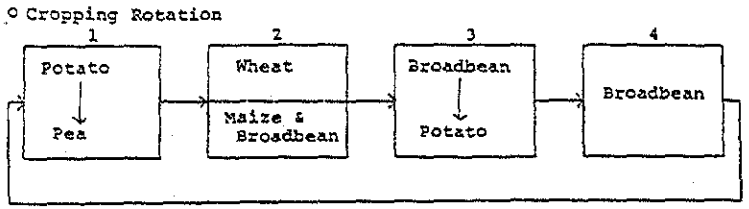
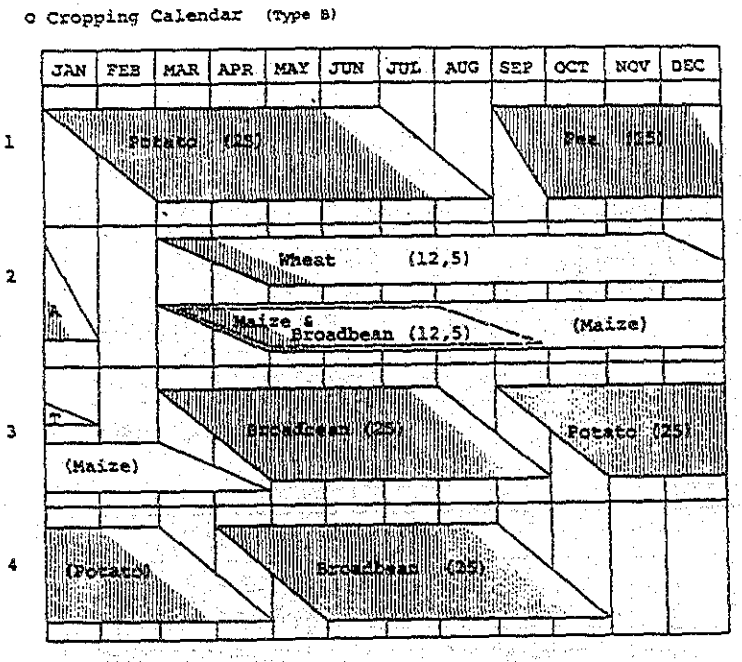
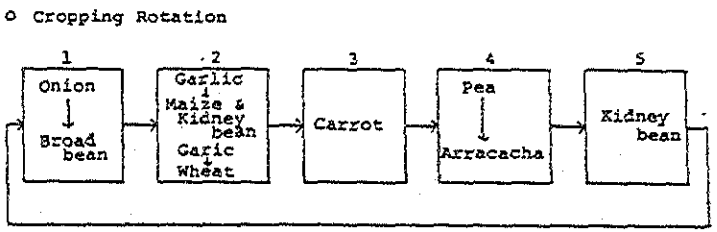
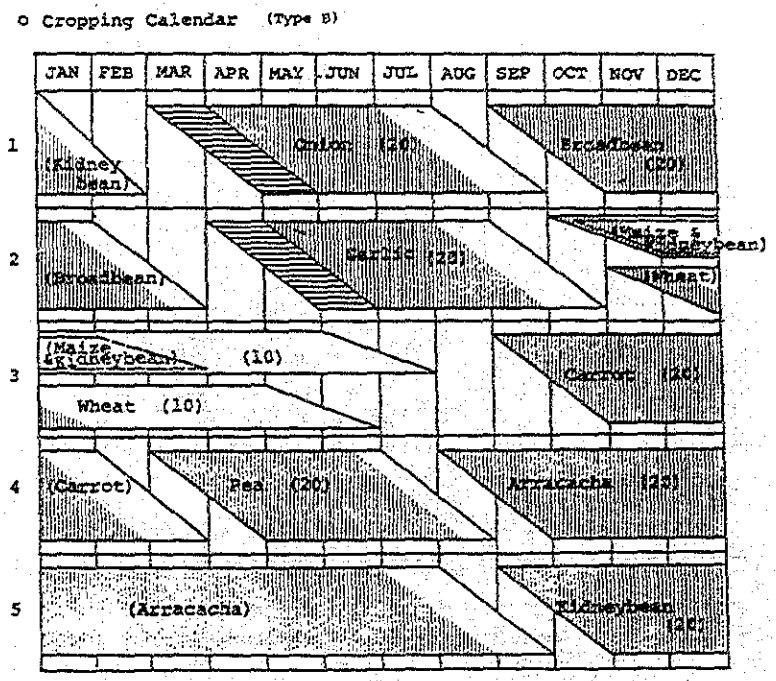




(1) San Pedro de Iguaque

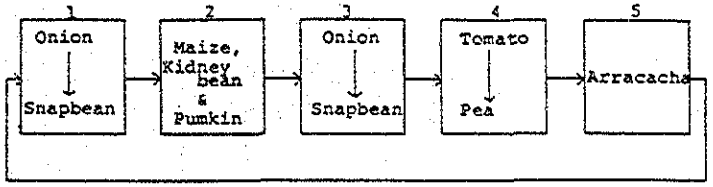




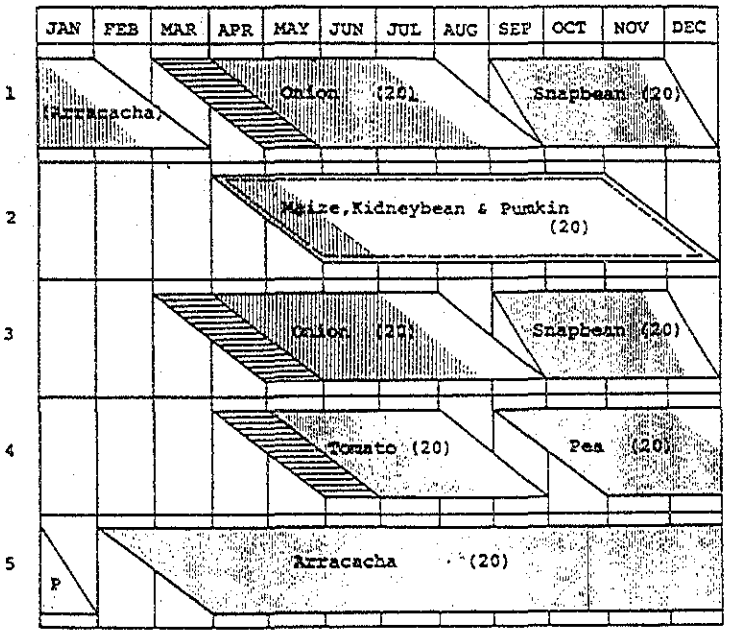
(2) Santa Sofia

Fig.D.2 **Cropping calendar in fields**
- Cropping Pattern Type B -

o Cropping Rotation

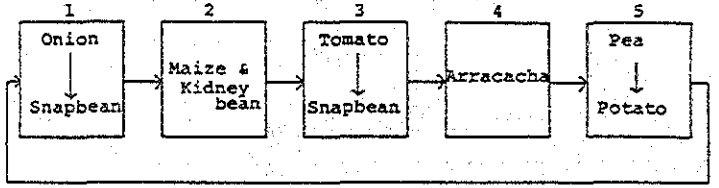


o Cropping Calendar (Type B)

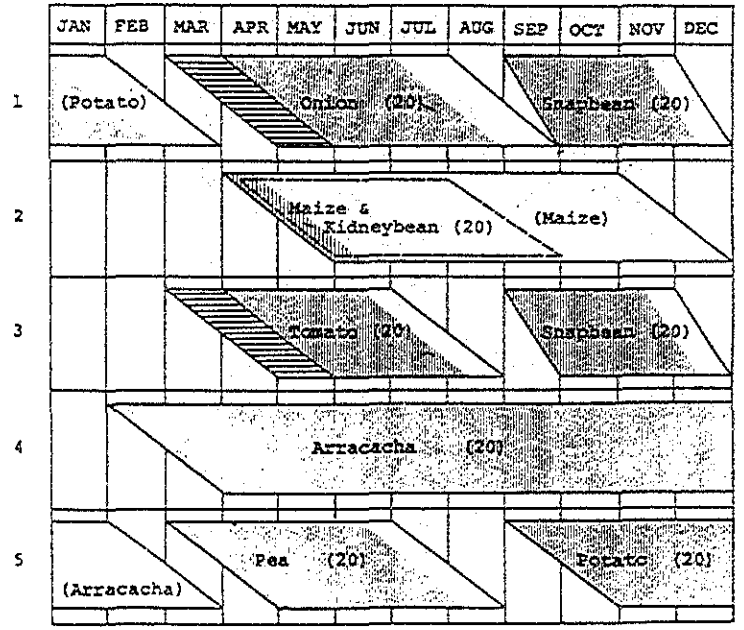


(3) Caqueza

o Cropping Rotation



o Cropping Calendar (Type B)



