3.13 Social Facilities

3.13.1 Existing social services

(1) Health

There are 12 hospitals in the Province with a total of 428 beds, 13 main health centers and 87 barangay health centers. As for the available medical personnel, there are 28 hospitals, 11 rural physicians, 9 dentists, 45 hospital nurses, 27 public health nurses, 122 rural health midwives and 14 rural health sanitarians.

To date, the following specialized services are being rendered by the Ministry of Health to the whole population of Benguet : Medical care, Family Planning, Nutrition, Expanded Program on Immunization, Maternal and Child Health Care Services, Under-Six Clinic Program, Diarrhea Control, National Tuberculosis Program, Leprosy Control, Malaria Control, Environmental Sanitation, Food and Drug, Health Education, Primary Health Care and Cardiovascular Disease Control.

The ten leading causes of morbidity for Benguet Province are as follows : pneumonia, parasitism, wounds, bronchitis, gastro-urinary infections, scabies, gastro enteritis, hypertension, influenza and anemia. Health indicators are as follows : crude birth rate 20.58 per 1,000 population; crude death rate 2.74 per 1,000 population; maternal mortality rate 0.56 per 1,000 live birth; infant mortality rate 17.84 per 1,000 live births; and life expectancy 62 years of age, from the 1984 Provincial Health Office Annual Report.

(2) Education

In 1984, the Province had a total of 288 schools for all educational levels breaking down as following : elementary 255 (public 248, private 7) ; secondary 24 (public 14 , private 10) ; vocational schools 8 (public 6, private 2) and only 4 collegiate schools. Total enrollments for 1984 are : elementary level 40,105 (public 34,538, private 5,567) and secondary level 10,069 (public 4,653, private 5,416). The enrollment participation rate for 1984 is 95 percent for the elementary level and 40.5 percent for the secondary level. For the year 1984, with a teacher to pupil ratio of 1:24 for both public elementary and secondary level; 1:29 for private elementary and 1:33 for private secondary level. The 1984 literacy level in the Province is approximately 93 percent with the Ministry of Education, Culture and Sports (MECS).

3.13.2 Existing social facilities in the Project area

(1) Zone I

Zone I is a central area in the Municipality of La Trinidad and had the population of about 14,000 in 1985. Social facilities, such as the Provincial Capitol of Benguet, Municipal Office, Integrated Provincial Health Office (IPHO), General Hospital (100 beds), Rural Health Unit (RHU) and Benguet State University (BSU), etc. are existing in Zone I. As for educational facilities, five (5) elementary schools with about 2,300 pupils in total and a few nursery schools are available. In addition to the above, there is one (1) fire station with one (1) fire engine in Betag. BSU's Library exists also in Zone I.

(2) Zone II and Zone III

Zone II had a population of about 6,300 and Zone III of about 1,600 in 1985. Each barangay has a barangay health center. These centers, however, can not be operated properly due to the lack of potable water and medical appliances. As for the educational facilities, each barangay except for that of Cruz has an elementary school.

Table 3.4.1 Summary of Observed Data in Baguio and BSU Station

BAGUIO PAGASA Station

Averaged for 1949 - 1987

Items	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
Mean Temperature (°C)	17.6	18.4	19.5	20.4	20.6	20.6	20.0	19.6	19.4	19.6	19.1	18.4
Maximum Temperature (°C)	22.6	23.5	24.7	25.2	24.8	23.7	23.1	22.2	23.0	23.5	23.3	22.9
Minimum Temperature (°C)	12.9	13.3	14.3	15.6	16.4	16.3	16.2	15.9	15.8	15.6	14.9	14.1
Dry Bulb Temperature (°C)	16.6	17.2	18.4	19.3	19.5	19.0	18.6	18.2	18.5	18.7	18.2	17.3
Wet Bulb Temperature (°C)	14.5	14.8	16.1	17.2	17.8	17.7	17.3	17.3	17.3	17.2	16.4	15.3
Relative Humidity (%)	82	80	80	82	86	88	90	92	90	87	84	82
Open Pan Evaporation (mm/day)	3.0	3.6	4.1	3.7	3.0	2.8	2.5	2.1	2.4	2.6	2.8	2.9
Duration of Sunshine (min)	425	481	458	444	350	300	239	161	268	356	367	400
Average Wind Velocity (m/sec)	2.0	2.1	1.9	1.9	1.9	2.3	2.3	2.4	2.1	2.1	2.1	2.1
Monthly Rainfall (mm/month)	12.3	9.0	31.8	99.0	327.2	467.0	721.3	897.2	591.3	327.5	140.8	25.5

