1.49
CU (mm/month)							91.2	123.0	168.9	167.6	145.8	46.3
Effective rainfall (mm)							41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)							0.00	0.00	0.00	0.84	2.10	0.15
Rice												
Planting area (ha)	0.8						3.3	9.8	13.0	13.0	12.2	6.5
kc							1.10	1.15	1.25	1.25	1.00	
							1.10	1.15	1.25	1.25	1.00	
	1.00						1.10	1.15	1.25	1.25	1.00	
Average kc	1.00						1.10	1.13	1.17	1.22	1.17	1.13
CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
CU (mm/month)	136.7						200.7	212.9	246.4	244.6	201.5	173.6
Percolation (mm/month)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
Effective rainfall (mm)	20.0						41.9	40.2	15.4	39.3	39.9	40.4
Land Preparation, 300 mm (MCM)							0.01	0.01	0.01	0.01	0.01	0.01
Net Requirement (MCM)	0.00						0.02	0.04	0.06	0.05	0.04	0.02
Beans												
Planting area (ha)	328	901	983	656	82	0	0	0	0	0	0	0
kc												
	0.50	0.80	1.10	0.40								
		0.50	0.80	1.10	0.40							
Average kc	0.50	0.65	0.95	0.75	0.40							
CU (mm/day)	2.3	2.9	4.5	4.0	2.4							
CU (mm/month)	68.3	90.2	139.4	113.1	75.3							
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1							
Net Requirement (MCM)	0.16	0.70	1.33	0.70	0.95							
Other Crops (ha)	4,228	4,654	3,737	1,901	492	911	2,583	4,195	4,261	4,261	4,261	4,032
kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.8	4.0
CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	3.78	4.58	4.21	2.18	0.69	7.20	3.11	4.67	6.54	5.18	4.18	3.35
Total Net Requirement for Upland (MCM)	10.86	12.57	13.45	10.50	9.76	9.43	9.70	11.95	16.81	14.77	13.95	10.21
Total Net Requirement for Paddy (MCM)	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.06	0.05	0.04	0.02
Diversion Requirement (MCM)	23.10	26.74	28.62	22.33	20.77	20.06	20.67	25.53	35.88	31.51	29.74	21.97

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (15/19)
in the Area from Santana downstream to Tomate upstream**

		2853 ha											
Crop		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	ETo (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Plantain	(ha)	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131
Banana		454	454	454	454	454	454	454	454	454	454	454	454
Coconut		98	98	98	98	98	98	98	98	98	98	98	98
Sub-total		2,693	2,693	2,693	2,693	2,693	2,693	2,693	2,693	2,693	2,693	2,693	2,693
	Planting area modified	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
	lc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
	CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	2.59	2.83	3.24	3.30	4.04	3.76	3.05	3.25	4.42	3.55	2.88	2.44
Corn & Sorghum	Planting area modified							9	26	35	35	26	9
	lc							0.50	0.80	1.10	0.60		
									0.50	0.80	1.10	0.60	
	Average lc							0.50	0.65	0.80	0.83	0.85	0.30
	CU (mm/day)							2.94	4.10	5.45	5.41	4.89	1.49
	CU (mm/month)							91.2	123.0	168.9	167.6	146.8	46.3
	Effective rainfall (mm)							41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)							0.00	0.00	0.00	0.01	0.03	0.00
Rice	Planting area (ha)	1						3	8	10	10	9	5
	lc							1.10	1.15	1.25	1.25	1.00	
									1.10	1.15	1.25	1.25	1.00
	Average lc	1.00						1.10	1.13	1.17	1.22	1.17	1.13
	CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
	CU (mm/month)	136.7						200.7	212.9	246.4	244.6	201.5	173.6
	Percolation (mm/mo)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
	Effective rainfall (mm)	20.0						41.9	40.2	15.4	39.3	39.9	40.4
	Land Preparation, 300 mm (MCM)							0.01	0.01	0.01			
	Net Requirement (MCM)	0.00						0.02	0.03	0.05	0.04	0.03	0.01
Beans	Planting area (ha)	10	27	29	19	2							
	lc	0.50	0.80	1.10	0.40								
			0.50	0.80	1.10	0.40							
	Average lc	0.50	0.65	0.95	0.75	0.40							
	CU (mm/day)	2.3	2.9	4.5	4.0	2.4							
	CU (mm/month)	68.3	90.2	139.4	113.1	75.3							
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1							
	Net Requirement (MCM)	0.00	0.02	0.04	0.02	0.00							
Pasture & Other Crops (ha)		122	133	107	54	13	26	81	112	115	115	115	113
	lc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
	CU (mm/month)	109.3	111.0	117.4	129.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	0.11	0.13	0.12	0.06	0.02	0.03	0.08	0.12	0.13	0.14	0.11	0.09
Total Net Requirement for Upland (MCM)		2.70	2.99	3.40	3.38	4.06	3.80	3.13	3.37	4.60	3.70	3.02	2.54
Total Net Requirement for Paddy (MCM)		0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.04	0.03	0.01
Diversion Requirement (MCM)		5.76	6.35	7.22	7.19	8.63	8.08	6.70	7.24	9.86	7.93	6.47	5.43

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (16/19)
in the Area of Los Tomate - Mena**

371 ha

Crop	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
ETo (mm/day)	4.6	4.3	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
Plantain (ha)	266	266	266	266	266	266	266	266	266	266	266	266
Banaba	60	60	60	60	60	60	60	60	60	60	60	60
Coconut	21	21	21	21	21	21	21	21	21	21	21	21
Sub-total	348	348	348	348	348	348	348	348	348	348	348	348
kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
CU (mm/month)	116.2	117.9	124.7	138.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	0.33	0.37	0.42	0.43	0.52	0.49	0.39	0.42	0.57	0.45	0.37	0.32
Corn & Sorghum								1	3	4	4	3
Planting area modified												1
kc							0.50	0.80	1.10	0.60		
Average kc							0.50	0.65	0.80	0.83	0.85	0.30
CU (mm/day)							2.94	4.10	5.45	5.41	4.89	1.49
CU (mm/month)							91.2	123.0	168.9	167.6	146.8	46.3
Effective rainfall (mm)							41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)							0.00	0.00	0.00	0.00	0.00	0.00
Rice								1	2	2	2	1
Planting area (ha)	0											
kc							1.10	1.15	1.25	1.25	1.00	
Average kc	1.00						1.10	1.15	1.25	1.25	1.25	1.00
CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
CU (mm/month)	136.7						200.7	212.9	246.4	244.6	201.5	173.6
Percolation (mm/month)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
Effective rainfall (mm)	20.0						41.9	40.2	15.4	39.3	39.9	40.4
Land Preparation, 300 mm (MCM)	0.00						0.00	0.00	0.00	0.00	0.00	0.00
Net Requirement (MCM)	0.00						0.00	0.01	0.01	0.01	0.01	0.00
Beans												
Planting area (ha)	1	2	2	1	0							
kc	0.50	0.80	1.10	0.40								
Average kc	0.50	0.65	0.95	0.75	0.40							
CU (mm/day)	2.3	2.9	4.5	4.0	2.4							
CU (mm/month)	68.3	90.2	139.4	113.1	75.3							
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1							
Net Requirement (MCM)	0.00	0.00	0.00	0.00	0.00							
Pasture & Other Crops (ha)	17	18	15	8	2	3	11	16	17	17	17	17
kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	0.02	0.02	0.02	0.01	0.00	0.00	0.01	0.02	0.03	0.02	0.02	0.01
Total Net Requirement for Upland (MCM)	0.35	0.39	0.44	0.44	0.52	0.49	0.40	0.44	0.60	0.45	0.39	0.33
Total Net Requirement for Paddy (MCM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00
Diversive Requirement (MCM)	0.74	0.82	0.93	0.93	1.12	1.04	0.87	0.94	1.29	1.03	0.84	0.71

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (17/19)
in the Area from Tamate downstream to Palo Alto upstream**

		1,565 ha												
Crop		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
Sugar cane	ETo (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0	
	(ha)	200	200	200	200	200	200	200	200	200	200	200	200	
	kc	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15	1.15	1.15	
		1.15	0.85	0.80	0.85	0.50	0.80	0.95	1.10	1.15	1.15	1.15	1.15	
		1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15	
		1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	
		1.15	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15
		1.15	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15
	Average kc	1.10	1.06	0.99	0.89	0.84	0.81	0.81	0.85	0.90	0.97	1.06	1.11	
	CU (mm/day)	5.01	4.73	4.67	4.81	5.12	5.10	4.75	5.36	6.13	6.30	6.13	5.55	
	CU (mm/month)	150.3	146.6	144.6	134.6	158.7	153.1	147.3	160.9	190.0	195.3	183.8	171.9	
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4	
Net Requirement (MCM)	0.26	0.27	0.28	0.26	0.30	0.27	0.21	0.24	0.35	0.31	0.29	0.26		
Plantain	(ha)	1,139	1,139	1,139	1,139	1,139	1,139	1,139	1,139	1,139	1,139	1,139	1,139	
Banana		105	105	105	105	105	105	105	105	105	105	105	105	
Coconut		55	55	55	55	55	55	55	55	55	55	55	55	
Sub-total		1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	
	CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2	
	CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2	
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4	
	Net Requirement (MCM)	1.25	1.37	1.56	1.59	1.95	1.81	1.47	1.57	2.13	1.71	1.39	1.18	
Corn & Sorghum	Planting area modified							3	8	11	11	8	3	
	kc							0.50	0.80	1.10	0.50			
								0.50	0.80	1.10	0.60			
	Average kc							0.50	0.65	0.80	0.83	0.85	0.30	
	CU (mm/day)							2.94	4.10	5.45	5.41	4.89	1.49	
	CU (mm/month)							91.2	123.0	168.9	167.6	146.8	46.3	
	Effective rainfall (mm)							41.9	40.2	15.4	39.3	39.9	40.4	
	Net Requirement (MCM)							0.00	0.00	0.00	0.00	0.01	0.00	
Rice	Planting area (ha)	0						2	5	6	6	5	2	
	kc							1.10	1.15	1.25	1.25	1.00		
								1.10	1.15	1.25	1.25	1.00		
	Average kc	1.00						1.10	1.13	1.17	1.22	1.17	1.13	
	CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6	
	CU (mm/month)	136.7						200.7	212.9	246.4	244.6	201.5	173.6	
	Percolation (mm/mo)	0.0						0.0	0.0	0.0	0.0	0.0	0.0	
	Effective rainfall (mm)	20.0						41.9	40.2	15.4	39.3	39.9	40.4	
	Land Preparation, 300 mm (MCM)							0.01	0.01	0.01	0.01	0.01	0.00	
	Net Requirement (MCM)	0.00						0.01	0.01	0.02	0.01	0.01	0.00	
Beans	Planting area (ha)	5	13	14	9	1								
	kc	0.50	0.80	1.10	0.40									
		0.50	0.80	1.10	0.40									
	Average kc	0.50	0.65	0.95	0.75	0.40								
	CU (mm/day)	2.3	2.9	4.5	4.0	2.4								
	CU (mm/month)	68.3	90.2	139.4	113.1	75.3								
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1								
	Net Requirement (MCM)	0.00	0.01	0.02	0.01	0.00								
Other Crops (ha)		61	74	64	47	15	10	33	47	49	49	49	49	
	kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0	
	CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	145.0	151.4	168.9	160.9	138.1	123.4	
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4	
	Net Requirement (MCM)	0.05	0.07	0.07	0.05	0.02	0.01	0.03	0.05	0.08	0.06	0.05	0.04	
Total Net Requirement for Upland (MCM)		1.57	1.72	1.93	1.90	2.27	2.09	1.72	1.86	2.56	2.08	1.73	1.45	
Total Net Requirement for Paddy (MCM)		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.00	
Diversion Requirement (MCM)		3.33	3.65	4.11	4.05	4.82	4.45	3.66	3.98	5.47	4.46	3.70	3.16	

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (18/19)
in the Area from Palo Alto to the Downstream**