(4) Tibacuy

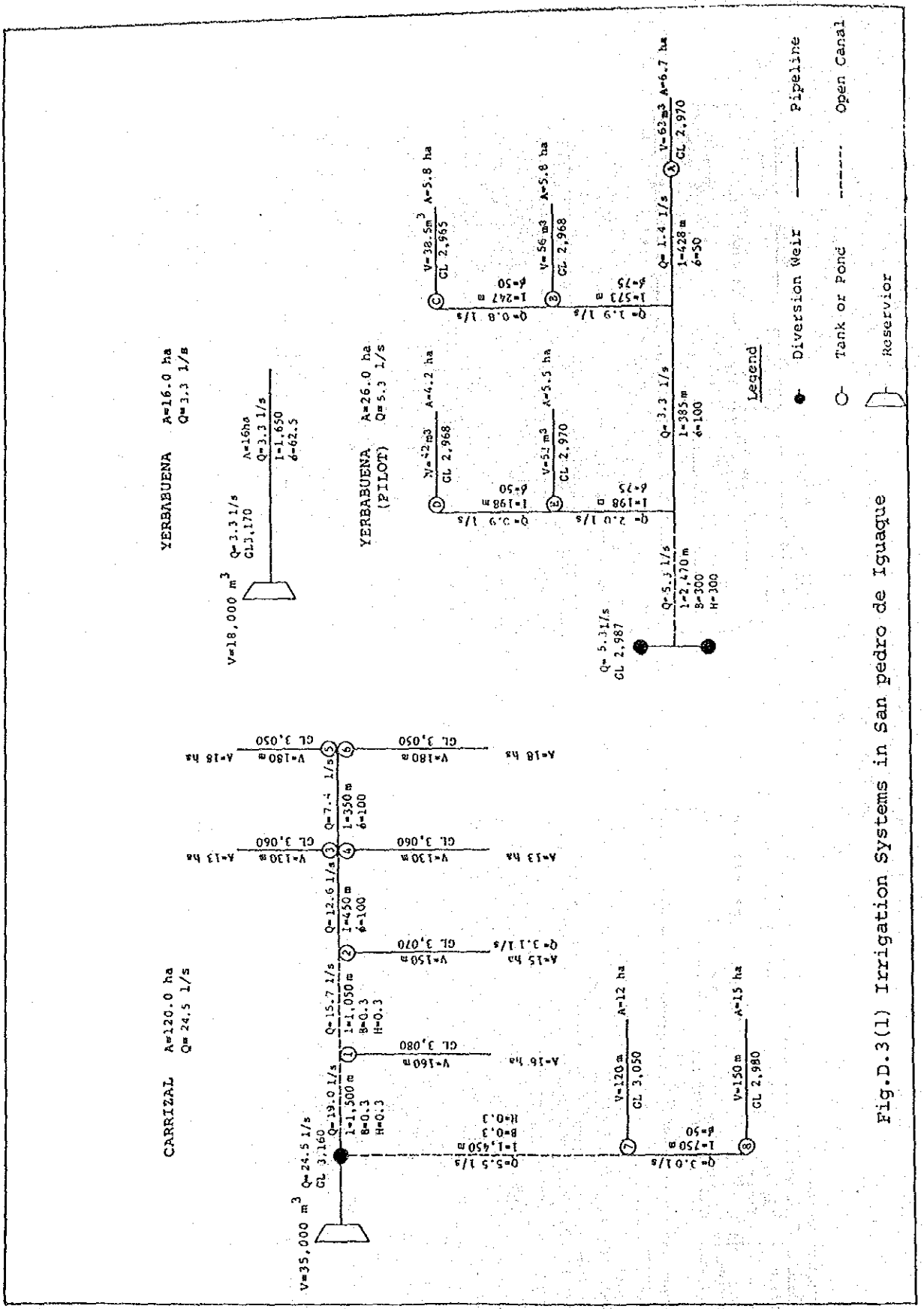


Fig.D.3(1) Irrigation Systems in San pedro de Iguaque

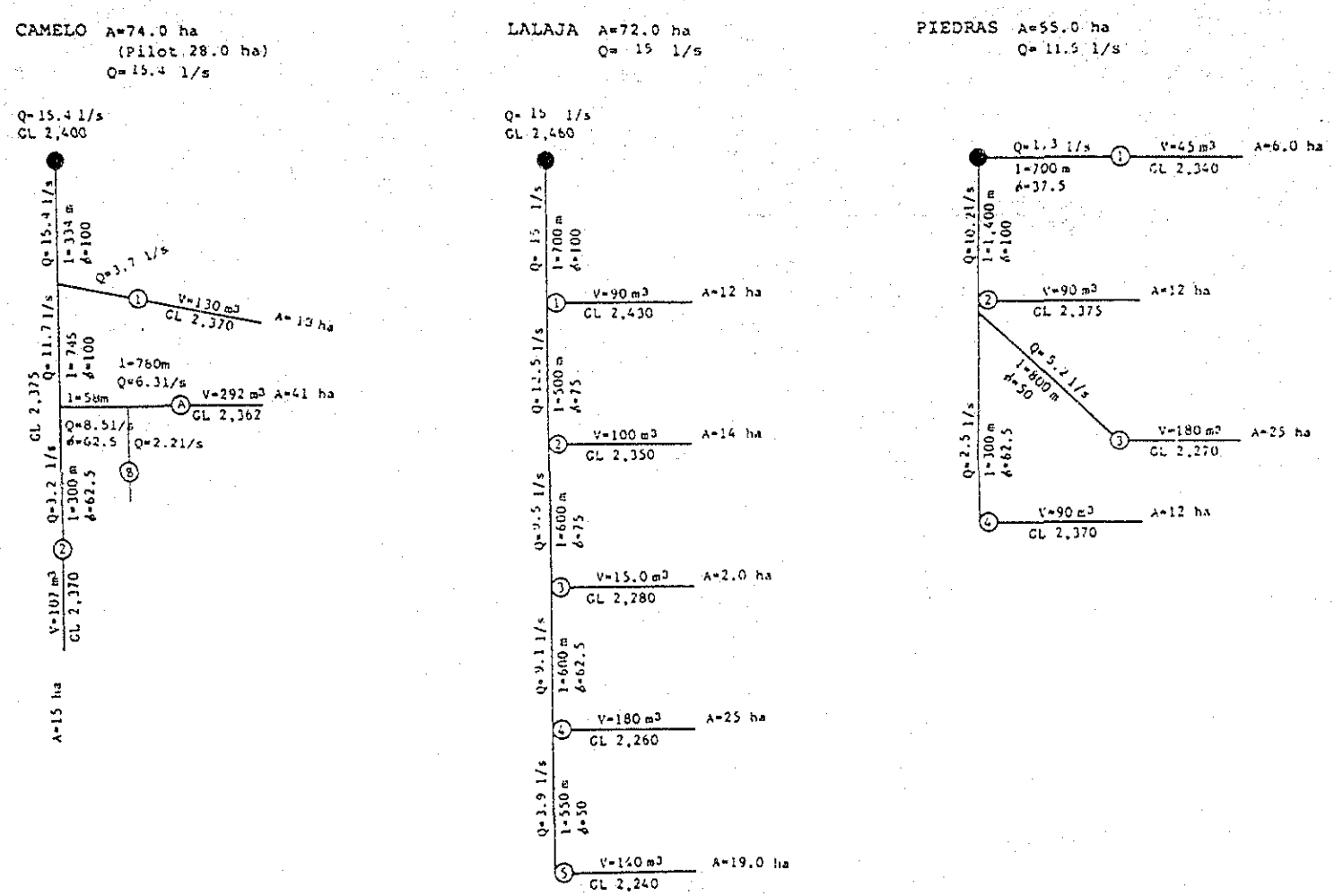


Fig.D.3(2)-1) Irrigation Systems in Santa Sofia

Fig.d.3(2)-2) Irrigation Systems in Santa Sofia

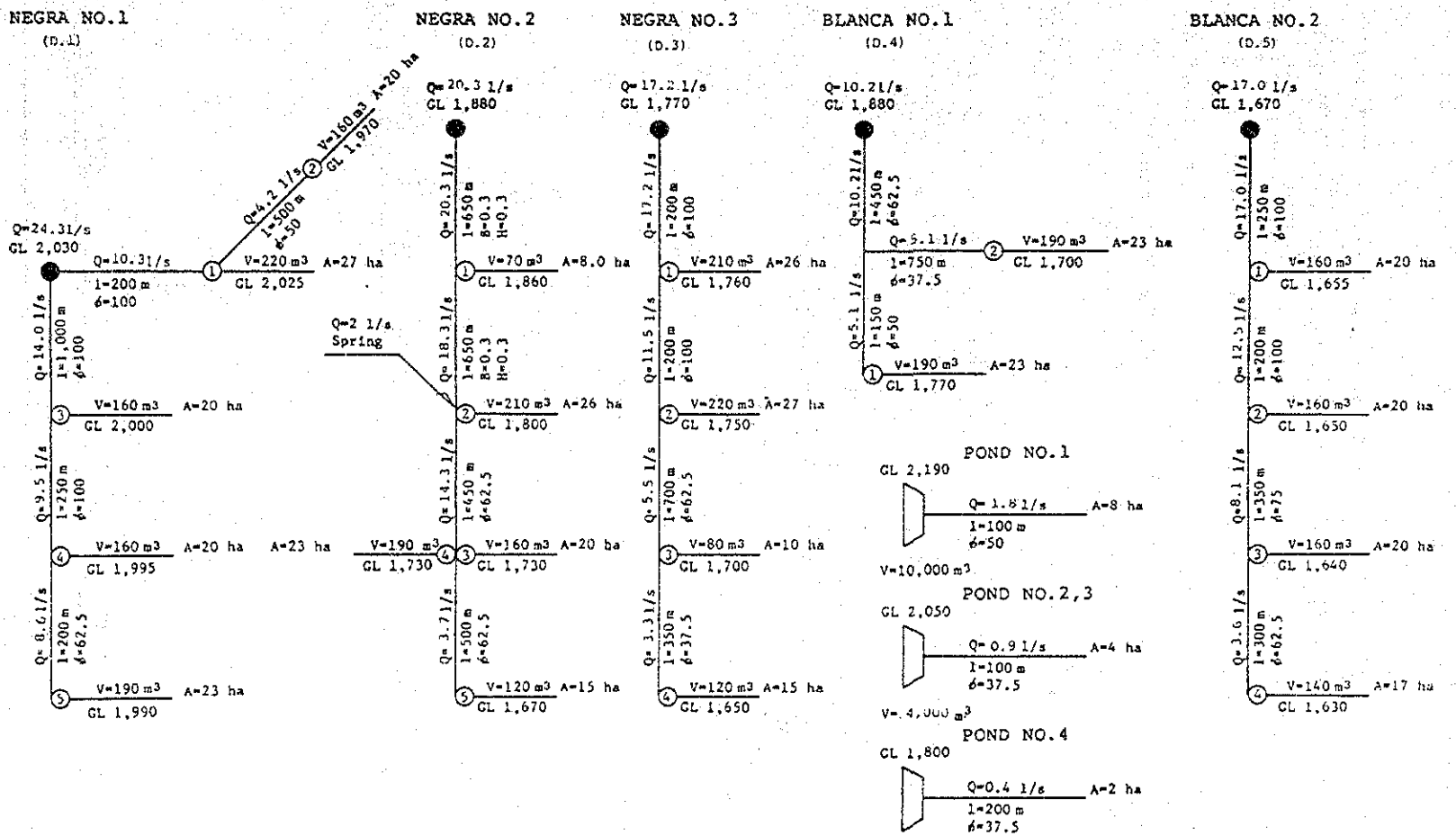


Fig.d.3(3) Irrigation Systems in caquesa

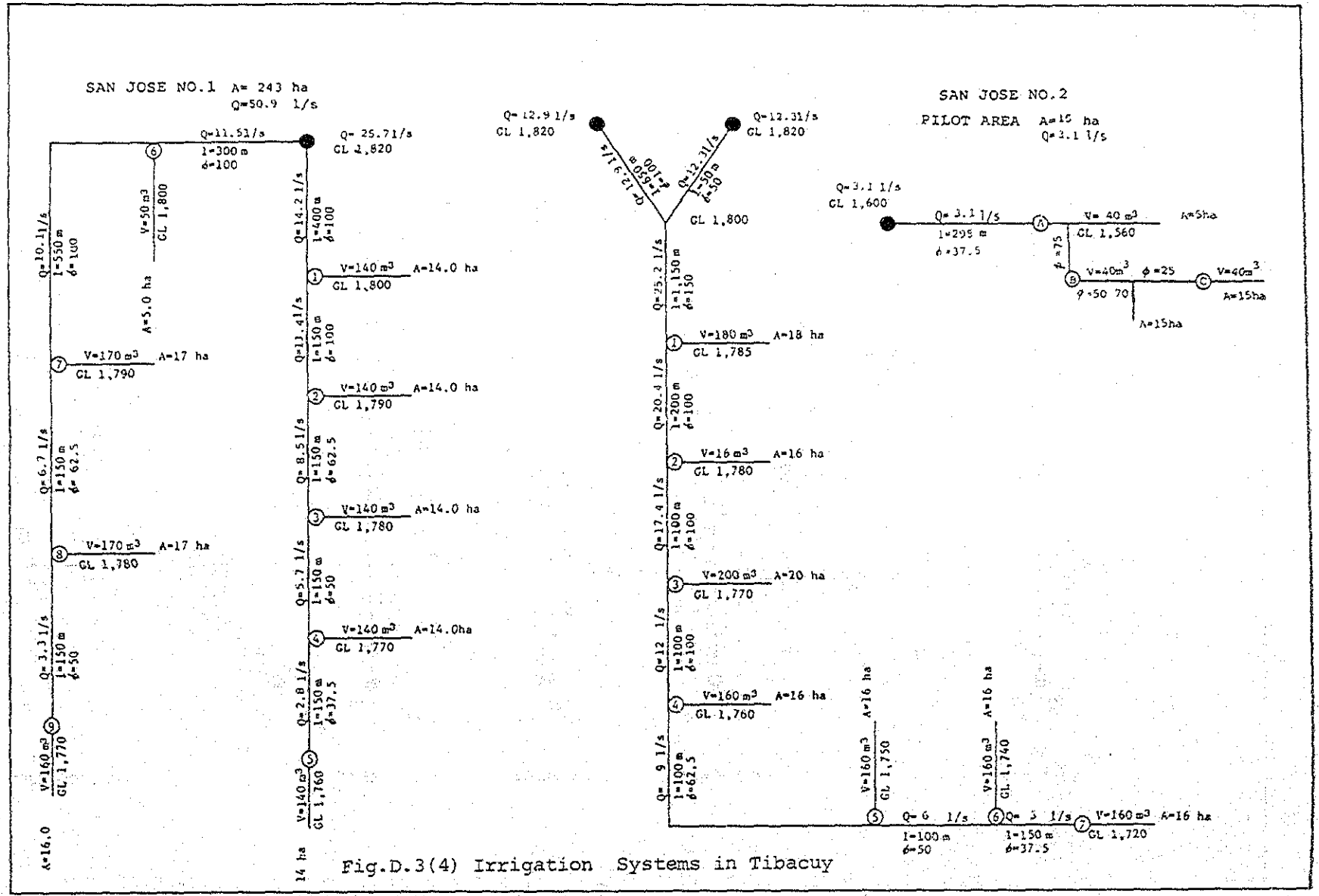


Fig.D.3(4) Irrigation Systems in Tibacuy

5. Study on Irrigation Water Shortage and Decrease of Crop Production

(In case of Carrizal Irrigation System, San Pedro de Iguaque Area)

As described in Annex D.3, the water balance study during 10 years from 1974 to 1983 was carried out in case of irrigable areas of 190 ha, 155 ha, 120 ha and 90 ha, adopting A type of proposed cropping pattern. Through the above-mentioned study, the decreasing ratio of the crop production in growing stage of the crops corresponding to the month when water shortage occurs was estimated, based on the conditions as shown in Fig. D.4 which is prepared referring the FAO Irrigation and Drainage Paper No.33.

For example, in case of 120 ha, the decreasing ratio of the crop production responding to the irrigation water shortage is as follows:

Table D.7 Water Shortage and Decreasing Production in Carrizal Irrigation System

Year	Month	Water Shortage mm	Water Shortage (%)	Decreasing ratio per one crop(%)	Decreasing* ratio per year (%)	Decreasing** production Col.$1,000