BSU PAGASA Station

Averaged for 1977 - 1987

Items	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
Mean Temperature (°C)	16.8	17.2	18.6	19.9	20.2	20.6	20.1	19.9	19.8	19.6	18.9	17.6
Maximum Temperature (°C)	22.2	23.0	24.5	25.0	24.4	24.4	23.6	23.5	23.6	23.8	23.8	23.0
Minimum Temperature (°C)	11.3	11.3	12.7	14.8	15.8	16.8	17.0	16.8	16.2	15.5	14.3	12.6
Dry Bulb Temperature (°C)	15.9	16.4	18.7	20.6	21.1	21.0	20.5	19.9	20.3	20.2	19.2	17.3
Wet Bulb Temperature (°C)	13.9	14.3	16.1	18.1	18.6	18.9	18.8	18.6	18.4	17.9	17.1	15.1
Relative Humidity (%)	82	80	77	76	79	83	85	88	84	82	83	80
Open Pan Evaporation (mm/day)	*	*	*	*	*	*	*	*	*	*	*	*
Duration of Sunshine (min)	399	455	411	376	306	251	240	137	245	281	332	345
Average Wind Velocity (m/sec)	1.3	1.1	1.3	1.5	1.3	1.8	2.1	1.9	1.4	1.2	1.1	1.2
Monthly Rainfall (mm/month)	13.6	7.5	28.1	89.6	404.4	434.2	652.9	950.4	554.5	243.2	169.9	27.0

* : missing data

Table 3.4.2 Estimated Runoff of the Balili River (31.4 sq.km)

(Unit : MCM)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1977	0.78	0.58	1.19	0.93	3.27	4.36	12.00	20.74	31.55	7.79	4.44	1.48
1978	0.87	0.64	0.64	0.57	4.32	9.63	13.09	27.77	13.35	6.86	2.66	1.92
1979	0.94	0.63	0.62	1.04	8.30	6.60	13.96	21.98	6.91	5.74	1.31	0.96
1980	0.70	0.54	0.54	0.47	22.09	6.03	27.52	8.13	15.31	6.04	24.77	2.11
1981	1.12	0.71	0.69	1.29	4.62	17.37	12.57	26.52	17.98	8.14	6.52	2.04
1982	0.99	0.68	0.68	2.26	5.66	7.71	30.89	24.10	15.20	6.91	3.22	1.31
1983	1.01	0.70	0.68	0.59	1.91	5.87	5.67	21.89	8.44	4.47	2.76	1.03
1984	0.65	0.52	0.55	2.19	7.71	7.13	9.12	29.13	12.23	7.97	2.84	1.08
1985	0.77	0.59	0.67	1.56	6.59	26.54	10.42	32.43	15.25	5.48	3.69	1.63
1986	0.93	0.68	0.68	0.65	8.05	7.41	27.54	23.98	25.65	4.22	1.70	1.10
1987	0.80	0.65	0.64	0.59	2.99	8.22	5.50	13.92	12.28	11.03	2.83	1.10
Average	0.9	0.6	0.7	1.1	6.9	9.7	15.3	22.8	15.8	6.8	5.2	1.4

Annual Runoff Coefficient

Year	Max.Daily Runoff (cu.m/s)	Min.Daily Runoff (cu.m/s)	Ave.Daily Runoff (cu.m/s)	Annual Runoff (MCM)	Annual Runoff (mm)	Annual Rainfall (mm)	Runoff Coeff. (%)
1977	54.425	0.212	2.826	89.12	2838.2	3676.8	77.2
1978	56.364	0.191	2.611	82.33	2621.9	3406.3	77.0
1979	35.274	0.207	2.188	69.01	2197.6	2903.4	75.7
1980	86.150	0.167	3.613	114.24	3638.4	4524.0	80.4
1981	43.179	0.227	3.157	99.56	3170.7	3987.7	79.5
1982	34.509	0.239	3.159	99.62	3172.5	4033.6	78.7
1983	34.958	0.197	1.744	55.01	1751.8	2372.6	73.8
1984	47.534	0.174	2.566	81.13	2583.7	3428.7	75.4
1985	42.779	0.195	3.349	105.60	3363.0	4362.4	77.1
1986	71.531	0.207	3.253	102.59	3267.3	4057.7	80.5
1987	40.651	0.192	1.920	60.54	1928.0	2574.9	74.9