2,669 ha

Crop	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Sugar cane	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
ETo (mm/day)	560	560	560	560	560	560	560	560	560	560	560	560
(ha)	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15	1.15	1.15
kc	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15	1.15
	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15	1.15
	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10	1.15	1.15
	1.15	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95	1.10
	1.10	1.15	1.15	1.15	1.15	1.15	0.85	0.80	0.65	0.50	0.80	0.95
Average kc	1.10	1.06	0.99	0.89	0.84	0.81	0.81	0.85	0.90	0.97	1.06	1.11
CU (mm/day)	5.01	4.73	4.67	4.81	5.12	5.10	4.75	5.36	6.13	6.30	6.13	5.55
CU (mm/month)	150.3	146.6	144.6	134.6	158.7	153.1	147.3	160.9	190.0	195.3	183.8	171.9
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	0.73	0.75	0.78	0.72	0.83	0.74	0.59	0.68	0.98	0.87	0.81	0.74
Plantain	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597
Banana	320	320	320	320	320	320	320	320	320	320	320	320
Coconut	76	76	76	76	76	76	76	76	76	76	76	76
Sub-total	1,993	1,993	1,993	1,993	1,993	1,993	1,993	1,993	1,993	1,993	1,993	1,993
kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.8	155.1	160.9	179.5	170.9	146.8	131.2
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	1.92	2.10	2.39	2.44	2.99	2.78	2.26	2.40	3.27	2.62	2.13	1.81
Corn & Sorghum							6	19	25	25	19	6
Planting area modified							0.50	0.80	1.10	0.60		
kc							0.50	0.80	1.10	0.60		
Average kc							0.50	0.65	0.80	0.83	0.85	0.30
CU (mm/day)							2.94	4.10	5.45	5.41	4.89	1.49
CU (mm/month)							91.2	123.0	168.9	167.6	146.8	46.3
Effective rainfall (mm)							41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)							0.00	0.00	0.00	0.01	0.02	0.00
Rice	0						1	4	5	5	5	3
Planting area (ha)							1.10	1.15	1.25	1.25	1.00	
kc							1.10	1.10	1.15	1.25	1.25	1.00
Average kc	1.00						1.10	1.13	1.17	1.22	1.17	1.13
CU (mm/day)	4.6						6.5	7.1	7.9	7.9	6.7	5.6
CU (mm/month)	136.7						200.7	212.9	246.4	244.6	201.5	173.6
Percolation (mm/mo)	150.0						155.0	150.0	155.0	155.0	150.0	155.0
Effective rainfall (mm)	20.0						41.9	40.2	15.4	39.3	39.9	40.4
Land Preparation, 300 mm (MCM)	0.01						0.01	0.01	0.01	0.01	0.01	0.01
Net Requirement (MCM)	0.00						0.01	0.02	0.02	0.02	0.01	0.01
Beans	4	12	13	8	1							
Planting area (ha)	0.50	0.80	1.10	0.40								
kc	0.50	0.50	0.80	1.10	0.40							
Average kc	0.50	0.65	0.95	0.75	0.40							
CU (mm/day)	2.3	2.9	4.5	4.0	2.4							
CU (mm/month)	68.3	90.2	139.4	113.1	75.3							
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1							
Net Requirement (MCM)	0.00	0.01	0.03	0.01	0.00							
Pasture & Other Crops (ha)	89	95	75	37	9	19	60	84	86	85	85	85
kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
CU (mm/month)	109.3	111.0	117.4	120.6	150.6	150.4	146.0	151.4	168.9	160.9	138.1	123.4
Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
Net Requirement (MCM)	0.08	0.09	0.09	0.04	0.01	0.02	0.06	0.09	0.13	0.10	0.08	0.07
Total Net Requirement for Upland (MCM)	2.73	2.95	3.28	3.21	3.83	3.55	2.91	3.17	4.58	3.61	3.04	2.62
Total Net Requirement for Paddy (MCM)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.01	0.01
Diversion Requirement (MCM)	5.80	6.28	6.98	6.83	8.15	7.56	6.20	6.78	9.36	7.74	6.49	5.58

**Table 4.5.1 Estimate of Irrigation Water Requirements with Project Condition (19/19)
In the Aguacatico Irrigation Area**

750 ha

Crop		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
Plantain & Banana	ET _o (mm/day)	4.6	4.5	4.7	5.4	6.1	6.3	5.9	6.3	6.8	6.5	5.8	5.0
	(ha)	443	443	443	443	443	443	443	443	443	443	443	443
Fruit trees	(ha)	225	225	225	225	225	225	225	225	225	225	225	225
Sub-total		668	668	668	668	668	668	668	668	668	668	668	668
	kc	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	CU (mm/day)	3.9	3.8	4.0	4.6	5.2	5.3	5.0	5.4	5.8	5.5	4.9	4.2
	CU (mm/month)	116.2	117.9	124.7	128.2	160.0	159.2	155.1	160.9	179.5	170.9	145.8	131.2
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	0.64	0.70	0.80	0.82	1.00	0.93	0.76	0.81	1.10	0.88	0.71	0.61
Corn & Sorghum (1)	Planting area modified						4	13	18	18	13	4	
	kc						0.50	0.80	1.10	0.60			
								0.50	0.80	1.10	0.60		
	Average kc						0.50	0.65	0.80	0.83	0.85	0.30	
	CU (mm/day)						3.13	3.83	5.05	5.68	5.51	1.73	
	CU (mm/month)						94.0	118.6	151.4	176.0	170.9	51.8	
	Effective rainfall (mm)						20.0	41.9	40.2	15.4	39.3	39.9	
	Net Requirement (MCM)						0.00	0.01	0.02	0.03	0.02	0.00	
Corn & Sorghum (2)	Planting area modified	18	18	13	4							4	13
	kc	1.10	0.60									0.50	0.80
		0.80	1.10	0.60									0.50
		0.50	0.80	1.10	0.60								
	Average kc	0.80	0.83	0.85	0.30							0.50	0.65
	CU (mm/day)	3.64	3.73	4.02	1.62							2.83	3.24
	CU (mm/month)	109.3	115.6	124.7	45.2							86.3	100.3
	Effective rainfall (mm)	20.0	12.7	4.6	5.8							39.9	40.4
	Net Requirement (MCM)	0.02	0.02	0.02	0.00							0.00	0.01
Pigeon pea	Planting area (ha)	24					21	41	41	21	24	47	47
	kc						0.60	1.00	0.80		0.60	1.00	0.80
		0.80						0.60	1.00	0.80		0.60	1.00
	Average kc	0.80					0.60	0.80	0.90	0.80	0.60	0.80	0.90
	CU (mm/day)	3.6					3.8	4.7	5.7	5.4	3.9	4.6	4.5
	CU (mm/month)	109.3					112.8	146.0	170.3	168.9	120.6	138.1	138.9
	Effective rainfall (mm)	20.0					20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	0.02					0.02	0.04	0.05	0.03	0.02	0.05	0.05
Melon	Planting area (ha)	8	12	11	4								1
	kc	0.75	1.00	0.70									0.50
		0.50	0.75	1.00	0.70								
	Average kc	0.63	0.88	0.85	0.70								0.50
	CU (mm/day)	2.8	3.9	4.0	3.8								2.5
	CU (mm/month)	85.4	121.4	124.7	105.5								77.2
	Effective rainfall (mm)	20.0	12.7	4.6	5.8								40.4
	Net Requirement (MCM)	0.01	0.01	0.01	0.00								0.00
Tomato	Planting area (ha)	12	18	18	12	3							3
	kc	0.80	1.10	0.60									0.50
		0.50	0.80	1.10	0.60								
	Average kc	0.65	0.80	0.83	0.85	0.60							0.50
	CU (mm/day)	3.0	3.6	3.9	4.6	3.6							2.5
	CU (mm/month)	88.8	110.0	122.3	128.2	112.9							77.2
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1							40.4
	Net Requirement (MCM)	0.01	0.02	0.02	0.01	0.00							0.00
Vegetables	(ha)	24	24	24	24	24	24	18	18	18	18	18	18
	kc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	CU (mm/day)	3.6	3.6	3.8	4.3	4.9	5.0	4.7	5.0	5.4	5.2	4.6	4.0
	CU (mm/month)	109.3	110.0	117.4	120.6	150.6	150.4	145.0	151.4	168.9	160.9	138.1	123.4
	Effective rainfall (mm)	20.0	12.7	4.6	5.8	10.1	20.0	41.9	40.2	15.4	39.3	39.9	40.4
	Net Requirement (MCM)	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.01
Total Net Requirement for Upland (MCM)		0.74	0.77	0.88	0.86	1.04	0.99	0.83	0.90	1.18	0.91	0.78	0.68
Diversion Requirement (MCM)		1.52	1.65	1.87	1.84	2.21	2.10	1.76	1.91	2.53	1.99	1.66	1.44

Table 4.6.1 Water Supply Projection

	Population in 1998	Population in 2010	Water Supply Ratio in 1993 (%)	INAPA On-going & Planned Project	Proposed Project in this Study
Azua					
Azua de Compostela	72,642	120,066	69		
Guayabal	8,973	14,831	55		1
Las Charcas	9,534	15,758	69		
Las Yayas de Biajama	11,472	18,961	47	1	
Padre Las Casas	25,881	42,777	50	1	2
Peralta	12,847	21,234	59		1
Sabana Yegua	10,732	17,738	62	1	
Tabara Arriba	14,621	24,166	76		
Estebania	5,958	9,848	75		
Pueblo Viejo	21,549	35,617	67		
(Sub-total)	194,209	320,996	64	3	4
Barahona					
Santa Cruz de Barahona	66,145	82,387	81		
Vicente Noble	17,937	24,687	47	1	1
Cabral	12,576	17,309	80		
El Penon	7,639	10,514	84		
Fundacion	7,242	10,514	86		
(Sub-total)	111,539	145,411	76	1	1
Bahoruco					
Neyba	19,132	58,225	64	1	1
Galvan	13,834	21,050	34		1
Tamayo	18,912	28,777	64		
Uvilla	14,613	22,235	57		1
(Sub-total)	66,491	130,287	58	1	3
San Juan					
San Juan De La Maguana	129,167	145,430	59	4	
Bohechio	9,417	10,598	38		1
Juan De Herrera	16,825	18,943	42		1
Vallejuelo	14,091	15,865	52	1	
(Sub-total)	169,500	190,836	55	5	2
Total	541,739	787,530		10	10

Table 4.6.2 Identified Hydropower Projects

Project	River or Canal	Present Status	Potential Installed Capacity (MW)	Average Power Generation (GWh/year)	Source	Remarks
Dam projects						
Hondo Valle	San Juan	F/S	13.5	48.0	NORPLAN, 1991	Hondo valle projects was given first priority in this report (Phase I) (not feasible) (not feasible)
La Higuera	San Juan	F/S	15.0 *1	54.7	NORPLAN, 1991	
Los Jaiminez	San Juan	F/S	6.4 *1	23.8	NORPLAN, 1991	
San Pedro-Avispas	San Pedro	Pre F/S	9.3	55.9	NORPLAN, 1990	
Los Guanos	Arroyo Limon	Pre F/S	10.2	34.5	NORPLAN, 1990	
Palomino	Del Midio	Pre F/S	98.8	242.5	SWECO, 1989	
Boca de los Rios	Yaque del Sur	Identification	20.5 *2	79.8 *2	NORPLAN, 1984	
El Picacho	Yaque del Sur	Identification	21.2 *2	46.4 *2	NORPLAN, 1984	
El Mogete	Del Midio river	Pre F/S	13.0 *2	36.4 *2	NORPLAN, 1984	
El Yayal	Mijo	F/S	2.0	24.1	INITEC, 1985	
Los Rukos	Arroyo Grande	F/S	0.9	9.0	INITEC, 1985	
Los Argúeyes	Del Medio	Identification	33.4	86.0	PNORHI, 1995	
Las Piedra Colorada	Las Cuevas	Identification	15.2	24.5	PNORHI, 1995	
El Cigual	Las Cuevas	Identification	20.7	43.6	PNORHI, 1995	
La Marcelino	Las Cuevas	Identification	21.4	59.6	PNORHI, 1995	
Los Guayuyos	A Limón	Identification	5.5	9.3	PNORHI, 1995	
La Angostura	Arroyo Grande	Identification	28.5	66.2	PNORHI, 1995	
El Pino	Mijo	Identification	13.0	24.2	PNORHI, 1995	
Loma	La Maguana	Identification	3.7	4.1	PNORHI, 1995	
Fondo Negro	Mijo	Identification	32.3	62.0	PNORHI, 1995	
Mini-hydropower projects						
José Joaquín Puello	J.J.P canal	Preliminary Design	3.6	28.2 *2	INDRHI, 1995	under reformulation
Santana	Santana canal	Preliminary Design	1.0	7.4	PNORHI, 1993	
Los Toros	Ysura canal	Under implementation	9.6	57.3	INDRHI, 1997	
Magueyas	-	Identification	16.0	109.0	PNORHI, 1995	
Los Bancos	Ysura canal	Identification	8.0	70.0	PNORHI, 1995	
Magueyal	Ysura canal	Identification	2.6 *3	22.0 *3	PNORHI, 1995	

Note: *1; Pre F/S by NORPLAN, 1984

*2; INDRHI

*3; JICA study team

Table 4.6.3 Preliminary Comparison Study of Mini-hydropower Scheme

	Santana		J. J. Puello		Magueyal
	Original Plan	Present Study	Original Plan	Present Study	
Designed Discharge for Generator (m ³ /sec)	18	11	8.4	6.5	8
Effective Head (m)	6	6	58	58	40
Generated Output (Installation capacity) (kW)	940	574	3,900	3,000	2,600
Annual Possible Power Generation (GWh)	6.9	4.1	28	21	22
Direct Construction Cost (million RD\$)	18.5 (in 1989)		118.8 (in 1994)		
Direct Construction Cost (million RD\$)	68.45 (present value)	40.33	237.6 (present value)	190	156 (JICA Study)
Cost per power (50 years) (RD\$/kWh)	0.26	0.27	0.23	0.24	0.19