1974		0.0	0.0	0.0	0.0	0
1975	Jan.	6.84	14.4	6.0	3.0	14,000
1976	Jun.	4.64	12.9	4.0		
	Aug.	6.63	16.0	6.0	12.0	56,000
	Sep.	11.8	19.4	14.0		
1977	Jun.	6.07	9.3	3.0	1.0	5,000
1978	Jan.	53.4	12.0	6.0	3.0	14,000
1979		0.0	0.0	0.0	0.0	0
1980		0.0	0.0	0.0	0.0	0
1981		0.0	0.0	0.0	0.0	0
1982		0.0	0.0	0.0	0.0	0
1983		0.0	0.0	0.0	0.0	0
Average					1.9	8,900

Benefit (127 - 8.9) x 1,000 x 120 = 14,172,000 Col.$

Note 1: * 1/2 of decreasing ratio per one crop is used for two crops year round.

Note 2: ** Annual gross income of San Pedro de Iguaque is Col.$467,000/ha.

Note 3: Annual benefit of San Pedro de Iguaque is Col.$127,000/ha.

An example on calculation of decreasing ratio in case of 50 % of water shortage in January and type A of the Proposed cropping pattern in San Pedro de Iguaque is shown below.

Name of crops	Cropping percentage %	Growing Stage	Decreasing ratio per one crop %	Decreasing per ha %
Potato	25.0	Maturing-Ripening	30.0	7.5
"	12.5	Ripening-Harvesting	15.0	1.9
Carrot	9.4	Ripening-Harvesting	15.0	1.4
Maize	12.5	Harvesting	-	-
Welsh Onion	25.0	Flowering-Maturing	50.0	12.5
Total				23.3

As the results of the study applying the above-mentioned calculation to all of the proposed irrigation system, the relationship among irrigated area, benefit and decreasing ratio is shown Fig. D.5.