Table 3.8.1 Basic Socio Data in La Trinidad Municipality

Barangay	Land Area	Population in 1975	1985							
			Population	Family	Household	Farm #1 Family	Farm Household #2		Farm Area	Farm Size per Farm Household
							No.	Percent		
	(ha)				(A)		(B)	(B/A)	(ha)	(ha)
Alapang	143.8	938	1,697	265	229	146	126	(55.1%)	49.7	0.39
Alno	1012.8	954	1,043	190	169	152	135	(80.0%)	232.2	1.72
Ambiong	337.2	708	995	205	200	150	146	(73.2%)	149.3	1.02
Bahong	410.0	1,490	2,010	372	348	186	174	(50.0%)	60.0	0.34
Balili	166.5	2,099	3,343	645	533	235	194	(36.4%)	57.2	0.29
Beckel	930.9	1,514	2,075	347	339	240	234	(69.2%)	131.6	0.56
Betag	167.5	2,026	2,505	531	261	125	61	(23.5%)	4.1	0.07
Bineng	693.1	590	718	156	125	109	87	(69.9%)	183.5	2.10
Cruz	92.0	927	1,403	229	204	55	49	(24.0%)	15.0	0.31
Lubas	283.0	629	949	176	175	80	80	(45.5%)	73.7	0.93
Pico	733.0	4,097	5,457	1,091	815	297	222	(27.2%)	52.5	0.24
Poblacion	197.6	2,563	3,663	704	607	100	86	(14.2%)	51.1	0.59
Puguis	940.8	1,366	2,403	436	402	145	134	(33.3%)	171.9	1.29
Shilan	196.5	1,520	1,847	351	328	270	252	(76.9%)	511.9	2.03
Tawang	855.9	638	1,589	275	261	124	118	(45.1%)	30.9	0.26
Wangal	1113.4	673	893	187	153	126	103	(67.4%)	64.1	0.62
LA TRINIDAD TOTAL	8274.0	22,732	32,590	6,160	5,149	2,540	2,203	(41.2%)	1,839	0.83

Population growth rate from 1975 to 1985 (%) : 3.67

Source : 1980 Census of Agriculture and Fisheries, Province of Benguet, NCSO
1980 Census of Population and Housing, NCSO
Family Survey 1985, Rural Health Unit

Remarks : #1 : Family whose income source is agriculture.
#2 : Derived from the correlation between total family and total household