Table 4.7.1 Irrigation Water Demand

Irrigation Zone & System	Unit: MCM												
	Nov.	Dec.	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
San Juan Zone													
JJ Pueblo	4.37	11.87	19.01	10.18	2.80	2.43	7.06	13.75	11.72	10.24	6.16	4.06	103.67
San Juan	3.02	10.68	13.56	10.53	3.14	1.54	6.80	13.84	13.53	11.33	7.77	4.63	105.38
Hato del Padre	0.59	2.36	4.35	2.52	0.94	0.62	2.26	4.22	3.91	3.53	2.58	1.47	29.36
Guano S. Juan	0.44	1.76	3.19	1.63	0.23	2.03	3.07	4.72	3.90	2.72	1.29	0.47	25.44
Other small system*	0.72	2.83	5.20	2.90	0.85	0.56	2.75	5.24	4.95	4.35	3.13	1.79	35.28
Mijo	2.68	3.51	5.20	3.07	1.29	1.09	3.19	5.80	7.17	5.56	4.20	3.08	45.86
Vallejuelo	0.90	0.96	0.40	0.14	0.17	0.26	0.24	0.51	0.48	0.28	0.11	0.08	4.54
Total	11.83	33.01	55.52	30.81	9.27	8.27	25.12	47.57	45.18	37.74	25.14	15.51	344.98
Azuza Zone													
Area from YSURA H.R.	1.46	2.16	2.69	2.25	1.81	1.65	1.33	1.83	2.60	1.94	1.32	0.85	21.89
Arriana Gomez & Biafara	2.80	3.38	3.59	3.84	4.28	3.95	3.01	3.82	5.06	3.72	2.49	1.61	41.54
YSURA include extension	13.04	19.43	20.39	19.29	17.33	17.80	14.52	17.73	19.26	13.51	8.78	5.59	186.68
Total	17.29	24.96	26.67	25.38	23.41	23.40	18.87	23.37	26.92	19.17	12.59	8.06	250.10
Barahona-Neiba Zone													
Area A1 (Azuza Zone)	4.13	5.94	7.26	7.28	6.72	4.84	3.77	5.17	7.68	5.86	3.92	2.46	65.02
Area B1	5.61	6.18	7.03	7.02	8.45	7.90	6.55	7.11	9.72	7.80	6.31	5.28	84.96
Aguacatico	1.52	1.65	1.87	1.84	2.21	2.10	1.76	1.91	2.52	1.99	1.66	1.44	22.47
Area B2	23.10	26.74	28.62	22.33	20.77	20.06	20.67	25.53	35.88	31.51	29.74	21.97	306.93
Area B3	5.76	6.35	7.22	7.19	8.63	8.08	6.70	7.24	9.86	7.93	6.47	5.43	86.86
Area B4	0.74	0.82	0.93	0.93	1.12	1.04	0.87	0.94	1.29	1.03	0.84	0.71	11.26
Area B5	3.33	3.65	4.11	4.05	4.82	4.46	3.66	3.98	5.47	4.45	3.70	3.16	48.85
Area B6	5.80	6.28	6.98	6.83	8.15	7.56	6.20	6.78	9.36	7.71	6.49	5.58	83.74
Total	49.99	57.61	64.03	57.47	60.87	56.05	50.19	58.65	81.78	68.29	59.12	45.03	710.09
Total	79.11	115.59	146.22	113.67	93.56	87.72	94.18	129.59	153.88	125.21	96.85	69.59	1305.17

*: served by the San Juan river

Area from YSURA H.R.: a group of small areas directly derived water from YSURA Head Race by private pipes.

Area A1: irrigation area in the reaches from Villar Pando to Los Guiros up

Area B1: irrigation area in the reaches from Los Guiros to Santana upstream

Area B2: Santana irrigation area

Area B3: irrigation area in the reaches from Santana downstream to Tomate-Mena upstream

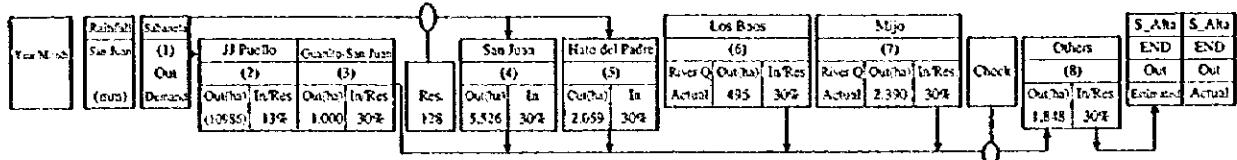
Area B4: irrigation area in the Tomate-Mena system

Area B5: irrigation area in the reaches from Tomate-Mena downstream to Palo Alto upstream

Area B6: irrigation area in the reaches from Palo Alto

Table 4.7.2 Water Balance Simulation by Irrigation Block --- San Juan Block

Proposed condition (with project)

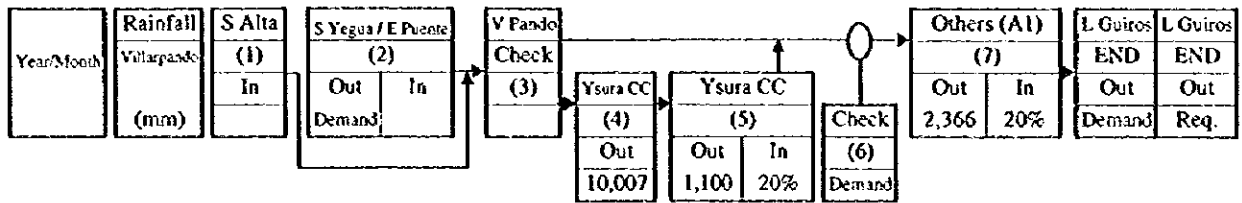


Year	Rainfall (mm)	S. Alta Demand (1)	JJ Pacillo Out (2)	Cuatros San Juan Out/In (3)	Res. (4)	San Jose Out/In (5)	Hato del Padre Out/In (6)	Los Boos River Q/Out/In (7)	Nijo River Q/Out/In (8)	Check (9)	Others Out/In/Res (10)	S. Alta Estimate (11)	S. Alta Actual (12)									
	(mm)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)									
1981	1269.8	187.7	103.7	74.0	25.4	56.2	62.9	104.2	31.3	29.3	8.8	28.1	4.5	25.0	214.7	45.8	182.7	529.3	35.2	504.6	504.6	758.8
1982	733.2	204.7	103.7	70.6	25.4	52.8	32.6	104.2	31.3	29.3	8.8	18.4	4.5	15.3	160.9	45.8	128.8	329.9	35.2	305.3	305.3	467.1
1983	1010.1	198.9	103.7	62.7	25.4	44.9	43.6	104.2	31.3	29.3	8.8	17.0	4.5	7.8	108.7	45.8	76.7	319.9	35.2	285.2	295.2	234.2
1984	903.8	196.0	103.7	67.8	25.4	50.0	42.6	104.2	31.3	29.3	8.8	14.3	4.4	11.2	118.3	45.6	85.4	328.3	35.2	303.6	303.6	-
1985	788.5	210.9	103.7	52.9	25.4	35.1	27.7	104.2	31.3	29.3	8.8	13.5	4.5	10.3	125.9	45.7	93.9	268.3	35.2	243.7	243.7	-
1986	833.9	202.5	103.7	59.0	25.4	41.2	40.4	104.2	31.3	29.3	8.8	17.3	4.5	14.1	112.7	45.8	80.6	315.7	35.2	291.1	291.1	385.9
1987	1123.7	184.0	103.7	82.8	25.4	65.0	56.9	104.2	31.3	29.3	8.8	11.7	4.5	8.6	138.8	44.9	107.3	410.7	35.2	386.0	386.0	384.6
1988	1015.9	193.8	103.7	72.5	25.4	54.8	45.4	104.2	31.3	29.3	8.8	14.6	4.5	11.5	133.3	45.8	101.3	356.2	35.2	331.6	331.6	497.4
1989	1030.2	190.7	103.7	75.5	25.4	57.7	49.6	104.2	31.3	29.3	8.8	17.1	4.5	13.9	159.9	45.8	127.8	404.0	35.2	379.3	379.3	463.2
1990	905.0	201.8	103.7	67.1	25.4	49.4	42.4	104.2	31.3	29.3	8.8	24.9	4.4	21.8	112.4	45.8	80.3	331.9	35.2	307.2	307.2	410.3
1991	512.3	219.1	103.7	49.8	25.4	32.0	18.1	104.2	31.3	29.3	8.8	10.0	4.1	7.1	128.0	45.8	95.9	224.1	35.2	199.5	199.5	280.2
1992	1267.9	191.1	103.7	72.3	25.4	54.5	59.8	104.2	31.3	29.3	8.8	5.0	2.3	3.4	133.4	44.2	102.5	413.5	35.2	388.9	388.9	625.3
1993	968.5	193.9	103.7	79.7	25.4	62.0	45.7	104.2	31.3	29.3	8.8	21.8	4.5	18.7	138.2	45.8	106.1	369.4	35.2	344.7	344.7	-
1994	664.6	211.5	103.7	51.4	25.4	33.6	25.8	104.2	31.3	29.3	8.8	28.6	4.5	25.4	118.1	45.8	85.1	266.9	35.2	242.3	242.3	-
Mean	934.1	199.0	103.7	67.0	25.4	49.2	42.4	104.2	31.3	29.3	8.8	16.9	4.3	13.9	135.9	45.6	104.0	347.7	35.2	323.1	323.1	-

Note: MCM, Million cubic meter
 Out: Water extraction from the source (irrigation area in hectare in the above)
 In: Return flow to the source (return flow rate in percent in the above)
 In/Res: Return flow, inflow from the residual catchment and the remaining flow to the downstream
 Actual: Actual discharge in the records
 Estimated: Estimated discharge by the simulation

Table 4.7.3 Water Balance Simulation by Irrigation Block --- Azua Block

Proposed condition (with project)



Year/Month	Rainfall Villarpede (mm)	S Alta (1) In	S Yegua / E Puente (2) Out Demand In	V Pando Check (3)	Ysura CC (4) Out 10,007	Ysura CC (5) Out In 1,100 20%	Check (6) Demand	Others (A1) (7) Out In 2,366 20%	L. Guiros END Out Demand	L. Guiros END Out Req.
	(uni (mm))	(MCM)	(MCM)(MCM)	(MCM)	(MCM)	(MCM)(MCM)	(MCM)	(MCM)(MCM)	(MCM)(MCM)	
1981	584.3	504.6	283.6	721.7	250.6	21.9 4.4	471.2	65.2 13.0	428.8 441.8	
1982	415.2	305.3	506.5	807.7	250.6	21.9 4.4	557.1	65.2 13.0	514.1 527.1	
1983	665.6	295.2	569.2	848.8	250.6	21.9 4.4	598.2	65.2 13.0	560.0 573.0	
1984	409.1	303.6	552.3	853.7	250.6	21.9 4.4	603.2	65.2 13.0	563.7 576.7	
1985	444.6	243.7	576.0	805.6	250.6	21.9 4.4	555.1	65.2 13.0	512.4 525.4	
1986	475.2	291.1	448.4	722.6	250.6	21.9 4.4	472.0	65.2 13.0	430.1 443.1	
1987	584.4	386.0	448.7	815.4	250.6	21.9 4.4	564.9	65.2 13.0	523.9 536.9	
1988	551.2	331.6	479.5	793.8	250.6	21.9 4.4	543.3	65.2 13.0	504.1 517.1	
1989	746.5	379.3	493.1	837.3	250.6	21.9 4.4	586.7	65.2 13.0	550.5 563.5	
1990	514.9	307.2	549.0	821.1	250.6	21.9 4.4	570.6	65.2 13.0	535.0 548.0	
1991	447.1	199.5	641.2	840.7	250.6	21.9 4.4	590.1	65.2 13.0	558.5 571.5	
1992	313.1	388.9	480.1	835.8	250.6	21.9 4.4	585.2	65.2 13.0	548.2 561.3	
1993	617.3	344.7	458.7	791.6	250.6	21.9 4.4	541.0	65.2 13.0	502.9 515.9	
1994	670.6	242.3	540.3	778.0	250.6	21.9 4.4	527.5	65.2 13.0	491.1 504.1	
Mean	531.4	323.1	501.9	805.3	250.6	21.9 4.4	554.7	65.2 13.0	515.9 529.0	

Note: MCM;

Million cubic meter

Out;

Water extraction from the source (irrigation area in hectare in the above)

In;

Return flow to the source (return flow rate in percent in the above)

In/Res.;

Return flow, inflow from the residual catchment and the remaining flow to the downstream

Actual;

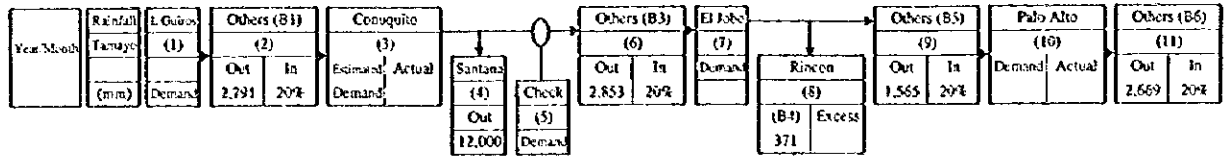
Actual discharge in the records

Estimated;

Estimated discharge by the simulation

Table 4.7.4 Water Balance Simulation by Irrigation Block --- Barahona Block

Proposed condition (with project)