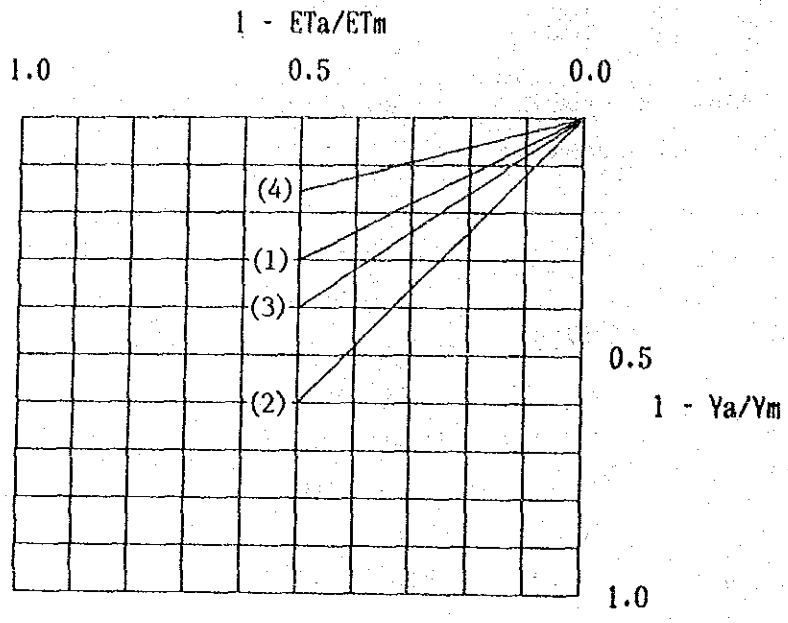
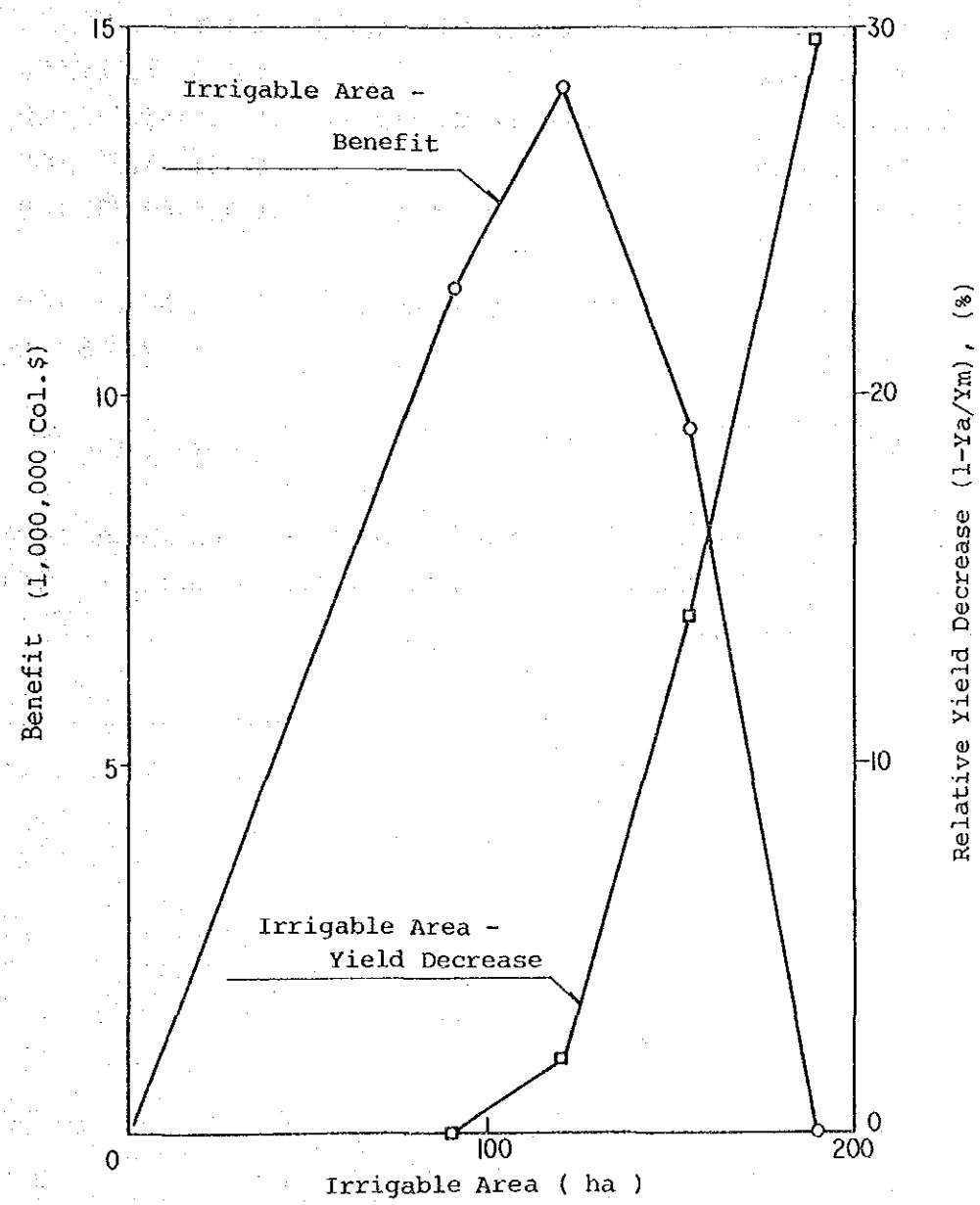


Fig. D.4 Relationship between Water Shortage and Yield

Note (1): Sowing Growing Period
(2): Flowering Period
(3): Maturing Period
(4): Ripening Period
ETa: Irrigated Water Amount
ETm: Maximum Irrigation Water Amount
Ya : Actual Yield
Ym : Maximum Yield
Applied range is 1 - ETa/ETm < 0.5
Ym : Estimated Value of Maximum Yield

San Pedro de Iguaque	(Cropping Pattern	A)	467,000 Col.$/ha
Santa Sofia	(- ditto -	A)	636,000 Col.$/ha
Caqueza	(- ditto -	B)	669,000 Col.$/ha
Tibacuy	(- ditto -	A)	761,000 Col.$/ha



Note; Ya:Actual Yield, Ym:Maximaum Yield

Fig.D.5 Relationship between Irrigable Area and Benefit in Irrigation System

6. Cost Estimation of Irrigation Facilities

Referring to the actual results of constructions for the similar projects, the construction cost was estimated including the physical contingency (15%).

Construction costs of each sub-project area are as follows:

San Pedro de Iguaque	(Including Pilot area)	Col.$ 33,251,000
Pilot area		Col.$ 7,825,000
Santa Sofia	(Including Pilot area)	Col.$ 42,363,000
Pilot area		Col.$ 5,012,000
Caqueza		Col.$ 62,388,000
Tibacuy	(Including Pilot area)	Col.$ 40,072,000
Pilot area		Col.$ 2,306,000
Total Cost		Col.$178,074,000

The breakdown of the costs above-mentioned is as shown in Table D.10. The cost of the laborers offered by the beneficiaries is included in the construction cost.

Table D.8 (1) Breakdown of the Construction Cost

(San Pedro de Iguaque)

Item	Description of the Work	Qty. Unit	Unit Price	Amount	Note
- Carrizal Irrigation System					
Carrizal Reservoir	Fill Type	1 place		2,135,000	Excavation 270m3 Banking 3,300m3
Diversion Weir	Concrete, Fixed Type	1 place		180,000	H=2m, L=4m
Driving Channel	Open Canal, Stone Pitching	4,000 m	326	1,304,000	
- do -	Pipeline, ϕ4"	800 m	1,046	836,800	
- do -	- do - ϕ2"	750 m	415	311,250	
Regulation Tanks	Reinforced Concrete	8 places	192,000	1,536,000	
Distribution Pipeline		120 ha	92,000	11,090,000	
Contingency				2,600,000	15%
Sub-Total				19,944,000	
- Yerbabuena Irrigation System					
Yerbabuena Reservoir	Fill Type	1 place		1,488,000	Banking 1,850m3
Driving Channel	Pipeline ϕ2-1/2"	1,650 m	649	1,070,850	
Distribution Pipeline		16 ha	138,000	2,208,000	
Contingency				715,000	15%
Sub-Total				5,482,000	

- Pilot Area			
Diversion Weir (No.1)		1 place	119,000
Connecting Canal	Pipeline, ϕ4"	105 m	103,000
Diversion Weir (No.2)		1 place	180,000
Driving Channel Open Channel	Stone Pitching	2,456 m	807,000
- do -	Pipeline, ϕ4"	1,148 m	1,440,000
Secondary Canal	Pipeline, ϕ2"-4"	1,636 m	1,117,000
Regulation Tanks	Reinforced Concrete	5 places	958,000
Distribution Pipeline		26 ha	1,943,000
Sprinkler Sets		48 sets	429,000
Miscella-neous works			779,000
Sub-Total			7,825,000
Total			33,251,000

Table D.8 (2) Breakdown of the Construction Cost

(Santa Sofia)

Item	Description of the Work	Qty. Unit	Unit Price	Amount	Note
Distribution Weir	Concrete Fixed Type	3 places	176,000	528,000	
Driving Channel	Pipeline, ϕ4"	2,100 m	1,075	2,257,500	
	- do -, ϕ3"	2,100 m	790	1,659,000	
	- do -, ϕ2-1/2"	1,900 m	649	1,233,100	
	- do -, ϕ2"	1,350 m	444	599,400	
	- do -, ϕ1-1/2"	2,200 m	353	776,600	
	Open Canal Stone Pitching	1,750 m	326	570,500	
Regulation Tanks	Reinforced Concrete	18 places	150,000	2,700,000	
Distribution Pipeline		211 ha	105,000	22,155,000	
Contingency				4,872,000	15%
Sub-Total				37,351,000	
Pilot Area (Camelo)					
Diversion Weir	Concrete Fixed Type	1 place	176,000	176,000	
	Pipeline, ϕ1-1/4"-4"	1,917 m	1,075	1,454,000	
Regulation Pond		2 place		433,000	
Distribution Pipeline		28 ha		2,734,000	
Sprinkler Set Contingency				214,000	
Sub-Total				5,012,000	
Total				42,363,000	

Table D.8 (3) Breakdown of the Construction Cost

(Caqueza)