Table 3.8.2 Crop Area, Yield and Production in La Trinidad

Crops	1984			1985			1986			1987			Average		
	Area (ha)	Production (ton)	Yield	Area (ha)	Production (ton)	Yield	Area (ha)	Production (ton)	Yield	Area (ha)	Production (ton)	Yield	Area (ha)	Production (ton)	Yield
Rice	84	143	1.7	113	213	1.9	123	237	1.9	130	247	1.9	113	210	1.9
Baguio Beans	190	1,710	9.0	414	3,058	7.4	395	2,765	7.0	385	2,905	7.5	346	2,610	7.5
Garden pea	45	203	4.5	95	298	3.1	310	883	2.8	220	605	2.8	168	497	3.0
Chinese Cabbage	90	1,485	16.5	330	4,875	14.8	375	5,925	15.8	340	5,780	17.0	284	4,516	15.9
Pechay/Mustard	25	200	8.0	255	2,040	8.0	283	2,264	8.0	310	2,264	7.3	218	1,692	7.8
Lettuce	35	228	6.5	87	1,044	12.0	95	1,026	10.8	75	900	12.0	73	800	11.0
Cabbage	50	800	16.0	44	652	14.8	56	896	16.0	65	1,072	16.5	54	855	15.9
Cauli./Broc.				17	245	14.4	15	240	16.0	11	176	16.0	14	220	15.4
Cucumber	5	90	18.0	53	795	15.0	53	822	15.5	55	880	16.0	42	647	15.6
Tomato	10	140	14.0	54	816	15.1	47	658	14.0	47	658	14.0	40	568	14.4
Sweet Pepper	5	30	6.0	28	160	5.7	32	190	5.9	65	390	6.0	33	193	5.9
Chayote	15	375	25.0	29	975	33.6	23	628	27.3	45	2,025	45.0	28	1,001	35.7
White Potato	40	600	15.0	19	279	14.7	24	384	16.0	50	800	16.0	33	516	15.5
Carrot/Radish	5	70	14.0	19	300	15.8	26	390	15.0	26	390	15.0	19	288	15.1
Sweet Potato	20	220	11.0	52	626	12.0	58	696	12.0	58	696	12.0	47	560	11.9
Gabi	10	120	12.0	13	182	14.0	12	168	14.0	12	169	14.1	12	160	13.6
Green onion	25	200	8.0	130	1,038	8.0	127	1,016	8.0	127	952	7.5	102	802	7.8
Celery	40	560	14.0	68	782	11.5	78	1,248	16.0	78	1,248	16.0	66	960	14.5
Strawberry	20	280	14.0	24	173	7.2	25	225	9.0	25	225	9.0	24	226	9.6
SUB-TOTAL	714	7,454	0	1,844	18,551	0	2,157	20,661		2,124	22,382		1,713	17,317	
Roses										45	1,125	25.0	45	1,125	25.0
Gladiola							195	2,925	15.0	200	2,916	14.6	198	2,921	14.8
Others				203	717	3.5	138	1,104	8.0	150	1,500	10.0	164	1,107	6.8
SUB-TOTAL	0	0	0	203	717	0	333	4,029		395	5,541		406	5,153	
Coffee	197	130	0.7	27	17	0.6	20	14	0.7	20	14	0.7	66	44	0.7
Citrus	10	21	2.1	7	10	1.4	10	12	1.2	18	35	1.9	11	20	1.7
Guava	5	30	6.0	4	19	4.8	6	24	4.0	10	60	6.0	6	33	5.3
Banana	10	70	7.0	24	225	9.4	21	250	11.9	24	280	11.7	20	206	10.4
SUB-TOTAL	222	251	0	62	271		57	300		72	389	0	103	303	
GRAND-TOTAL	936	7,705	0	2,109	19,539		2,547	24,990		2,591	28,312	0	2,223	22,772	

Source : Annual Report CY 1982 - 1987, Department of Agriculture La Trinidad, Benguet

Remarks : Production of flowers is shown in a thousand dozen

Area and production in 1984 were very low due to typhoon "Maring".

Crop areas of strawberry and roses are considered to be more than the above mentioned values based on the field survey.

Table 3.8.3 Prices of Agricultural Commodities

Items	Unit	Farmgate Price (pesos)	
a) Outputs (farmgate price)			
Paddy (Local variety) #1	kg	3.48	
Chinese Cabbage #2	kg	2.74	
Lettuce #1	kg	4.00	
Baguio Beans #1	kg	4.20	
Garden Peas #2	kg	16.19	
Green Onion #1	kg	2.50	
Strawberry #3	kg	15.00	
Celery #1	kg	4.50	
Rose #3	doz	7.00	
Gladiolus #3	doz	3.00	
b) Inputs (Seeds and seedlings) #4			
Paddy	kg	4.50	
Chinese Cabbage	kg	2,580	
Lettuce	kg	1,475	
Baguio Beans	kg	60	
Garden Peas	kg	163	
Green Onion (seedling)	kg	6	
Strawberry	runner	0.32	
Celery	kg	1,980	
Rose	piece	1.00	
Gladiolus	kg	5.40	
c) Fertilizers & Agro-chemicals #4			
Urea	kg	3.46	
14-14-14	kg	4.40	
16-20-0	kg	4.30	
Chicken Manure	kg	0.60	
Tamaron	lit	310	
Thiodan	lit	179	
Sumicidin	lit	175	
Vegetox	kg	183	
Dithane	lit	158	
Manzate	kg	123	
Curzate	kg	219	
Elosal	kg	78	
Trellises	100 pieces	20	
d) Labor charge #3	M-D	35	
e) Animal Power	Animal-D	85	
f) Transportation cost #3	kg	0.13	From farm to market
		0.10	From market to farm

Sources :
#1 : Semi-Annual Field Report , Selected Crop Statistics BAS
#2 : BAS, Baguio (based on the monthly price data)
#3 : Estimated price based on the results of the farm economic survey
#4 : Actual market price as of 1987