Year	Month	Rainfall (mm)	L. Guiros (1) Demand	Others (B1) (2) Out In	Conaquito (3) Estimated Actual Demand	Santana (4) Out	Check (5) Demand	Others (B3) (6) Out In	El Jobe (7) Demand	Rincon (8) Demand Excess	Others (B5) (9) Out In	Palo Alto (10) Demand Actual	Others (B6) (11) Out In
		(mm)	(MCM)	(MCM)(MCM)	(MCM)(MCM)	(MCM)	(MCM)	(MCM)(MCM)	(MCM)	(MCM)(MCM)	(MCM)(MCM)	(MCM)(MCM)	(MCM)(MCM)
1981		481.7	441.8	107.5 21.5	334.4 -	306.7	183.5	86.9 17.4	96.6	11.3 -	48.9 9.8	53.9 924.4	83.8 16.8
1982		271.5	527.1	107.5 21.5	419.7 -	306.7	193.6	86.9 17.4	106.7	11.3 -	48.9 9.8	64.0 381.8	83.8 16.8
1983		341.8	573.0	107.5 21.5	455.6 -	306.7	198.1	86.9 17.4	111.2	11.3 -	48.9 9.8	68.5 -	83.8 16.8
1984		248.7	576.7	107.5 21.5	469.2 543.6	306.7	199.1	86.9 17.4	112.2	11.3 -	48.9 9.8	69.4 181.7	83.8 16.8
1985		655.3	525.4	107.5 21.5	418.0 412.8	306.7	195.6	86.9 17.4	108.7	11.3 -	48.9 9.8	66.0 218.1	83.8 16.8
1986		343.8	443.1	107.5 21.5	335.7 -	306.7	189.5	86.9 17.4	102.6	11.3 -	48.9 9.8	59.8 422.0	83.8 16.8
1987		476.9	536.9	107.5 21.5	429.5 513.6	306.7	195.6	86.9 17.4	108.7	11.3 -	48.9 9.8	65.9 -	83.8 16.8
1988		254.4	517.1	107.5 21.5	409.7 867.4	306.7	194.5	86.9 17.4	107.6	11.3 -	48.9 9.8	64.8 -	83.8 16.8
1989		303.6	563.5	107.5 21.5	456.1 -	306.7	197.6	86.9 17.4	110.7	11.3 -	48.9 9.8	67.9 -	83.8 16.8
1990		354.1	548.0	107.5 21.5	440.6 -	306.7	195.6	86.9 17.4	109.7	11.3 -	48.9 9.8	66.9 -	83.8 16.8
1991		157.8	571.5	107.5 21.5	464.1 666.9	306.7	199.1	86.9 17.4	112.2	11.3 -	48.9 9.8	69.4 -	83.8 16.8
1992		497.2	561.3	107.5 21.5	453.8 -	306.7	197.1	86.9 17.4	110.2	11.3 -	48.9 9.8	67.5 -	83.8 16.8
1993		449.6	515.9	107.5 21.5	408.5 -	306.7	194.3	86.9 17.4	107.5	11.3 -	48.9 9.8	64.7 -	83.8 16.8
1994		557.4	504.1	107.5 21.5	396.7 -	306.7	193.8	86.9 17.4	106.9	11.3 -	48.9 9.8	64.2 -	83.8 16.8
Mean		385.6	529.0	107.5 21.5	421.5 -	306.7	194.8	86.9 17.4	108.0	11.3 -	48.9 9.8	65.2 -	83.8 16.8

Note: MCM; Million cubic meter
 Out; Water extraction from the source (irrigation area in hectare in the above)
 In; Return flow to the source (return flow rate in percent in the above)
 In/Res; Return flow, inflow from the residual catchment and the remaining flow to the downstream
 Actual; Actual discharge in the records
 Estimated; Estimated discharge by the simulation

Table 4.7.5 Irrigation Areas in San Juan Block (1/2)

(1) J.J. Puello (SAN JUAN) Irrigation area = 10,986 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	3,650	0	3,650	0	4,738	0	1,088	0
Rice	0	1,681	0	1,681	0	1,681	0	0
Sweet Potato 1	190	0	190	0	247	0	57	0
Sweet Potato 2	0	450	0	450	0	1,699	0	1,249
Corn/Sorghum	0	260	0	260	0	982	0	722
Plantain	35	35	35	35	45	45	10	10
Banana	120	120	120	120	120	120		
Papaya	100	100	100	100	130	130		
Others	469	770	469	770	608	1,000	139	230
Total	4,564	3,416	4,564	3,416	5,888	5,657	1,324	2,241

(2) San Juan (SAN JUAN) Irrigation area = 5,526 ha (present) + 3,000 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	2,200	0	2,200	0	4,870	0	2,670	0
Rice 1	0	2,215	0	2,215	0	2,215	0	0
Rice 2	90	0	90	0	90	0	0	0
Sweet Potato 1	180	0	180	0	398	0	218	0
Sweet Potato 2	0	437	0	437	0	967	0	530
Corn/Sorghum	0	820	0	820	0	1,815	0	995
Plantain	134	134	134	134	297	297	163	163
Others	257	285	257	285	288	320	31	35
Total	2,861	3,891	2,861	3,891	5,943	5,614	3,082	1,723

(3) Hato del Padre (SAN JUAN) Irrigation area = 2,056 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	866	0	866	0	1,095	0	229	0
Rice 1	0	772	0	772	0	772	0	0
Rice 2	62	0	62	0	62	0	0	0
Sweet Potato 1	90	0	90	0	114	0	24	0
Sweet Potato 2	0	246	0	246	0	311	0	65
Corn/Sorghum	0	55	0	55	0	70	0	15
Plantain	10	10	10	10	13	13	3	3
Banana	5	5	5	5	5	5		
Others	55	61	55	61	70	78	15	17
Total	1,088	1,149	1,088	1,149	1,359	1,249	271	100

Table 4.7.5 Irrigation Areas in San Juan Block (2/2)

(4) Guanito San Juan (SAN JUAN) Irrigation area = 1,000 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	370	0	370	0	935	0	565	0
Rice 1	0	736	0	736	0	736	0	0
Rice 2	14	0	14	0	14	0	0	0
Sweet Potato	14	20	14	20	35	49	21	29
Corn/Sorghum	0	5	0	5	0	196	0	191
Others	8	11	8	11	21	27	13	16
Total	406	772	406	772	1,005	1,008	599	236

(5) Mijo (SAN JUAN) Irrigation area = 2,390 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	843	0	684	0	1,182	0	498	0
Rice	0	1,250	0	1,014	0	1,250	0	236
Sweet Potato 1	70		57	0	98	0	41	0
Sweet Potato 2	0	130	0	105	0	182	0	77
Corn/Sorghum	0	200	0	162	0	281	0	119
Banana	30	30	24	24	30	30		
Papaya	15	15	12	12	21	21	9	9
Others	276	316	224	256	388	443	164	187
Total	1,234	1,941	1,001	1,573	1,719	2,207	718	634

(6) Vallejuelo (SAN JUAN) Irrigation area = 495 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	195	0	195	0	361	0	166	0
Corn 1	0	75	0	75	0	139	0	64
Corn 2	75	0	75	0	139	0	64	0
Onion 1	0	50	0	50	0	93	0	43
Onion 2	50	0	50	0	93	0	43	0
Pigeon Pea 1	0	25	0	25	0	46	0	21
Pigeon Pea 2	0	25	0	25	0	46	0	21
Sweet Potato	0	15	0	15	0	28	0	13
Cassava	0	10	0	10	0	19	0	9
Total	320	200	320	200	593	371	273	171

(7) Others (SAN JUAN) Irrigation area = 1,848 ha unit:ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Beans	925	0	925	0	1,378		453	0
Rice 1	0	1,108	0	1,108		1,108	0	0
Rice 2	45	0	45	0	45		0	0
Sweet Potato 1	75	0	75	0	112		37	0
Sweet Potato 2	0	170	0	170		253	0	83
Corn&Sorghum	0	260	0	260		387	0	127
Plantain	35	35	35	35	52	52	17	17
Banana	9	9	9	9	9	9	0	0
Others	31	54	31	54	46	80	15	26
Sub-total	1,120	1,636	1,120	1,636	1,642	1,889	522	253

Table 4.7.6 Irrigation Areas in Azua Block (1/2)

(1) Ysura Head Race (AZUA) Irrigation area = 1,100 ha unit : ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	310	310	310	310	470	470	160	160
Banana	43	43	43	43	43	43	0	0
Papaya	24	24	24	24	37	37	13	13
Corn&Sorghum	0	145	0	145	0	220	0	75
Cassava	0	60	0	60	0	92	0	32
Pigeon Pea	0	26	0	26	0	78	0	52
Sweet Potato	14	0	14	0	21	0	7	0
Beans	279	0	279	0	423	0	144	0
Tobacco	12	0	12	0	18	0	6	0
Others	0	6	0	6	0	9	0	3
Total	682	614	682	614	1,012	949	330	335

(2) A1 (Yaque del Sur, AZUA) Irrigation area = 2,366 ha unit : ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	600	600	455	455	847	847	392	392
Banana	160	160	121	121	160	160	39	39
Papaya	52	52	39	39	73	73	34	34
Corn/Sorghum	0	312	0	236	0	440	0	204
Cassava	0	130	0	98	0	183	0	85
Pigeon Pea	0	55	0	42	0	78	0	36
Sweet Potato	30	0	23	0	42	0	19	0
Beans	600	0	455	0	847	0	392	0
Tobacco	25	0	19	0	35	0	16	0
Rice	0	5	0	4	0	7	0	3
Others	0.2	8.1	0.2	6.2	0.3	11.5	0	5
Total	1,467	1,322	1,112	1,001	2,004	1,800	537	477

(3) Azua + Extension (AZUA) Irrigation area = 8,870 ha unit : ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	2,893	2,893	2,893	2,893	3,407	3,407	514	514
Banana	543	543	543	543	543	543	0	0
Papaya	51	51	51	51	60	60	9	9
Tomato	2,958	0	2,958	0	3,482	0	524	0
Corn/Sorghum	1,268	0	1,268	0	1,492	0	224	0
Rice	0	45	0	45	0	45	0	0
Others	576	932	576	932	678	1,098	102	166
Total	8,289	4,464	8,289	4,464	9,662	5,153	1,373	689

Table 4.7.6 Irrigation Areas in Azua Block (2/2)

(4) Extension (AZUA) Irrigation area = 1,138 ha unit : ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	200	200	200	200	236	236	36	36
Banana	40	40	40	40	40	40	0	0
Papaya	5	5	5	5	6	6	1	1
Tomato	208	0	208	0	244	0	36	0
Corn/Sorghum	68	0	68	0	79	0	11	0
Rice	0	45	0	45	0	45	0	0
Others	93	119	93	119	109	141	16	22
Total	614	409	614	409	714	468	100	59

(5) Amiana Gomes, Biafara (AZUA) Irrigation area = 2,160 ha unit : ha

Irrigable area Crop	Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain/Bnana	0	0	0	0	1,080	1,080	1,080	1,080
Papaya	0	0	0	0	42	42	42	42
Corn/Sorghum	0	0	0	0	0	215	0	215
Cassava	0	0	0	0	0	65	0	65
Pigeon Pea	0	0	0	0	0	86	0	86
Sweet Potato 1	0	0	0	0	65	0	65	0
Sweet Potato 2	0	0	0	0	0	65	0	65
Tomato	0	0	0	0	45	0	45	0
Tobacco	0	0	0	0	68	0	68	0
Vegetables	0	0	0	0	215	215	215	215
Total	0	0	0	0	1,515	1,768	1,515	1,768

Table 4.7.7 Irrigation Areas in Barahona Block (1/2)

(1) Aguacatico (BARAHONA) Irrigation area = 750 ha unit : ha

Crop	Irrigable area		Present		0 ha		Modified		0 ha		Future		750 ha		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain/Banana	0	0	0	0	0	0	443	443	443	443	443	443	443	443	443	443
Fruit trees	0	0	0	0	0	0	225	225	225	225	225	225	225	225	225	225
Corn/Sorghum 1	0	0	0	0	0	0	0	18	0	18	0	18	0	18	0	18
Corn/Sorghum 2	0	0	0	0	0	0	18	0	18	0	18	0	18	0	18	0
Pigeon Pea	0	0	0	0	0	0	0	88	0	88	0	88	0	88	0	88
Melon	0	0	0	0	0	0	12	0	12	0	12	0	12	0	12	0
Tomato	0	0	0	0	0	0	18	0	18	0	18	0	18	0	18	0
Vegetables	0	0	0	0	0	0	24	18	24	18	24	18	24	18	24	18
Total	0	0	0	0	0	0	740	792	740	792	740	792	740	792	740	792

(2) Los Guiros - Santana HW (B1, BARAHONA) Irrigation area = 2,791 ha unit : ha

Crop	Irrigable area		Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	1,890	1,890	1,436	1,436	2,080	2,080	644	644	644	644
Banana	470	470	357	357	470	470	0	0	0	0
Coconut	80	80	61	61	88	88	27	27	27	27
Corn/Sorghum	0	40	0	30	0	44	0	14	0	14
Rice	0	10	0	8	0	10	0	2	0	2
Beans	20	0	15	0	22	0	7	0	7	0
Others	60	85	46	64	66	93	20	29	20	29
Total	2,520	2,575	1,915	1,956	2,726	2,785	811	829	811	829

(3) Santana Area (B2, BARAHONA) Irrigation area = 12,000 ha unit : ha

Crop	Irrigable area		Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sugarcane	7,660	7,660	5,813	5,813	3,240	3,240	-2,573	-2,573	-2,573	-2,573
Plantain	85	85	64	64	2,786	2,786	2,722	2,722	2,722	2,722
Banana	21	21	21	21	21	21	0	0	0	0
Rice	0	13	0	10	0	13	0	3	0	3
Beans	30	0	23	0	983	0	960	0	960	0
Corn/Sorghum	0	80	0	61	0	2,622	0	2,561	0	2,561
Others	81	122	61	93	2,655	3,999	2,594	3,906	2,594	3,906
Total	7,877	7,981	5,982	6,062	9,685	12,681	3,703	6,619	3,703	6,619

(4) Santana HW - Tomato (B3, BARAHONA) Irrigation area = 2,853 ha unit : ha

Crop	Irrigable area		Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	1,840	1,840	1,398	1,398	2,131	2,131	733	733	733	733
Banana	464	464	353	353	464	464	0	0	0	0
Coconut	85	85	65	65	98	98	33	33	33	33
Corn/Sorghum	0	30	0	23	0	35	0	12	0	12
Rice	0	10	0	8	0	10	0	2	0	2
Beans	25	0	19	0	29	0	10	0	10	0
Others	66	94	50	71	76	108	26	37	26	37
Total	2,480	2,523	1,885	1,918	2,798	2,846	913	928	913	928

Table 4.7.7 Irrigation Areas in Barahona Block (2/2)