Item	Description of the Work	Qty. Unit	Unit Price	Amount	Note
Reservoir No.1				1,330,000	Excavation 90m3 Banking 1,000m3
- do -, No.2				1,277,000	Banking 950m3
- do -, No.3				1,039,000	Banking 350m3
- do -, No.4				1,257,000	Banking 900m3
Diversion Weir		5 places	190,000	950,000	
Driving Channel	Pipeline, ϕ4"	2,300 m	1,075	2,472,500	
	- do -, ϕ3"	350 m	790	276,500	
	- do -, ϕ2-1/2"	2,600 m	649	1,687,400	
	- do -, ϕ2"	750 m	444	333,000	
	- do -, ϕ1-1/2"	650 m	353	229,450	
	Open Canal Stone Pitching	1,300 m	326	423,800	
Regulation Tanks		29 places	150,000	4,350,000	
Distribution Pipeline	Reinforced Concrete	417 ha	92,000	38,354,000	
Contingency				8,138,000	15%
Total				62,388,000	

Table D.8 (4) Breakdown of the Construction Cost
(Tibacuy)

Item	Description of the Work	Qty. Unit	Unit Price	Amount	Note
San Jose No.1 Diversion Weir	Concrete Fixed Type	3 places	171,000	513,000	L = 3m
Driving Channel	Pipeline, ϕ6"	1,150 m	2,343	2,694,450	
	- do -, ϕ4"	2,450 m	1,075	2,633,750	
	- do -, ϕ3"	400 m	790	316,000	
	- do -, ϕ2-1/2"	400 m	649	259,600	
	- do -, ϕ1-1/2"	300 m	353	105,900	
Regulation Tanks	Reinforced Concrete	16 places	186,000	2,976,000	
Distribution Pipeline		243 ha	98,000	23,814,000	
Contingency				4,453,450	15%
Sub-Total				37,766,150	
Pilot Area (San Jose No.2)					
Diversion Weir		1 place		171,000	1 = 4.5m
Driving Channel	Pipeline, ϕ1-1/2"	295 m		106,000	
Regulation Tank		3 place		557,000	
Distribution Pipeline		15 ha		1,472,000	
Contingency					
Sub-Total				2,306,000	
Total				40,072,000	
Note: Future Plan					
Palonegro Reservoir	Fill Type	1 place		1,988,000	Excavation 100m3 Banking 3,000m3

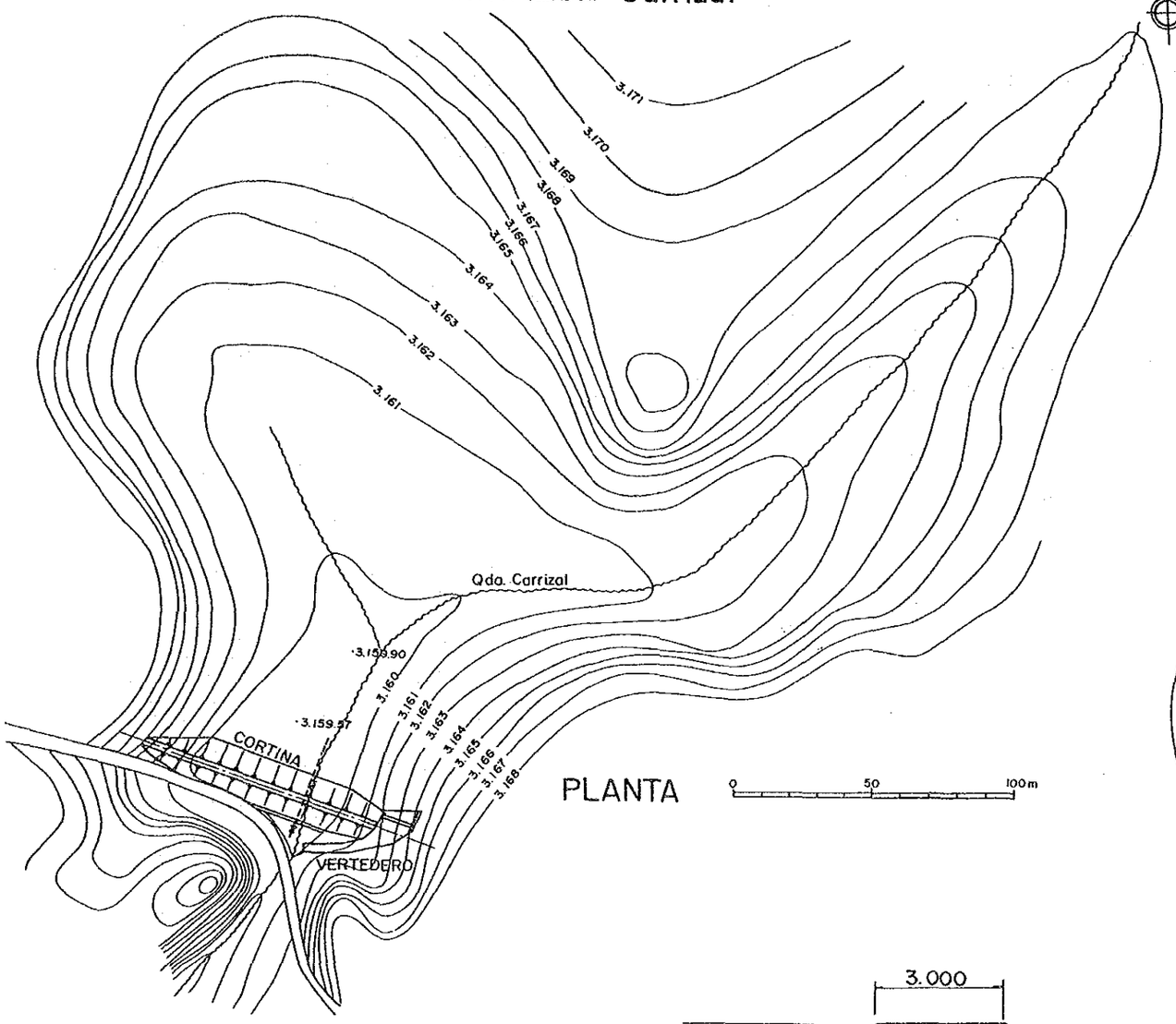
Table D.9 Administration Costs during Construction

(Per 2 Sub-Projects)

Item	Qty	Unit Price Col.$/month	Amount Col.$/month	Note
Engineer	1 person	87,705	87,705	
Assistant Engineer	2 persons	25,575	51,150	
Secretary	1 person	22,750	22,750	
Other Costs			162,275	
Total			323,880	

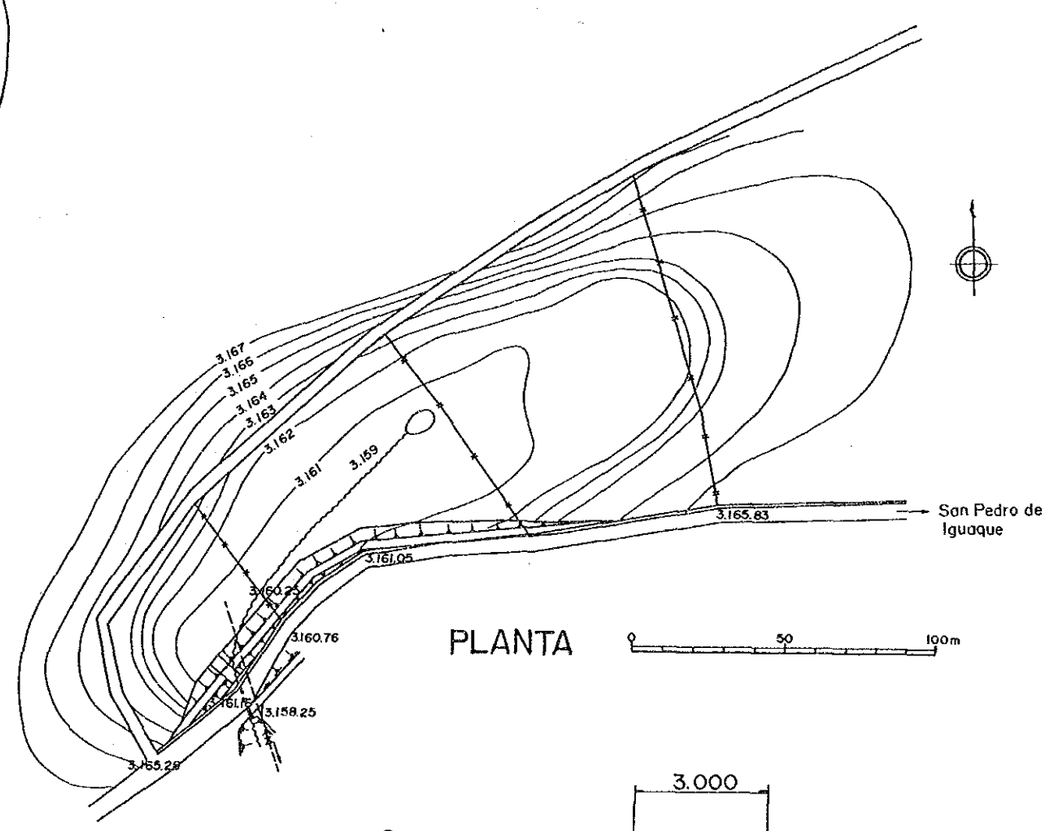
323,880 ÷ 2 = 161,940 Col.$/month/Sub-Project