(5) Tomate - Mena (B4, BARAHONA) Irrigation area = 371 ha unit : ha

Crop	Irrigable area		Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plantain	250	250	190	190	266	266	76	76		
Banana	60	60	46	46	60	60	14	14		
Coconut	20	20	15	15	21	21	6	6		
Corn/Sorghum	0	4	0	3	0	4	0	1		
Rice	0	2	0	2	0	2	0	0		
Beans	2	0	2	0	2	0	0	0		
Others	10	15	8	11	11	16	3	5		
Total	342	351	261	267	360	369	99	102		

(6) Tomate - Palo Alto (B5a, BARAHONA) Irrigation area = 1,565 ha unit : ha

Crop	Irrigable area		Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sugarcane	580	580	441	441	200	200	-241	-241		
Plantain	415	415	315	315	1,139	1,139	824	824		
Banana	105	105	80	80	105	105	25	25		
Coconut	20	20	15	15	55	55	40	40		
Corn/Sorghum	0	4	0	3	0	11	0	8		
Rice	0	6	0	5	0	6	0	1		
Beans	5	0	4	0	14	0	10	0		
Others	16	17	12	13	44	46	32	33		
Total	1,141	1,147	867	872	1,557	1,562	690	690		

(7) Palo Alto - Carribbean Sea (B6, BARAHONA) Irrigation area = 2,669 ha unit : ha

Crop	Irrigable area		Present (Statistics)		Present (Irrigable)		Future (Irrigable)		Increase	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sugarcane	560	560	426	426	560	560	134	134		
Plantain	1,260	1,260	958	958	1,597	1,597	639	639		
Banana	320	320	243	243	320	320	77	77		
Coconut	60	60	46	46	76	76	30	30		
Corn/Sorghum	0	20	0	15	0	25	0	10		
Rice	0	5	0	4	0	5	0	1		
Beans	10	0	7	0	13	0	6	0		
Others	43	64	32	49	54	81	22	32		
Total	2,253	2,289	1,712	1,741	2,620	2,664	908	923		

Table 4.8.1 Preliminary Cost Estimate of Water Resources Development Project and Studies

Name of Projects	Specifications (Estimated or assumed)	Cost in '000 US\$
1 Jose Joaquin Puello Dam development Project		
1 Preparatory works		460
2 Embankment (Rock-fill type)	Volume = 668,400 m ³	7,352
3 Spillway and other concrete works	Design Q = 200 m ³ /sec	380
4 Other civil works		1,470
5 Miscellaneous		97
Total		9,759
2 Sabana Yegua Dam Rehabilitation Project		
1 Civil works		21,200
2 Miscellaneous		5,300
Total		26,500
3 Justification Study on Water Resources Development Project		
1 Foreign Consultants	2 x 12 men months	430
2 Local Consultants	5 x 12 men months	214
3 Survey / Investigations	geological boring, topo survey, etc.	70
4 Miscellaneous		71
Total		785
4 Rincon Lagoon Aquasphere Resources Study		
1 Foreign Consultants	1 x 12 men months	215
2 Local Consultants	2 x 12 men months	85
3 Survey / Investigations	environmental survey, bathymetric survey, etc	70
5 Miscellaneous		37
Total		407

Table 4.10.1 Condition of Project Area and Project Features (1/3)

Project Title	Condition of Project Area	Project Features
1) YSURA Extension Area Development Project	The project area is the extension area of YSURA canal. The area is utilized for agricultural purpose. Wet paddy fields and the farms planted by plantain, corn and sorghum are distributed.	The YSURA main canal is improved with full lining of concrete. Lateral canals and distribution canal networks are largely constructed or partly improved with the provision of night storage ponds commanding an irrigation area of 400 ha to 800 ha. Drainage canals are also constructed. For O&M, a water users' organization will be set up under the YSURA Irrigation Committee.
2) Night Storage Pond Project, 3) Guanito San Juan Irrigation System Improvement project, 4) YSURA Area Irrigation Improvement Project, 5) YSURA Headrace Small Irrigation System Improvement Project	Project areas are J.J.Puello, San Juan, Ganito San Juan and Mijo in San Juan Valley and YSURA irrigation system in Azua Valley Irrigation Zones. Agricultural farms are mainly distributed.	Provision of night storage ponds commanding an irrigation area of 400 ha to 800 ha. Enlargement of canals existing in the downstream of the proposed ponds, if the capacity is insufficient to convey water only during the daytime, corresponding to the water demands.
6) Yaque del Sur Small Gravity Irrigation System Improvement Project	The project areas are irrigation areas served by small gravity irrigation systems diverting water from the Yaque del Sur river and the YSURA head race. Most of small gravity irrigation systems have only a free intake at their heads and earthen canals. The area is occupied by agricultural lands mainly planted by plantain and corn.	Major works are the provision of a gated intake structure at the head of the irrigation systems and the improvement of the major irrigation canals. The implementation of the improvement works should be subject to O&M executed by beneficiaries themselves through the setting-up of water users organization and payment water fees.
7) Yaque del Sur Lower Reaches Irrigation and Drainage Project	Irrigation areas commanded by the Santana headworks and other systems located astride the Yaque del Sur River in the downstream of the Santana. Mainly plantain and sugar cane plantation are distributed in the project area.	Major works are the improvement of Santana headworks, unification of small irrigation systems, construction of main canals from the Santana and night storage ponds.
8) Sabana Yegua Dam Rehabilitation Project	Sabana Yegua dam is located on Yaque del Sur river.	Major works are reconstruction of the spillway with lower crest elevation to discharge larger volume than that of original design flood, and provision of flood alerting system.
9) Jose Joaquin Puello Dam Development Plan	The proposed site is located near the Jose Joaquin Puello irrigation canal. The area is occupied by bush. There is no communities, houses and farm land.	The proposed dam height is about 40 m and the reservoir area is about 100 ha large.
10) Galvan Groundwater Development Project, 11) Galvan Groundwater Irrigation Project	In the area, groundwater is comparatively abundant, and people use it mainly for domestic purpose. Agricultural farms planted plantain are distributed.	The total groundwater potential is estimated at 50 MCM which will be exploited by deep tubewells. Yield per tubewell is expected at 20 to 25 liter/sec. Irrigation area per tubewell is estimated at 25 to 30 ha. Proper distance between wells is considered to be 1 km.

Table 4.10.1 Condition of Project Area and Project Features (2/3)

Project Title	Condition of Project Area	Project Features
12) Azua Groundwater Development Project	The extension area of YSURA irrigation system located to the west of Azua city. A large agricultural farm is extended. Main products are tomato and plantain.	Groundwater will be exploited by deep tubewells. Yield per tubewell is expected at 20 to 25 liter/sec. Irrigation area per tubewell is estimated at 25 to 30 ha. The groundwater is to be used conjunctively with surface water to maintain the groundwater table properly.
13) Plan of Villarpando Water Management Center	The center will cover the entire basin of the Yaque del Sur river and Azua irrigation area. The Villarpando Headworks exist on Yaque del Sur River.	The water management center will control and operate Sabaneta dam, Sabana Yegua dam, Villarpando headworks to realize equal and efficient water distribution of the Yaque del Sur River. Replace existing gates with new ones in the Villarpando and newly provide a gated sluice at the left end of the existing overflow weir section so as to supply water to the Yaque del Sur lower reaches on the same condition as the intake to the YSURA canal in Villarpando.
14) Magueyal Mini-Hydropower Project	There are 3 project areas which are on the Jose Joaquin Puello canal, on the Santana canal, and on the YSURA headrace canal (Magueyal). Around the canal, bush is mainly distributed, and some agricultural farm exist near the YSURA canal.	Project consists of construction of 1) Inlet channel, 2) Inlet structure, 3) Pipeline, 4) Power house including electrical facilities, 4) Outlet structure and 5) connection to the existing transmission line. For J.J.Puello and Santana schemes, discharge of water for power generation is depending on the irrigation water in the canals, while the river water after power generation at Magueyal is to be returned to the Yaque del Sur river.
15) Rural Water Supply Plan	Project will cover all study area, especially near the villages.	Rural water supply project may include rehabilitation of the existing water supply facilities of INAPA and construction of new system in the isolated areas. Rehabilitation scheme consists of repair and replacement of pipeline and related facilities. Construction of new system consists of water supply networks, water resource development, surface water or groundwater, and water treatment facilities, if necessary.
16) Other Social Infrastructure Improvement Plan	Project will cover all study area, especially near the villages.	Project consists of construction of the social infrastructure such as community hall, etc. (project component has not been specified)
17) Rural Road Improvement Plan	Project will cover all study area, especially near the villages.	Rehabilitation of rural roads will consist of grading of road surface, additional embankment, simple pavement and repair / installation of small structures, such as culvert drain ditch, etc.
18) Plan for Agricultural Cooperatives, 19) Plan for Seed Multiplication	Project will cover the all study area.	Strengthen cooperatives and agricultural organizations as well as other rural organization such as youth and women. Increase managerial and technical capabilities for farmers. Make cooperatives sustainable financially and technically.
20) Plan for Credit Services	Project will cover all study area.	Develop a credit program by providing funding the rural poor through NGOs, farmers organization or government agencies.
21) Plan for Marketing Information System	Project will cover all study area.	Establishment of a market information system through farmers associations, NGOs and the extension agents. It will include computerized information and linkages to important market outlets. "Two-way street" information system to obtain feedback from producers and the market.
22) Plan for Strengthening CIAZA Research Center, 23) Plan for Strengthening Extension Services	CIAZA is located in Azua and an experimental farm is located in Barahona	Strengthen the capacity of CIAZA to do research. Include new equipment and strengthening the technical capacity of researchers. New management to include the active participation the private sector and farmers within the research process .

Table 4.10.1 Condition of Project Area and Project Features (3/3)

Project Title	Condition of Project Area	Project Features
24) Coffee Production Improvement Project	The project will benefit small and medium scale coffee farmers with farm size varying from 2 to 6 ha. There is an estimated total number of 1,400 beneficiary households, with a total population of about 8000 people to be directly beneficiaries of the project. Majority of coffee farmers in the project areas are very poor, and the only source of income is from agriculture. Within the project areas there are not industries other than agriculture production.	The project consists of the improvement of coffee production by replanting of old/deteriorated coffee areas that are located in lands suitable for coffee production, multiplication of coffee seedlings, introduction of high yielding coffee varieties, improvement of farming practice for coffee production, including fertilization, improvement of post-harvest processing, improvement of existing access roads, provision of drinking water supply for some rural communities.
25) Reforestation in the Upper Watershed Areas of Grande River	The area is along Arroyo Limon River, a tributary of Grande River and is around 24,000 ha. large. The grade of inclination is generally very high, which is 32 to 40 degree. Annual rainfall is 800 to 1000mm. Several communities (paraje) exist in the area. People practice shifting cultivation in the area.	The project include nursery construction, seedling production, improvement access road, tree planting, and monitoring. Totally 720 ha will be reforested in the project period of 5 years.
26) Wildlife Conservation in Rincon Lagoon	The Rincon Lagoon is covered by the national park of 47 km ² . Several kind of valuable wildlife exist. Recently the fluctuation of water level and lack of water are considered to affect the wildlife existence.	Long term monitoring concerning wildlife is conducted in order to judge whether the water introduction to the lagoon is necessary or not.

Table 4.10.2 Environmental Impacts and Countermeasures (1/3)

Project Title	Environmental Impacts	Countermeasures	EIA is required or not?
1) YSURA Extension Area Development Project	Disturbance to the crop fields during the construction stage may occur. Infiltration of water from the canals and ponds may cause the groundwater rising and waterlogging, which may result in the soil salinization. Night storage ponds give the possibility of increase of mosquitoes and snails carrying malaria and schistosomiasis. The project affects the present condition of water rights. As the result of the project, the use of agrochemical and fertilizer will increase.	Careful planning and construction work so as not to disturb to the fields is necessary. The ponds and the canals should be provided with an impervious lining. The ponds have to be periodically kept empty to remove mosquitoes and snails. Importation of fishes as the natural enemies is also one of the countermeasures. Careful planning for the water right and agrochemical use is necessary.	No
2) Night Storage Pond Project, 3) Guanito San Juan Irrigation System Improvement Project, 4) YSURA Area Irrigation Improvement Project, 5) YSURA Headrace Small Irrigation System Improvement Project	A little impacts of disturbance of farms in the construction stage is foreseen. Seepage losses from the night storage pond cause the groundwater-rising around the ponds, which often becomes a trigger of soil salinization. Night storage ponds give the possibility of increase of mosquitoes and snails carrying malaria and schistosomiasis. The project affects the present condition of water rights.	The ponds should be provided with an impervious lining inside the pond or a drainage canal surrounding the pond to avoid the groundwater-rising. The ponds have to be periodically kept empty to remove mosquitoes and snails. Importation of fishes as the natural enemies is also one of the countermeasures. Careful planning for the water right is necessary.	No
6) Yaque del Sur Small Gravity Irrigation System Improvement Project	A little impacts of disturbance of farms during the construction stage are foreseen. Some impacts for social and economic conditions of rural communities as the result of the creation of new water right and the user's fee.	Present beneficiaries have no water rights and do not pay any water fees. The implementation of the improvement works should be subject to O&M executed by beneficiaries themselves through the setting-up of water users organization and payment water fees.	No
7) Yaque del Sur Lower Reaches Irrigation and Drainage Project	Dispute in land acquisition may occur. Disturbance of present irrigation water supply and turbidity of river water during the construction is foreseen. Infiltration of water from the canals and ponds may cause the groundwater rising and waterlogging, which may result in the soil salinization may occur. By the improvement of drainage canal networks to remove salt contained in the soil layer and maintain the salt content low, drained water will contain much more salt than before. The night storage ponds may cause the increase of mosquito and snails carrying malaria and schistosomiasis. As the result of the project, the use of agrochemical and fertilizer will increase. The project affects the present condition of water rights. The set up of water users organization affects lifestyle of local people.	It is important to obtain a consensus from the farmers about the crop compensation and the land possession prior to the implementation of the project. Execute construction works not to disturb the present irrigation water supply and not to cause the turbidity. In order to mitigate the seepage and salt concentration, provide an impervious lining inside the major canals and the ponds. The ponds have to be periodically kept empty to restrain the propagation and get rid of them. Fish breeding is also effective. The implementation of the project works should be subject to the setting-up of water users organization being responsibility for and executing O&M works. Careful planning is necessary not to affect rural society.	Yes

Table 4.10.2 Environmental Impacts and Countermeasures (2/3)

Project Title	Environmental Impacts	Countermeasures	EIA is required or not?
8) Sabana Yegua Dam Rehabilitation Project	Flood damage by the spilled water may occur. A little impact of turbidity of river water during the construction stage.	Flood alerting system should be facilitated from the dam site to the downstream.	No
9) Jose Joaquin Puello Dam Development Plan	Some forest areas will be inundated. Water pollution during construction stage occur. The soil erosion will cause sedimentation in the reservoir. Water born diseases might appear. Water conflict might occur between irrigation systems covered by Sabaneta dam.	Appropriate construction management should be conducted to avoid water pollution. Water users' committee should be organized to avoid the conflict on water use. Survey in inundation area is necessary to evaluate the existing value of landuse. Careful monitoring for water born diseases.	Yes
10) Galvan Groundwater Development Project, 11) Galvan Groundwater Irrigation Project	An impact for the water volume of wells used by local people will occur. Salinization will occur. As the result of the project, the use of agrochemical and fertilizer will increase. Disturbance of farm might occur due to irrigation construction.	Careful examination about water volume in Feasibility Study is necessary. Control and monitoring for agrochemical use. Compensation for farm land.	Yes
12) Azua Groundwater Development Project	Salt water intrusion from sea, and ground subsidence are occur in case of over exploitation. Interference to existing wells occur because of uncontrolled development of wells. Problem of soil salinization might occur. The project might affect the present condition of water right. Water born diseases might appear.	Preparation of inventory of existing wells covering number and location of wells, discharge, groundwater table, structure is necessary. Conjunctive use of surface water and groundwater is recommended. Monitoring of water quality is necessary. Careful planning not to cause the problem of water right and water born diseases.	No
13) Plan of Villarpando Water Management Center	The revised water right will affect the agricultural system and social system of the communities. Disturbance of present irrigation water supply and turbidity of river water caused by construction may occur.	Careful planning and implementation not to affect the present agricultural and social system of the communities. Execute construction works not to disturb the present irrigation water supply and not to make river water turbid.	No
14) Mini Hydropower Development Project	A little areas of deforestation and farm disturbance may occur for the pipeline and power house construction.	Executive construction works so as not to make river water turbidity should be done.	No
15) Rural Water Supply Plan	Generally, water supply project is effective for improving health condition and human life. In case of construction of new water supply system, consideration should be taken to some negative effects due to the construction works. Some clearing of forest may occur due to pipeline and access road construction.	Careful planning so as not to cut the forest in large scale is necessary.	No
16) Other Social Infrastructure Development	No negative impact is foreseen.	none	No

Table 4.10.2 Environmental Impacts and Countermeasures (3/3)

Project Title	Environmental Impacts	Countermeasures	EIA is required or not?
17) Rural Road Improvement Plan	Generally this project is only rehabilitation of the existing road, hence no considerable negative environmental impact is foreseen. However, attention should be paid to avoid deforestation and water pollution during construction stage.	Executive construction works should be done to avoid deforestation and water pollution.	No
18) Plan for Agricultural Cooperatives Plan for Agricultural Cooperatives, 19) Plan for Seed Multiplication	Increase of economic deference between riches and poor in a community might occur.	Careful planning to assist the poorer class so as not to increase the economic difference.	No
20) Plan for Credit Services	Increase of economic deference between riches and poor in a community might occur.	Careful planning to assist the poorer class so as not to increase the economic difference.	No
21) Plan for Marketing Information System	No environmental impact expected.	none	No
22) Plan for Strengthening CIAZA Research Center, 23) Plan for Strengthening Extension Services	No environmental impact expected.	none	No
24) Coffee Production Improvement Project	During the construction of access road, turbidity of river water may occur. The post-harvesting process of a larger volume of coffee may increase pollution of some small water courses. Agrochemical use will increase.	Careful construction work not to cause the turbidity should be done. Some countermeasures to avoid water pollution, for example collocation of small pond before rivers.	No
25) Reforestation in the Upper Watershed Areas of Grande River	A small impact concerning river water pollution in construction stage of the access road improvement. Turbidity of river water would occur.	Careful construction so as not to cause the turbidity is required.	No
26) Wildlife Conservation in Rincon Lagoon	This is a just monitoring plan, so that no environmental impact will occur.	none	No

Table 4.11.1 Salient Features of the Proposed Projects in the Yaque del Sur River Basin (1/5)

Sector	Agricultural development			Agricultural Support Services		
	Name of Project	Landuse Plan	Crop Production Plan	Coffee Production Improvement Project	Rural Development Fund and Fund for the Rural Poor	Plan for Strengthening CIAZA Research Center
Basic Concept of the Plan	The future land use pattern in the Study area should be based on three main factors such as land capability, water availability either from rainfall or irrigation and soil conservation. In the hilly area with steep slopes, natural pasture and shifting culture land of 154,000 ha and rainfed agriculture lands of 46,000 ha are causing serious problem of soil erosion due to the inadequate land use management. In order to expedite to spread reforestation and adequate landuse, fixed cultivation should be introduced in the place of shifting cultivation. In the irrigated area, the basic development concept is set up with the improvement of the crop intensity through the rehabilitation of the existing irrigation system instead of new land development except 6,540 ha in total composing of the Galvan groundwater development project (540 ha) and the on-going INDRHI project (5,950 ha).	The irrigation is essential for the crop production in the study area because of scarcity of rainfall. The improvement of irrigation efficiency as a result of implementation of the proposed irrigation and drainage projects and Yaque del Sur water management center project will increase availability of irrigation water. It is proposed that future additional available water be used to achieve an increase in the cropping intensity as well as the crop yield in existing irrigated lands, instead of increasing the irrigated lands, following the present cropping pattern taking into consideration the farmers' experienced practices.	There are about 12,000ha of land in the mountainous areas of Bahoruco and Azua provinces where small holders having about 2 ha each have plant coffee. About 60 % of the coffee areas are deteriorated. An economical durability of coffee trees are over and unit yield of coffee is low. Also quality of coffee products are low due to deterioration of harvesting and processing facilities. The smallholders in this area is low in their living standard. Rural roads for the transportation of products are deteriorated. It is planned in order to increase farm income that increasing unit yield of coffee and quality should be performed by introducing improved farming, replanting of the old coffee trees and improvement of processing facilities. The target of the project is about 7,200ha of deteriorated coffee areas and 3,500 smallholders. For expansion of improved farming to small holders, education and training should be carried out for the relevant people. Pilot scheme will be done for providing basic data for successful and smooth operation of the project.	The poor access to the credit is one of the main constraints to hinder the agricultural production in the study area, the settlement farmers have received credit from agricultural bank through the program prepared by the Ministry of Land Reform. Most farmers do not use the credits. The interest of the credit is 18 % per year. Credit service is provided with individual's not groups. The basic concept of credit plan is to apply group loan system and reduce the handling charges. The rural development Fund will be instituted within the agricultural bank. In addition to this Fund, the Fund to the Rural Poor is planned to institute within the Special Fund for Agricultural Development (FEDA) that has carried out through trust fund on a small scale. This fund is invested to the poorest in the study area through the local financial institutions such as women's associations, youth associations, NGOs and cooperatives.	There are two Agricultural Research Centers (CIAZA in Azua and CIAS in San Juan) in the study area that are under Vice Ministry of Agricultural Research and Extension, SEA. Over 90 % of the budgets of the Centers are allocated personnel cost and it appears that function on research is not performed actually. Further, the number of trained staff and equipment/facilities for research work are in shortage. The basic concept of the plan is to strengthen research function of CIAZA which will provide basic technology necessary for the successful implementation of the proposed agriculture, and irrigation and drainage projects. For this purpose, CIAZA integrates all stockholders in the generation and deliver of technology. Also reinforcement of institutional capacity as well as equipment/facilities will be undertaken.	Most of the farmers in the study area use seeds from the last harvest. The most seeds used are old and deteriorated that is one of the constraints to force unit yield of crops to be low. Through the Government has promoted increasing improved varieties, quantity of such seeds are small and insufficient. An increase of production of improved variety is essential for successful performance of the proposed irrigation and drainage development projects. Seed multiplication work is now undertaken by CIAZA and APASIM (association of farmers of San Juan de la Maguana). The basic concept of the project is to carry out seed multiplication by strengthening productive function of the existing these two organizations. The objective seeds are paddy, bean, pigeon pea, maize, sorghum, plantain and banana.
Content of the Plan	In order to promote the reforestation and adequate use of steep lands, the present Master Plan proposes the development of a pilot project for reforestation of about 720 ha and the Coffee Production Improvement Project, which includes about 7,200 ha of poorly maintained coffee plantations as described hereinafter. The rural peoples are expected through these projects to get basic technology and information for fixed cultivation instead of the present shifting cultivation. With rehabilitation and improvement project for irrigation system, the crop intensity would be enhanced upto 125 %.	For selection of the crops in the present study, it is not proposed to introduce new crops but the crops which are widely prevailing in the study area taking into consideration the existing farmers' experiences and performances, actual conditions of research and extension services to the farmers and the support to the marketing services. Considering the farmers' intention, however, the followings should be carried out: (1) Considering the farmers' intention, annual cropping intensity should be decided based on the distribution program to each irrigation system. (2) Following the Government policy, the cropping area of the paddy which needs high water requirement remains unchanged. (3) For the sugarcane area in the Barahona and Enriquillo irrigation district, sugarcane production is controlled applying the improved farming practices based on the capacity of the existing sugar factory. (4) Planting area of the banana remains unchanged according to the market forecast by the Ministry of Agriculture. It is necessary to implement projects and programs for introducing appropriate irrigation farming practices, including the use of improved crop varieties, good quality seeds and adequate level of fertilization.	(1) formulation of detailed plan on the coffee production improvement, (2) formation and strengthening of 180 farmer's associations, (3) education and training for 4-coffee specialist, 15-extension workers and 180-nucleus farmers, (4) establishment of 2 pilot schemes (80 ha in total), (5) production : construction of nurseries (14.4 ha), replanting 1.2 million trees by new trees, introduction of improved farming, improvement and provision of harvesting and processing facilities, construction of 18 km access road and improvement of 66 km rural roads.	(1) The Yaque del Sur Rural Development Fund will be instituted in the Agricultural Bank. (2) The member of the Fund consists of 1-manager, 1-secretary, 6-credit / accounting staff, 3-credit officer, 1-lawyer and 1-accountant, (3) The Fund will provide group loans with organizations such as water user's organizations (irrigation nucleus), agricultural cooperatives, NGOs, etc. (4) procurement of necessary office equipment, (5) training for the staff, and (6) Capital of the Fund 5 million US\$. With respect to the 'Fund for the Rural Poor', (1) The Fund will be established within FEDA for the Poor through the local financial institution, (2) The Fund consists of 1-manager, 1-secretary and 3-credit officer, (3) procurement of necessary office equipment, (4) training for the staff,	(1) The 'Research Trust Fund' will be established to obtain research funds and efficient development of applied technology. The member of the Fund is composed of governmental agencies, private sector (agro-processing companies, etc.), academic research sector (ISA, USAID, etc.), water user's organization, NGOs, etc.. CIAZA will employ additional 5 staff. (2) The capability of the present staff will be improved by training of 'Master Degree Program' that is now performed by the Government, ISA and FDA, and various training/seminar programs. (3) procurement of necessary equipment and facilities for laboratory, and (4) expansion of the experimental farms in Barahona (from 12.5 ha at present to 200 ha) and procurement of agricultural machinery	(1) the target of production for improved seeds (paddy: 960 tons, bean: 990 tons, pigeon pea: 12 tons, maize: 105 tons, sorghum: 40 tons, plantain: 2.7 million seedlings and banana: 0.6 million seedling), (2) CIAZA covering with seed and seedling requirement in Azua, Yaque del Sur and Lago Enriquillo irrigation districts and APASIM in charge of seed requirement in Sa Juan irrigation district, (3) construction of cold storage (CIAZA: 260 m ² , APASIM: 2,900 m ²) and (4) procurement of tractors and related attachments
Total Project Cost			249.8 million pesos (formation of association: 11.4 million pesos, education and training: 20 million pesos, vehicle procurement: 0.7 million, pilot scheme: 3.9 million pesos, road improvement: 15.5 million pesos)	The Rural Development Fund: 16.9 million pesos (procurement cost of office equipment and vehicle, education and training cost, staff salaries, operation cost), The Fund or the Rural Poor: 10.5 million pesos.	24 million pesos (procurement of laboratory equipment/facility and agricultural machinery: 4.1 million pesos, education and training cost: 3.2 million pesos, operation cost: 2.7 million pesos)	5.4 million pesos (procurement of agricultural machinery: 1.6 million pesos, procurement of equipment for lab: 0.7 million pesos, storage and other building construction: 3.1 million pesos)
Total Benefit			77.1 million pesos			
Internal Rate of Return			13%			
Implementation Years			11 years	6 years	6 years	3 years
Number of Beneficiaries			3,500 farm households			
Implementation Agency			Ministry of Agriculture	Agricultural bank for the rural development fund and FEDA for the fund to the rural poor	Ministry of Agriculture	Ministry of Agriculture