EMBALSE Carrizal



PLANTA 0 50 100m

EMBALSE Yerbabuena



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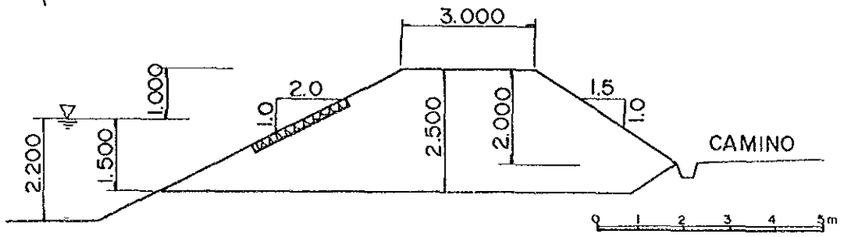

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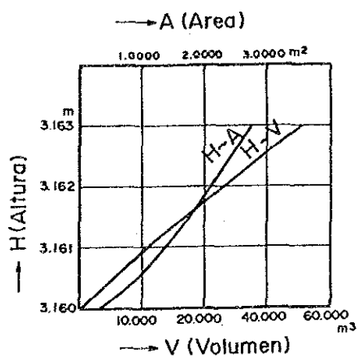
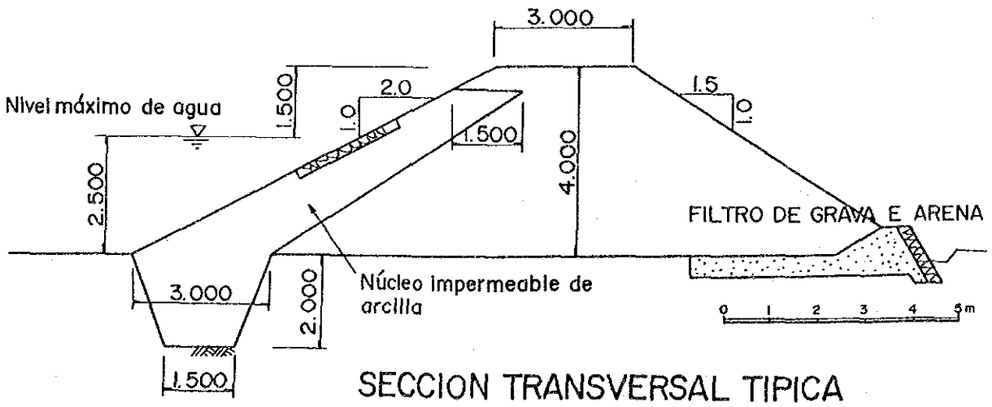


Curva de H~V y H~A



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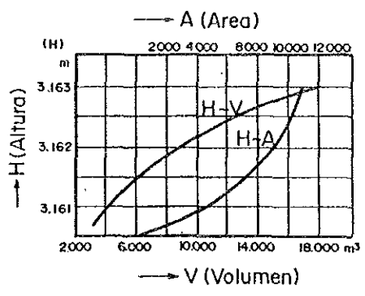
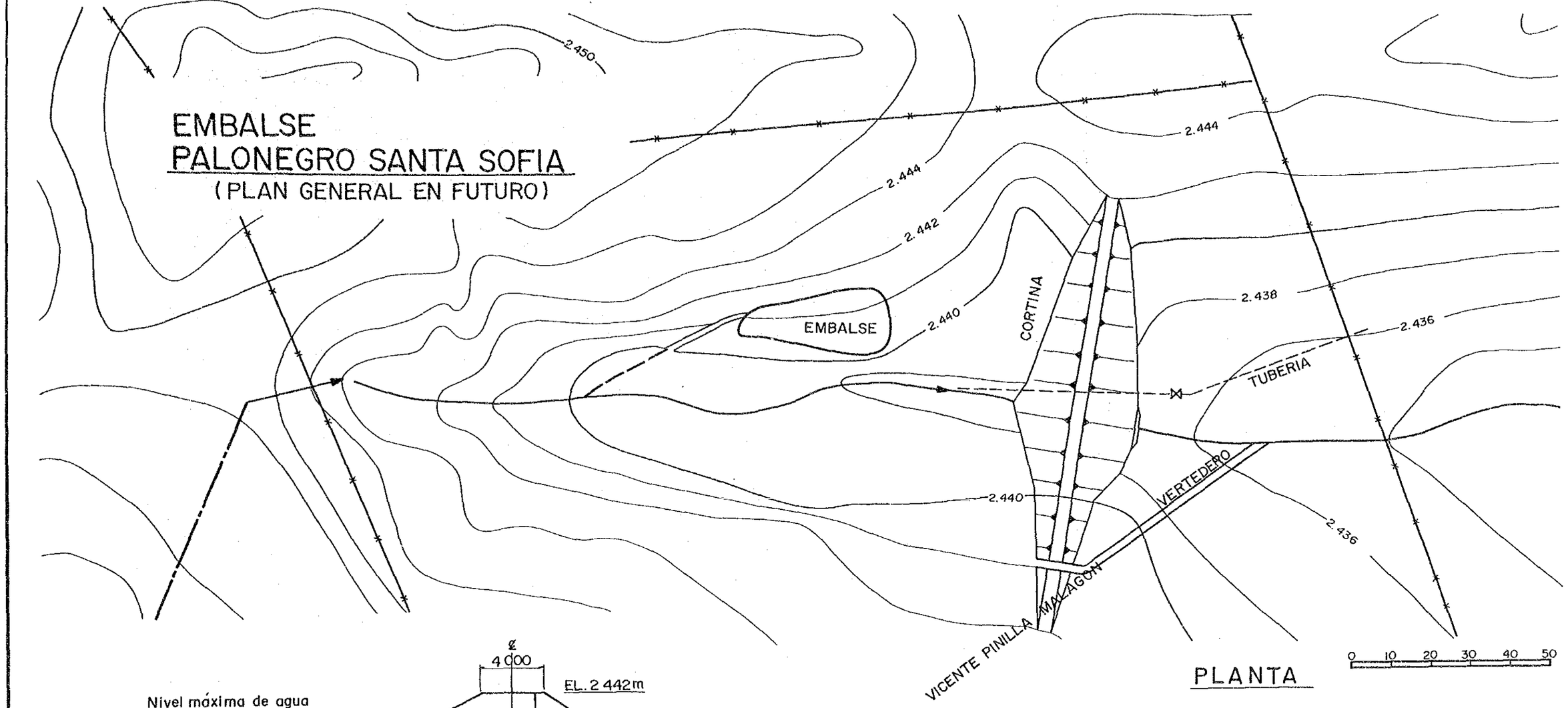


Curva de H~V y H~A

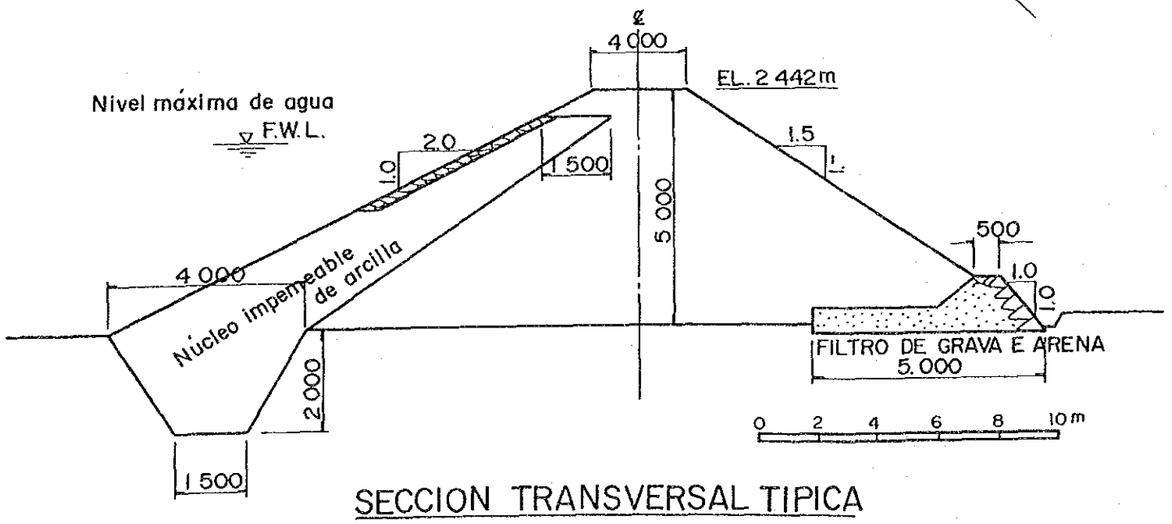
Fig. D. 6
Embalses Carrizal y Yerbabuena (San Pedro de Iguaque)

EMBALSE PALONEGRO SANTA SOFIA

(PLAN GENERAL EN FUTURO)