Table 4.11.1 Salient Features of the Proposed Projects in the Yaque del Sur River Basin (2/5)

Sector	Agricultural Support Services			Irrigation and Drainage				
	Name of Project	Plan for Strengthening Extension Services	Plan for Market Information Systems	Plan for Agricultural Cooperatives	Night Storage Pond Project	Guarito San Juan Irrigation System Improvement Project	YSURAArea Irrigation Improvement Project	
Basic Concept of the Plan	The present extension work is carried out through the channel from Vice-minister of research and extension of central SEA, region, province to sub-zone. There are 178 of extension workers in the study area. The activities of extension work is limited due to (1) insufficient number of trained extension workers, (2) lack of transport facilities for extension workers and (3) lack of modern extension aids for technical transfer. The basic concept of the project is paid on special emphasis on improvement of the capability of the extension workers among above three constraints. For this purpose, education and training for all extension workers will be performed at the existing training centers at Barahona and San Juan.	There are no organizations that systematically provide data and information about prices of farm input and outputs, location of sale and market, market requirement classified by grade, list and activities of dealers on agro-processing and machinery. SEA provides irregular services of market information with farmers. At present, Agricultural Business Council (JAD) is undertaking the market information system in cooperation with SEA, custom office, Export Promotion Center, Suppliers of farm inputs, Associations of farmer's cooperatives, etc.. Under JAD in Santo Domingo there are several branches in which provincial agricultural cooperatives take part. Market information are exchanged between JAD headquarters and the branches. It is necessary to strengthen these market information system through reinforcement of communication equipment and staffing. The present member of the branches consists of only farmer's cooperatives. Participation of water user's organization, relevant agro-processing companies, etc., will be expected.	There are about 300 agricultural cooperatives at village level and 2 provincial associations of the agricultural cooperatives at San Juan and Azua provinces. These cooperative and associations are weak institutionally and provide poor services on market. The basic concept of the project is to strengthen institutional capacity of cooperatives by setting up new 2 provincial associations at Barahona and Bahoruco provinces. Also affiliation of the associations will be created at the basin level. Reinforcement of activities of the cooperatives should be carried out being paid with an emphasis on cooperative purchase and processing and marketing business.	The San Juan irrigation area suffers from the shortage of water resources. It is, however, difficult to develop new water source from the economic view point. At present the Government is aiming at the enhancement of irrigation conveyance efficiency by the improvement of irrigation canals with the provision of lining from the main canal to the tertiary canals and the related structures under PRODAS and PROMASIR.	This project aims at the increase of crop production and then of farmers' income by establishing the foundation, in which an improved farming technology can be introduced and improving the irrigation efficiency by changing irrigation water supply from present 24 hour supply to daytime supply by the provision of night storage ponds in the existing major systems, of which total irrigation area is 20,958 ha, such as (1) the Jose Joaquin Puello, (2) the Hato del Padre, (3) the San Juan, which are served by Sabanela Dam, and (4) the Mijo irrigation system, which is served by the Mijo river.	This project is the improvement of the existing Guarito San Juan irrigation system serving the irrigation area of 1,000 ha located in the south of the San Juan irrigation system area. The water resources are the river water of the San Juan river mainly composed of return flow from J.J. Puello and San Juan irrigation areas. This project is the plan to efficiently utilize limited water resources as same as the San Juan Irrigation District Night Storage Pond Project.	This project aims at the increase of crop yield and production and then increase of farmers' income by establishing the foundation, in which an improved farming technology can be introduced improving the irrigation efficiency by the provision of night storage ponds in the area and the provision of lining of the main canal in the earthen canal reaches.	YSURAArea is irrigated with water of the Yaque del Sur river diverted at Villarpardo and flowing through the YSURA Headrace, which is a transbasin canal to the Tabara river and then diverted by Tabara headworks. Drainage improvement program (PROMAIRES) financed by World Bank is scheduled to be implemented.
Content of the Plan	(1) All extension workers will be trained on four aspects: technical issues, methodological aspects, managerial aspects and organization aspects, (2) professional staff of SEA and universities will be assigned as trainees, (3) training programs consists of short course program, workshop, seminars, conference, field trips, etc., (4) procurement of necessary equipment and facilities for two training centers	(1) In addition to the present branches of San Juan and Azua provinces, new branches at Barahona and Bahoruco provinces will be established, (2) The Barahona branch will be set up in the present Coffee Producer's Association and the Bahoruco branch is instituted in Agricultural cooperatives that will become member of this system, (3) procurement of communication and office equipment necessary for making market information system among JAD headquarters and four branches, (4) education and training for system operators	(1) setting up of the Yaque del Sur farmer's Market Board, (2) establishment of 2 provincial farmers associations in Barahona and Bahoruco provinces, (3) technical guidance and training for the members of the Market Board and provincial associations and (4) procurement of necessary equipment and materials.	(1) Jose Joaquin Puello : construction of night storage pond at 15 sites, total storage capacity of 523,000 m3, earthwork volume of 550,000 m3 (2) Hato de Padre : construction of night storage pond at 3 sites, total storage capacity of 98,000 m3, earthwork volume of 120,000 m3 (3) San Juan : construction of night storage pond at 8 sites, total storage capacity of 263,000 m3, earthwork volume of 300,000 m3 (4) Mijo irrigation system : construction of night storage pond at 5 sites, total storage capacity of 114,000 m3, earthwork volume of 170,000 m3 (5) Improvement of canals and related structures.	(1) Construction of night storage pond at 2 sites, total storage capacity of 49,000, total earthwork volume of 70,000 m3, (2) Concrete lining of 8 km (3) Improvement of canals and the related structures.	(1) Rehabilitation and improvement of offakes and the canal related structures, 180 numbers in total, (2) Rehabilitation of canal lining damaged, (3) Repair or replacement of existing gates of Tabara headworks, (4) Bank protection works at Tabara headworks, (5) Construction of night storage ponds at 14 sites (361,000 m3 in total).		
Total Project Cost	30 million pesos (procurement cost of equipment and facilities : 2.1 million pesos, training cost : 7.5 million pesos, vehicles : 1.1 million pesos, operation cost: 10.6 million pesos, other cost: 1.5 million pesos)	7.5 million pesos (procurement cost : 0.7 million pesos, vehicle procurement : 0.6 million pesos, staff salaries : 3.1 million pesos, operation cost : 3.1 million pesos)	19.7 million pesos (procurement of equipment : 0.3 million pesos, guidance cost : 5.3 million pesos, education and training cost : 4.2 million pesos, staff salaries : 7.8 million pesos, operation cost : 2.1 million pesos)	841.5 million pesos (of them, construction cost for night storage ponds is 419.8 million pesos)	75 million pesos	459 million pesos		
Total Benefit				318.7 million pesos	16.3 million pesos	159.2 million pesos		
Internal Rate of Return				20%	14%	21%		
Implementation Years	6 years	6 years	5 years	6 years	2 years	3 years		
Number of Beneficiaries				5,800 farm households	268 farm households	4,500 farm households		
Implementation Agency	Ministry of Agriculture	JAD under supervision of the Ministry of Agriculture	Ministry of Agriculture	INDRAH	INDRAH	INDRAH		

Table 4.11.1 Salient Features of the Proposed Projects in the Yaque del Sur River Basin (3/5)

Sector	Irrigation and Drainage					
	Name of Project	YSURA Extension Area Development Project	YSURA Headrace Small Irrigation System Improvement Project	Yaque de Sur Lower Reaches Irrigation and Drainage Project	Galvan Groundwater Irrigation Project	Yaque del Sur Small Gravity Irrigation System Improvement Project
Basic Concept of the Plan	<p>YSURA extension area, 2,275 ha is located in the downstream of the YSURA irrigation area. The YSURA main canal is of earthen canal type in the extension area. The irrigation canals and the related structures are incomplete. Groundwater resources are expected especially in the lower part of the extension area.</p> <p>This project aims at the increase of crop yield and production and then increase of farmers' income by establishing the foundation, in which an improved farming technology can be introduced and improvement of the irrigation efficiency by the improvement of canal and related structures including canal lining and construction of night storage ponds and tubewells expecting the utilization of the groundwater resources as well as the surface water delivered from the YSURA canal.</p>	<p>The project area of 1,100 ha in total is distributed discontinuously along the south side of the YSURA headrace. Farmers divert water from the YSURA headrace through plastic pipes installed by themselves. The total amount of diverted water is assumed to be extremely more than the irrigation water demands.</p> <p>This project aims at the increase of crop yield and production and increase of farmers' income by establishing the foundation, in which an improved farming technology can be introduced and improvement of the irrigation efficiency by the improvement of the irrigation water management and the operation and conveyance efficiency. For this purpose, permanent intakes will be placed unifying the existing ones as much as possible and canals and related structures are improved.</p>	<p>The project area is 19,500 ha extending astride the Yaque del Sur river in the downstream of the Santana headworks. Of the project area, 13,800 ha is served by gravity irrigation systems such as the Santana canal system in the right bank and the Vicente Nobre canal system in the left side. The remaining areas are irrigated by pumps. The project area has disadvantage in the water availability especially in the dry season caused by the defective structures of the Villarpando headworks. Canals and the related structures have been deteriorated and the most of the canals are of earthen type especially in the Santana sugarcane area of 12,000 ha. The present irrigation efficiency seems to be lower than the other areas. The area of 5,600 ha currently served by pumps suffers from the unstable water availability caused by erratic electric supply. It has brought a decline in crop production. The project aims at the increase of crop yield and production and increase of farmers' income by establishing the foundation, in which an improved farming technology can be introduced by the improvement of the irrigation water management. For this purpose, (1) irrigation water supply is shifted from 24 hour supply to the daytime supply by provision of night storage ponds, (2) Santana headworks and the Santana and Vicente Nobre canal systems are improved, and (3) an irrigation canal is newly constructed along the left bank of the Yaque del Sur river so as to connect to existing pump irrigation systems as much as possible.</p>	<p>An alluvial fan develops along Neyba - Galvan road in the extent of about 15 km in the east-west direction and 3 km in the north-south direction in the foot of the Neyba mountains. According to insufficient data, it is expected that a tubewell produces 20 to 30 litre/sec and an area of 540 ha in total can be irrigated.</p>	<p>The project objective areas are 7,500 ha in total consisting of (1) irrigation areas, 2,790 ha in total located along both banks of the Yaque del Sur river in the reaches from Los Guiros to the Santana weir, (2) irrigation areas, 2,370 ha in total located along both banks of the Yaque del Sur river in the reaches from Villarpando to Los Guiros, (3) Vallejueto irrigation areas, 495 ha in total located along the Los Baos river in San Juan Irrigation District, and (4) the other small-scale irrigation area of 1,850 ha. Small irrigation systems mostly divert water through free intakes without permanent structures or simple intakes. In the irrigation areas located along the Yaque del Sur river, irrigation systems especially intakes are sometimes damaged by flood. Most of the irrigation systems are composed of earthen canals and fragile. The project aims at the increase of crop yield and production and increase of farmers' income by establishing the foundation, in which an improved farming technology can be introduced by the improvement of the irrigation water management. For this purpose, the project includes (1) construction of an intake structure equipped with a steel gate and improvement of a main canal and an access road for the areas of the above (1) and (2), and improvement of irrigation canals and the related structures in the other areas.</p>	<p>O&M of present irrigation and drainage systems are carried out by INDRHI in the area where no water user organization (WUO) exists. Even in the area WUO exists, INDRHI is substantially involved in O&M works. This O&M plan proposes that WUO carries out O&M works for irrigation and drainage facilities under his responsibility. After WUO functions, the Irrigation District office will function as a superintendent and a technical assistant, and prepare overall water distribution program in his jurisdiction. Small distribution canals and field canals will be maintained by farmers' themselves of every Nucleuses as a communal work. Major facilities such as headworks, main and lateral canals, the related structures, night storage ponds, and major drainage canals will be maintained by the staff employed by WUO on WUO's responsibility. In case of the emergency repairing or a large-scale maintenance, the Irrigation District Office will assist WUO to repair the damaged portion or to carry out the large-scale maintenance works mobilizing construction equipment owned by the Irrigation District office.</p>
Content of the Plan	<p>(1) Concrete lining about 20 km in main and lateral canals, (2) Construction of distribution and field canals, (3) Construction of two night storage ponds (total storage capacity of 55,000 m³) (4) construction of tubewells about 60 numbers and small-scale sprinkler irrigation systems.</p>	<p>(1) Construction of steel pipe intakes equipped with valves at about 75 sites along the YSURA head race, (2) Improvement of canals and the related structures.</p>	<p>(1) Improvement of Santana Headworks (Replacement of sand flushing sluices: steel roller gates 2 sets, 3 m x 3 m, and intake structures with steel slide gates 1.5 m x 1.5 m, rehabilitation of the overflow-type weir and banks), (2) Improvement and construction of canals of about 900 km in total and the related structures serving 20,000 ha, (3) Construction of a siphon, about 150 m in length from the Santana intake across the Yaque del Sur river, (4) Construction of night storage ponds at 10 sites for the left bank area (total storage capacity of 540,000 m³), (5) Construction of night storage ponds at 17 sites for the Santana and right bank area (total storage capacity of 580,000 m³), (6) Drainage canal system improvement, and (7) Construction of night storage ponds at 4 sites for the other areas (total storage capacity of 110,000 m³)</p>	<p>(1) Construction of tubewells at 18 to 20 points, (2) Construction of irrigation systems.</p>	<p>(1) Construction of intake structures equipped with a steel slide gate, about 40 sites, (2) Canal lining of 1 km in each irrigation system and protection measures against flood, (3) Construction of an access road, and (4) Improvement and construction of canals and the related structures.</p>	<p>A cropping program and an irrigation schedule are essential for proper water management. They will be prepared before the planting season. Then, based on the schedule, water is released from the dams and diverted at the intake of each of irrigation systems. For these system operation as well as maintenance works, WUO will be set up as stated in plan for strengthening WUOs.</p>
Total Project Cost	353.7 million pesos	51 million pesos	2,424 million pesos	65.5 million pesos	382.1 million pesos	
Total Benefit	24.8 million pesos	22.4 million pesos	688.7 million pesos	25.8 million pesos	130.6 million pesos	
Internal Rate of Return	5%	24%	18%	24%	22%	
Implementation Years	3 years	3 years	7 years	3 years	3 years	
Number of Beneficiaries	1,300 farm households	740 farm households	4,400 farm households	?	3,650 farm households	20,700 farm households
Implementation Agency	INDRHI	INDRHI	INDRHI	INDRHI	INDRHI	INDRHI