PLANTA



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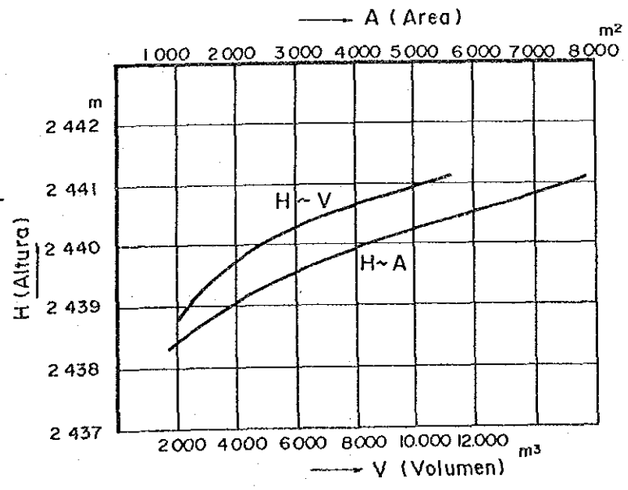
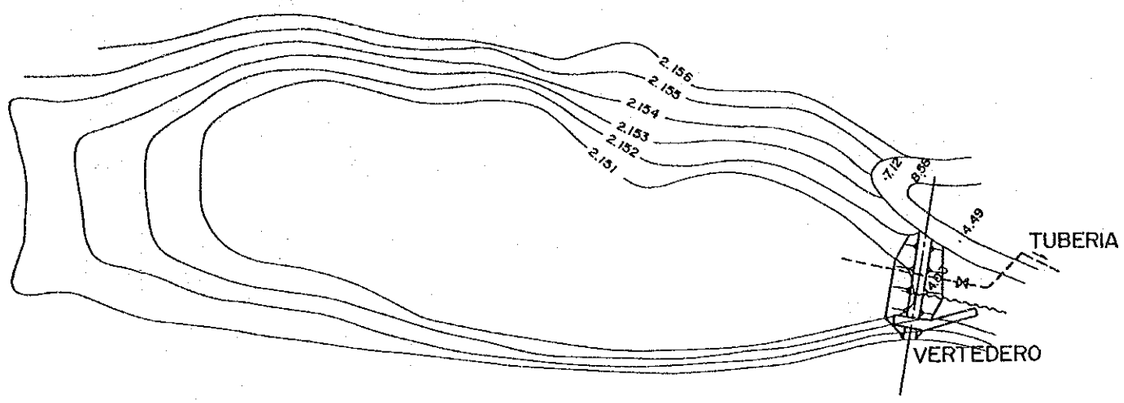


Curva H~V y H~A

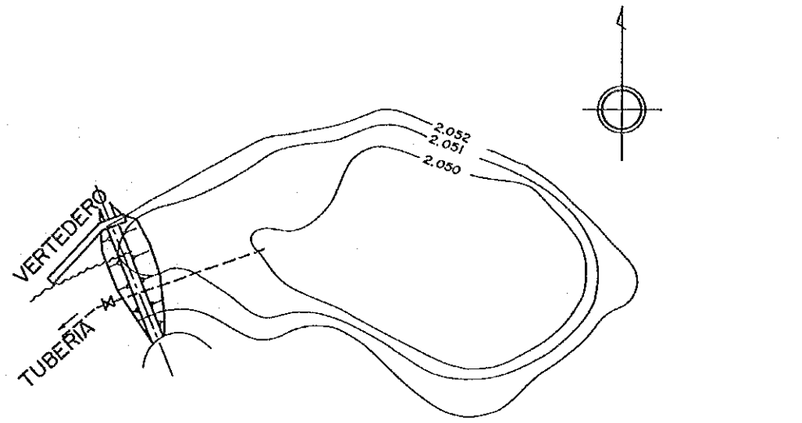
Fig. D.7
Embalse Palonegro
(Santa Sofía)
-Plan general en futuro-

EMBALSE Cáqueza NO.1



PLANTA 0 50 100m

EMBALSE Cáqueza NO.2



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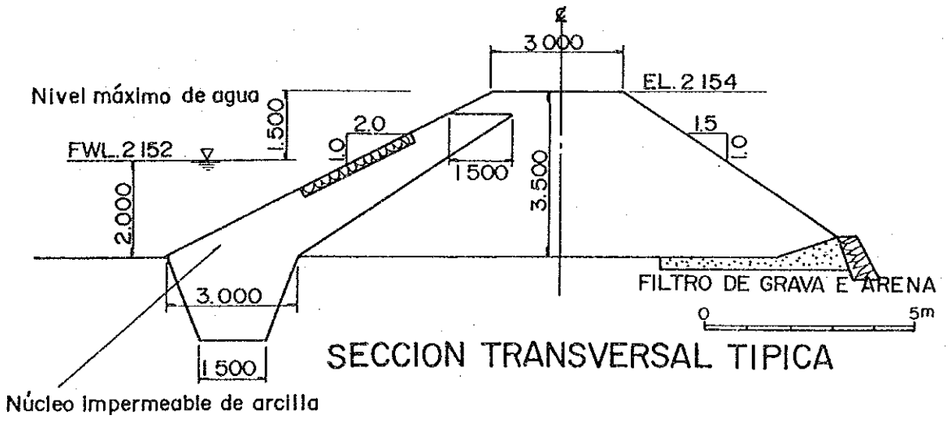

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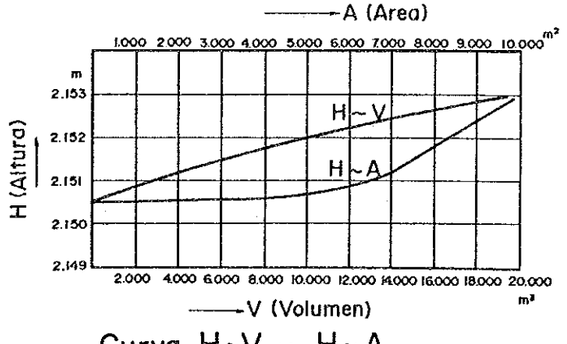

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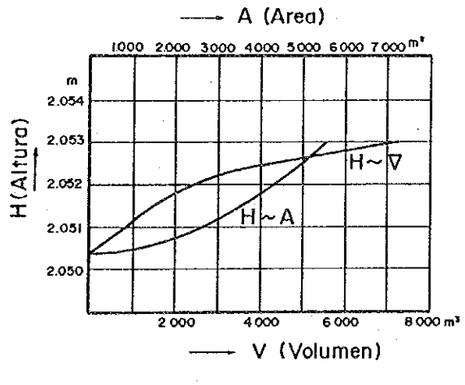

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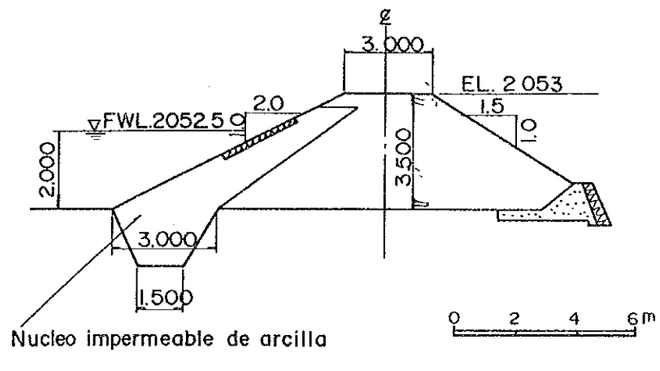

SECCION TRANSVERSAL TIPICA

Fig. D.8
Embalse Cáqueza Nº1 y Nº2
(Cáqueza)

ANNEX E ECONOMIC EVALUATION

E. Economic Evaluation

As an indicator for identification of viability for the project, the internal economic rate of return was estimated.

Tables E.1.1 - E.1.4 show the results of the calculation of the internal economic rate of return for each sub-project area.

Table E.1 ESTIMATION OF EIRR SAN PEDRO DE IGUAQUE

(UNIT : THOUSAND Col.$)

YEAR		PROJECT COSTS: CONSTRUCTION COSTS	O & M COSTS	REPLACEMENT COSTS	COSTS OF REPAIRING	TOTAL	INCREMENTAL BENEFIT	PROJECT RETURN	PRESENT WORTH VALUE - DISCOUNT RATE (24 %)	(25 %)
1	1987	27502.00	0.00	0.00	0.00	27502.00	0.00	-27502.00	-22179.00	-22001.60
2	1988	8017.00	0.00	0.00	0.00	8017.00	0.00	-8017.00	-5213.97	-5130.88
3	1989	0.00	1662.00	0.00	0.00	1662.00	4197.00	2535.00	1329.58	1297.92
4	1990	0.00	1662.00	0.00	0.00	1662.00	8393.00	6731.00	2847.04	2757.02
5	1991	0.00	1662.00	0.00	0.00	1662.00	12589.00	10927.00	3727.29	3580.56
6	1992	0.00	1662.00	0.00	0.00	1662.00	16786.00	15124.00	4160.42	3964.67
7	1993	0.00	1662.00	810.00	0.00	2472.00	16786.00	14314.00	3175.48	3001.86
8	1994	0.00	1662.00	0.00	0.00	1662.00	16786.00	15124.00	2705.79	2537.39
9	1995	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	2131.88	1983.20
10	1996	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	1719.26	1586.56
11	1997	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	1386.50	1269.25
12	1998	0.00	1662.00	3240.00	348.00	5250.00	16786.00	11536.00	872.96	792.75
13	1999	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	901.73	812.32
14	2000	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	727.20	649.86
15	2001	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	586.45	519.89
16	2002	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	472.95	415.91
17	2003	0.00	1662.00	810.00	348.00	2820.00	16786.00	13966.00	360.50	314.49
18	2004	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	307.59	266.18
19	2005	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	248.05	212.95
20	2006	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	200.04	170.36
21	2007	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	161.33	136.29
22	2008	0.00	1662.00	3240.00	348.00	5250.00	16786.00	11536.00	101.57	85.12
23	2009	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	104.92	87.22
24	2010	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	84.61	69.78
25	2011	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	68.24	55.82
26	2012	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	55.03	44.66
27	2013	0.00	1662.00	810.00	348.00	2820.00	16786.00	13966.00	41.95	33.77
28	2014	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	35.79	28.58
29	2015	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	28.86	22.86
30	2016	0.00	1662.00	0.00	348.00	2010.00	16786.00	14776.00	23.28	18.29
TOTAL		35519.00	46536.00	8910.00	7656.00	98621.00	444829.00	346208.00	1173.24	-416.98

INTERNAL RATE OF RETURN(IRR) = 24 + 1173.24 / (1173.24 + 416.98) = 24.7 %

Table E.2 ESTIMATION OF EIRR SANTA SOFIA

(UNIT : THOUSAND Col.$)

YEAR	PROJECT COSTS: CONSTRUCTION COSTS	PROJECT COSTS: O & M COSTS	PROJECT COSTS: REPLACEMENT COSTS	PROJECT COSTS: COSTS OF REPAIRING	PROJECT COSTS: TOTAL	INCREMENTAL BENEFIT	PROJECT RETURN	PRESENT WORTH VALUE - DISCOUNT RATE (56 %)	PRESENT WORTH VALUE - DISCOUNT RATE (57 %)
1 1987	33024.00	0.00	0.00	0.00	33024.00	0.00	-33024.00	-21169.20	-21034.40
2 1988	11607.00	0.00	0.00	0.00	11607.00	0.00	-11607.00	-4769.48	-4708.91
3 1989	0.00	2118.00	0.00	0.00	2118.00	16504.00	14386.00	3789.36	3717.41
4 1990	0.00	2118.00	0.00	0.00	2118.00	33808.00	31690.00	5350.86	5215.83
5 1991	0.00	2118.00	0.00	0.00	2118.00	49512.00	47394.00	5129.80	4968.50
6 1992	0.00	2118.00	0.00	0.00	2118.00	66019.00	63901.00	4433.63	4266.87
7 1993	0.00	2118.00	1195.00	0.00	3313.00	66019.00	62706.00	2788.92	2666.93
8 1994	0.00	2118.00	0.00	0.00	2118.00	66019.00	63901.00	1821.84	1731.05
9 1995	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	1164.78	1099.68
10 1996	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	746.65	700.44
11 1997	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	478.62	446.14
12 1998	0.00	2118.00	4780.00	168.00	7066.00	66019.00	58953.00	283.80	262.85
13 1999	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	196.67	181.00
14 2000	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	126.07	115.28
15 2001	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	80.82	73.43
16 2002	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	51.80	46.77
17 2003	0.00	2118.00	1195.00	168.00	3481.00	66019.00	62538.00	32.59	29.23
18 2004	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	21.29	18.97
19 2005	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	13.65	12.09
20 2006	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	8.75	7.70
21 2007	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	5.61	4.90
22 2008	0.00	2118.00	4780.00	168.00	7066.00	66019.00	58953.00	3.32	2.89
23 2009	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	2.30	1.99
24 2010	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	1.48	1.27
25 2011	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	0.95	0.81
26 2012	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	0.61	0.51
27 2013	0.00	2118.00	1195.00	168.00	3481.00	66019.00	62538.00	0.38	0.32
28 2014	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	0.25	0.21
29 2015	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	0.16	0.13
30 2016	0.00	2118.00	0.00	168.00	2286.00	66019.00	63733.00	0.10	0.08
TOTAL	44631.00	59304.00	13145.00	3696.00	120776.00	1750300.00	1629520.00	596.36	-170.02

INTERNAL RATE OF RETURN(IRR) = 56 + 596.36 / (596.36 + 170.02) = 56.8 %

Table E.3 ESTIMATION OF EIRR CAQUEZA

(UNIT : THOUSAND Col.$)

YEAR	PROJECT COSTS: CONSTRUCTION COSTS	PROJECT COSTS: O & M COSTS	PROJECT COSTS: REPLACEMENT COSTS	PROJECT COSTS: COSTS OF REPAIRING	PROJECT COSTS: TOTAL	INCREMENTAL BENEFIT	PROJECT RETURN	PRESENT WORTH VALUE - DISCOUNT RATE (57 %)	PRESENT WORTH VALUE - DISCOUNT RATE (58 %)
1 1987	19106.00	0.00	0.00	0.00	19106.00	0.00	-19106.00	-12169.40	-12092.40
2 1988	44578.00	0.00	0.00	0.00	44578.00	0.00	-44578.00	-18085.10	-17856.90
3 1989	0.00	3119.00	0.00	0.00	3119.00	19948.00	16829.00	4348.70	4266.65
4 1990	0.00	3119.00	0.00	0.00	3119.00	39898.00	36779.00	6053.43	5901.62
5 1991	0.00	3119.00	0.00	0.00	3119.00	59846.00	56727.00	5946.91	5761.08
6 1992	0.00	3119.00	0.00	0.00	3119.00	79794.00	76675.00	5119.83	4928.46
7 1993	0.00	3119.00	2085.00	0.00	5204.00	79794.00	74590.00	3172.36	3034.46
8 1994	0.00	3119.00	0.00	0.00	3119.00	79794.00	76675.00	2077.09	1974.23
9 1995	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	1316.90	1243.76
10 1996	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	838.79	787.19
11 1997	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	534.26	498.22
12 1998	0.00	3119.00	8340.00	353.00	11812.00	79794.00	67982.00	303.11	280.87
13 1999	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	216.75	199.58
14 2000	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	138.06	126.31
15 2001	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	87.93	79.95
16 2002	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	56.01	50.60
17 2003	0.00	3119.00	2085.00	353.00	5557.00	79794.00	74237.00	34.70	31.15
18 2004	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	22.72	20.27
19 2005	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	14.47	12.83
20 2006	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	9.22	8.12
21 2007	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	5.87	5.14
22 2008	0.00	3119.00	8340.00	353.00	11812.00	79794.00	67982.00	3.33	2.90
23 2009	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	2.38	2.06
24 2010	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	1.52	1.30
25 2011	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	0.97	0.82
26 2012	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	0.62	0.52
27 2013	0.00	3119.00	2085.00	353.00	5557.00	79794.00	74237.00	0.38	0.32
28 2014	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	0.25	0.21
29 2015	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	0.16	0.13
30 2016	0.00	3119.00	0.00	353.00	3472.00	79794.00	76322.00	0.10	0.08
TOTAL	63684.00	87332.00	22935.00	7766.00	181717.00	2114540.00	1932820.00	52.28	-730.50

INTERNAL RATE OF RETURN(IRR) = 57 + 52.28 / (52.28 + 730.50) = 57.1 %

Table E.4 ESTIMATION OF EIRR TIBACUY

(UNIT : THOUSAND Col.$)

YEAR	PROJECT COSTS: CONSTRUCTION COSTS	PROJECT COSTS: O & M COSTS	PROJECT COSTS: REPLACEMENT COSTS	PROJECT COSTS: COSTS OF REPAIRING	PROJECT COSTS: TOTAL	INCREMENTAL BENEFIT	PROJECT RETURN	PRESENT WORTH VALUE - DISCOUNT RATE (40 %)	PRESENT WORTH VALUE - DISCOUNT RATE (41 %)
1 1987	30581.00	0.00	0.00	0.00	30581.00	0.00	-30581.00	-21843.60	-21688.70
2 1988	11597.00	0.00	0.00	0.00	11597.00	0.00	-11597.00	-5916.84	-5833.21
3 1989	0.00	2003.00	0.00	0.00	2003.00	9582.00	7579.00	2762.03	2703.68
4 1990	0.00	2003.00	0.00	0.00	2003.00	19164.00	17161.00	4467.15	4341.76
5 1991	0.00	2003.00	0.00	0.00	2003.00	28746.00	26743.00	4972.44	4798.60
6 1992	0.00	2003.00	0.00	0.00	2003.00	38328.00	36325.00	4824.33	4622.65
7 1993	0.00	2003.00	1290.00	0.00	3293.00	38328.00	35035.00	3323.58	3162.05
8 1994	0.00	2003.00	0.00	0.00	2003.00	38328.00	36325.00	2461.40	2325.16
9 1995	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	1750.83	1642.19
10 1996	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	1250.59	1164.68
11 1997	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	893.28	826.01
12 1998	0.00	2003.00	5160.00	151.00	7314.00	38328.00	31014.00	547.04	502.26
13 1999	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	455.76	415.48
14 2000	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	325.54	294.67
15 2001	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	232.53	208.98
16 2002	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	166.09	148.22
17 2003	0.00	2003.00	1290.00	151.00	3444.00	38328.00	34884.00	114.41	101.37
18 2004	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	84.74	74.55
19 2005	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	60.53	52.87
20 2006	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	43.24	37.50
21 2007	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	30.88	26.59
22 2008	0.00	2003.00	5160.00	151.00	7314.00	38328.00	31014.00	18.91	16.17
23 2009	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	15.76	13.38
24 2010	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	11.25	9.49
25 2011	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	8.04	6.73
26 2012	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	5.74	4.77
27 2013	0.00	2003.00	1290.00	151.00	3444.00	38328.00	34884.00	3.96	3.26
28 2014	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	2.93	2.40
29 2015	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	2.09	1.70
30 2016	0.00	2003.00	0.00	151.00	2154.00	38328.00	36174.00	1.49	1.21
TOTAL	42178.00	56084.00	14190.00	3322.00	115774.00	1015690.00	899918.00	1076.15	-13.48

INTERNAL RATE OF RETURN(IRR) = 40 + 1076.15 / (1076.15 + 13.48) = 41.0 %

JICA