Table 4.11.1 Salient Features of the Proposed Projects in the Yaque del Sur River Basin (4/5)

Sector	Irrigation and Drainage	Rural Infrastructure development		Rural Road Improvement Plan	
Name of Project	Plan for Strengthening WUOs	Magueyal Mini-hydro development Project	Rural Water Supply Plan	Other Social Infrastructure development Plan	
Basic Concept of the Plan	Water users will set up WUO in every irrigation systems one by one getting full assistance from INDRHI and then the Irrigation District and Zone offices will transfer O&M works to WUOs. For this purpose, WUOs will be reinforced. The organization is similar to the Sabana Dam Irrigation Committee (SIC) or the YSURA Canal Irrigation Committee (YIC) in principle. The organization is constituted by three or four hierarchy such as (1) nucleus (20 to 60 ha), (2) sub-committee (100 - 1,000 ha), (3) association (1,000 - 10,000 ha), and (4) irrigation committee (one organization in one river).	Generation of the electricity in the Study area is absolutely short, in which deficit would be covered by the development of new power stations. To cope with the rural electrification, INDRHI has a strong intention to develop some hydropower stations, both dam projects and mini-hydropower stations in the Yaque del Sur river basin. The potential projects have been identified since early 1970's, and the INDRHI made various studies and designs, most of which however have not been realized so far, due mainly to the lack of budgetary arrangement and the relevant data and information have been mostly lost. Since promising dam project has not been identified based on the present water balance study, it can be said that the mini-hydropower development has some advantages considering its urgent necessity. For the Magueyal project, a mini-hydropower station is planned to be constructed on the existing YSURA headrace utilizing maximum the canal water (25 m ³ /sec) taken at Villarpando intake for power generation after discharging water downstream for the YSURA irrigation area. After power generation, tail water is flowing to the tributary of the Yaque del Sur river and finally returned into the Yaque del Sur river, not affecting the water distribution for the proposed irrigation projects. This scheme needs also more detailed investigation including topographic survey and geological study.	The ratio of the rural water supply in the study area is about 10% lower than the national average. Bahoruco province and the hilly areas in Azua and San Juan provinces are worth especially. INAPA has various plans and projects for the development of the rural water supply, and the projects are to be formulated within the framework of the national policy and INAPA program. In the present master plan study, a target is preliminary set up to achieve that the ratio of rural water supply catches up with the national average level, particularly in the depressed area. These rural water supply schemes depend their water sources on groundwater where it is expected and surface water in the hilly area.	Most of the rural roads are not sufficiently maintained in the study area due to the lack of financial resources, badly affecting the transportation of the farm input and products especially in the rainy season. Since construction of canal inspection roads are planned along the major canals in the present study which will be utilized as farm roads, improvement of the roads linking these inspection roads and villages are considered as rural roads. In addition, supply of maintenance equipment are included for the project in order to enable the local government to continuously maintain the farm road network. The responsible organization is assumed to be the public works section of the provincial office.	In the Study area, there exist a number of community halls, most of which are located in only center of some municipalities, while community halls are not found in the rural area and some other place are utilized for this purpose, for example schools, churches, villagers' residences. Community hall is therefore proposed to be constructed for not only villagers' meeting but also some training/education programs in the rural area. Meanwhile, establishment of water users' organization require their offices including space for their meeting. In the present study, construction of community halls and water users' office are proposed in the rural area.
Content of the Plan	Future jurisdiction of WUO is as follows: (1) In San Juan Irrigation zone, the existing SIC will extend the management to the San Juan and Guanito San Juan irrigation systems through the establishment of WUO in addition to the J. J. Puello and Hato del Padre irrigation systems. (2) As for Mijo system, an irrigation committee will be established under the assistance of PROMASIR. (3) YSURA area is managed by present YIC. (4) YSURA extension area is managed by a new WUO under YIC. (5) In the YSURA headrace area, nucleuses, sub-committees and then an association will be set up and then enters into YIC. (6) As for the area served by small gravity irrigation systems along the Yaque del Sur river, sub-committees and an association will be set up and enter into the proposed Irrigation Committee of the Yaque del Sur river (ICYDSR). (7) As for the lower reaches, sub-committees and an association will be set up and enter into ICYDSR. Setting-up of WUO will be implemented by the following procedure: - Identification of resources - farmers and leaders' capability, education level, will, organizer's ability, physical conditions, water availability, condition of irrigation and drainage facilities, etc. - Setting-up of an executing team and preliminary orientation to farmers' leader and groups - Selection of pilot project areas and orientation to farmers' leaders and farmers belonging to the selected areas - Formation of nucleuses and training about O&M of facilities and administration management - Formation of sub irrigation committees in a lateral level or a pump station level and support of them - Transference of irrigation water management in their irrigation systems. - Formation of the irrigation association and then irrigation committee.	1) Construction of the Magueyal mini-hydro power station - Intake structure at YSURA headrace and settling basin - Pen stock 120 m and spillway channel 120 m - Tailrace canal 1,600 m and culvert on the national road - Power plant 2,600 kW - Transformer plant and transmission line 2) Improvement of Villarpando intake structure and YSURA headrace - Additional installation of intake gates (1.9 m x 2.5 m x 3 nos.) - Improvement of culvert	Rural water supply project by the surface water 1) 4 nos. in Azua province 2) 2 nos. in San Juan province 3) 1 nos. in Bahoruco province Rural water supply project by the surface water 1) 2 nos. in Bahoruco province 2) 1 nos. in Barahona province The design capacity is estimated with the unit requirement of 150 lit/day/person and according to the population projection in 2010. Construction work includes 1) tube well, 100 m and pumps, 0.5m ³ /min. or intake facilities and settling basin, 2) supply pipe, 3) reservoir, 4) booster pump, 5) distribution pipe and 6) elevated tank.	Total length of the rural road improvement is estimated at 1) 40 km for the rehabilitation of national rural road, 2) 248 km for the improvement of national rural road and 3) 141 km for the improvement of local rural road. Standard of the work includes repair of the impassable section, rehabilitation, additional pavement where required, shaping of unpaved road and repair / installation of road related structures. Road maintenance equipment to be supplied are bulldozers, back hoes, motor graders, water tanker, dump trucks, macadam rollers and their garages	1) Water user's office - Azua area 4 nos. - Bahoruco area 2 nos. - Barahona area 1 nos. 2) Community hall - Azua area 9 nos. - San Juan area 3 nos. - Bahoruco area 3 nos. - Barahona area 4 nos.
Total Project Cost		250 million pesos	115 million pesos	367 million pesos	198 million pesos
Total Benefit					
Internal Rate of Return					10 years
Implementation Years		6 years	10 years	10 years	10 years
Number of Beneficiaries	20,700 farm households				
Implementation Agency	INDRHI				INDRHI

Table 4.11.1 Salient Features of the Proposed Projects in the Yaque del Sur River Basin (5/5)

Sector	Environmental Conservation		Water Resources Development		Overall Water Management in Yaque del Sur River Basin
	Name of Project	Reforestation Plan in the Upper watershed Area of Grande River	Wildlife Conservation Plan in Rincon Lagoon	J.J. Puello Dam Development Project	Sabana Yegua Dam Rehabilitation Project
Basic Concept of the Plan	Most of the upperbasin of the Yaque del Sur river is steep. The squatters in the basin have performed shifting culture which seriously affected vegetation in the basin. As a result, an annual transported sand sediment becomes 2.5 mm, which has seriously affected sedimentation of Sabaneta and Sabana Yegua dams. At present, PRODA's carried out soil conservation program in the upperbasin of San Juan. SEA performed soil conservation program in the Las Cuevas river basin in the Azua province. The concept of the project is that pilot reforestation scheme will be performed for the soil conservation. The location of the scheme will be the area along the Arroyo Limon river, a tributary of the Grande river, a tributary of the Yaque del Sur river. Along with the reforestation, the squatters should carry out an appropriate land use instead of shifting culture. For this purpose, introduction of the sedentary agriculture will be promoted for increasing farmer's income. Implementation of the project will be carried out by p	There are variable wildlife in and around the Rincon Lagoon. After the completion of Sabaneta and Sabana Yegua dams, river discharge at Palo Alto decreases 1/2 to 1/3 of previous one during the rainy season from August to December and the level of the Rincon seems to decrease. It is said that such situation gives the environmental change for the wildlife. It is necessary to conserve such variable fauna and flora. At present, there are few information of wildlife and environmental conditions around them. The basic concept of the project is to collect and monitor information of wildlife and environmental conditions around them for long time.	According to a water balance simulation under the proposed conditions, the total irrigation demand for the irrigation area of Sabaneta dam is 200 MCM out of 270 MCM inflow into the reservoir. A dam reservoir is proposed along the José Joaquín Puello Canal in order to increase local agricultural income. The design capacity of the headrace canal is 8 m ³ /sec, and any remaining capacity over and above the irrigation demand will be utilized to feed the reservoir. The reservoir will also perform the functions of regulating reservoir levels to decrease operational losses caused by 24-hour water supply.	Since the peak flood inflow in the completion year of the Sabana Yegua dam exceeded the designed value, the maximum flood recharge rate had to be re-estimated. With the new result that the existing spillways cannot accommodate the re-estimated flooding, the maximum operation level (MOL) of the reservoir is currently maintained at 10 m lower than the designed MOL of 396 m. This 10 m difference in water levels is equivalent to a storage loss of 100 MCM. The aim of this project is to improve the emergency spillway and raise the maximum operation level in order to achieve the designed volume of water to be held by the reservoir. After completion of the rehabilitation works, a flood warning system will be put in place taking into account the proposed flood release through the improved spillway. The dam will be operated under an overall water management plan.	Optimization of very limited water resources in the Yaque del Sur River basin is a key issue in the basin development. It is necessary to distribute water under an efficient management plan covering the entire basin including the Sabaneta and Sabana Yegua dams. The Villarpando headworks, which divert water to the Azua irrigation area and to the Yaque del Sur and Lago Enriquillo irrigation areas, do not distribute water properly especially during dry periods owing to structural deterioration of the facilities. Further, the headworks are solely operated by the Azua Irrigation District Office despite the headworks irrigating three Irrigation Districts. In terms of overall water management, real time and accurate water management are not being achieved due to the absence of an adequate tele-communications system. This project aims at optimal basin water management consisting of: (i) the improvement of structural deterioration of the Villarpando headworks, (ii) the establishment of a Yaque del Sur Water Management Center to conduct overall water management in the basin as an organization independent of the Irrigation District Offices, (iii) the setting up of a telemetering system, a flood warning system, a real time and adequate water distribution system, and a data control system (data transmission, monitoring and operation management, data processing), and (iv) training of staff working in water management.
Content of the Plan	(1) objective village and participatory farmers (La Majaguit, Gajo de Monte, Mata de Café and Vallecito, 720 farmer), (2) reforestation area: 720 ha, (3) detailed plan of the project, (4) legal action for the squatters, (5) formation of farmers and education and training, (6) construction of 3-nursery with 1,500m ² each, (7) reforestation, (8) construction of 27 km- rural roads and (9) monitoring for condition of reforestation, fire-control, etc.	(1) bench mark survey for variable flora and fauna in and around the Rincon Lagoon, (2) monitoring survey, (3) provision of equipment and facilities necessary for monitoring	The detailed design and construction of a rock-fill type dam of 9.5 MCM total capacity, 670,000 m ³ dam embankment volume, and a 425 m crest length. The catchment area of the dam is 9 km ² and the designed flooding rate is estimated at 200 m ³ /sec. Due to its small catchment, sedimentation volume is also estimated to be comparatively small at 10 % of the total reservoir capacity over 50 years. It is necessary to optimize the dam size on the basis of water balance simulation results.	(1) rehabilitation of the emergency spillway, (2) installation of a flood warning system as a part of the telemetering network system, (3) dam operation during dry periods using a standard drought storage curve.	(1) construction of the Yaque del Sur Water Management Center, (2) installation of the telemetering system, (3) rehabilitation of the Villarpando headworks, replacement of gates and lifting devices, slide gates (1.9 m x 2.5 m, three gates), and a sand flushing gate (a four-meter-wide radial gate), (4) provision of a gated discharge sluice (5) implementation of staff training programs for the water management.
Total Project Cost	15 million pesos	4.6 million pesos	136.6 million pesos	371 million pesos for improvement of spillway	86.2 million pesos (rehabilitation of Villarpando headwork: 36.2 million pesos, telemetering systems and training: 51 million pesos)
Total Benefit					
Internal Rate of Return	5 years	10 years	5 years	3 years	6 years
Implementation Years	5 years	10 years	5 years	3 years	6 years
Number of Beneficiaries	720 farm households				20,700 farm households
Implementation Agency	INDRPH	The Ministry of Natural Resources	INDRPH	INDRPH	INDRPH