Table 3.8.4 Present Labor and Farm Inputs Requirement per Ha for Selected Crops

Crops	Unit Yield	Seed / Seedling	Labor			Animal Power	Fertilizer			Chicken Manure	Insecticides #		Fungicides #	
			Familiy	Hired	Total		Urea	14-14-14	16-20-0		Powder	Liquid	Powder	Liquid
		(kg)	(M-D)	(M-D)	(M-D)	(day)	(kg)	(kg)	(kg)	(kg)	(kg)	(lit)	(kg)	(lit)
Rice	1.9	60	169	8	177	5	0	0	0	0	0.0	0.0	0.0	0.0
C. cabbage	15.5	1.12	215	85	300	0	220	200	0	410	0.0	6.7	3.8	1.9
Lettuce	11.0	0.95	186	92	278	0	430	870	0	5,160	0.0	10.3	7.6	10.2
Baguio beans	7.5	60	188	34	222	0	250	280	0	910	1.1	5.7	1.0	4.8
Garden peas	3.0	60	166	56	222	0	290	300	50	1,190	0.3	6.2	4.1	3.5
Green onion	7.8	250	129	81	210	0	220	170	0	320	0.0	3.3	0.7	3.2
Strawberry	9.8	80,000	523	177	700	0	380	770	0	0	0.0	16.0	3.3	10.8
Celery	14.5	1.50	201	29	230	0	160	160	0	1,440	0.0	4.4	2.0	2.4
Rose	25.0	60,000	509	261	770	0	760	850	40	580	0.4	10.7	3.7	14.2
Gladiolus	14.8	480	143	42	185	0	318	389	0	0	0.3	4.2	0.8	6.1

Source : Farm Economic Survey conducted by JICA team

Remarks #
Insecticides : Powder Vegetox
Liquid Tamaron, Thiodan, Hostation, Sumicidin
Fungicides : Powder Manzate, Curzate, Elosal
Liquid Dithane

Table 3.10.1 Results of Traffic Survey

	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	No.13	No.14	TOTAL
DATE : Sep. 1987															
BUS	0	0	0	9	82	11	0	0	0	-	0	0	0	0	102
TRUCK above 2 ton	11	23	0	70	537	57	0	0	15	-	8	0	0	2	723
TRUCK below 2 ton	10	42	0	53	214	62	0	0	83	-	38	0	3	5	517
PASSENGER CAR	237	29	3	92	750	517	0	0	66	-	73	15	31	1	1,827
TAXI	31	2	0	13	116	105	0	0	16	-	0	0	0	0	283
JEEP	107	49	2	218	1,371	479	5	0	58	-	49	11	30	47	2,455
JEEPNEY	102	209	8	294	4,262	667	0	0	94	-	40	23	0	35	5,765
MOTORCYCLE	9	0	0	28	108	18	0	0	2	-	0	0	3	2	170
OTHERS	17	14	2	0	11	14	51	4	1	-	0	0	8	0	135
PERSON	1,034	362	248	1,938	-	1,111	218	53	1,421	-	296	973	437	793	9,891
DATE : Mar. 4, 1988															
BUS	0	-	0	-	-	-	0	0	0	0	-	0	0	0	0
TRUCK above 2 ton	4	-	0	-	-	-	0	0	4	0	-	0	0	2	10
TRUCK below 2 ton	0	-	0	-	-	-	0	0	3	2	-	0	2	3	10
PASSENGER CAR	0	-	0	-	-	-	0	0	0	3	-	2	0	0	55
TAXI	0	-	0	-	-	-	0	0	0	0	-	0	0	0	0
JEEP	22	-	2	-	-	-	2	9	59	27	-	4	34	38	197
JEEPNEY	19	-	27	-	-	-	0	50	67	19	-	72	0	33	237
MOTORCYCLE	2	-	3	-	-	-	0	0	3	0	-	0	0	2	10
OTHERS	0	-	0	-	-	-	0	0	0	2	-	0	13	30	45
PERSON	130	-	300	-	-	-	360	418	261	247	-	273	836	1,247	4,072
DATE : Mar. 5, 1988															
BUS	0	-	0	-	-	-	0	0	0	0	-	0	0	0	0
TRUCK above 2 ton	0	-	4	-	-	-	0	0	4	0	-	0	0	4	12
TRUCK below 2 ton	3	-	0	-	-	-	0	0	2	2	-	3	2	4	16
PASSENGER CAR	0	-	2	-	-	-	0	0	19	3	-	6	0	0	107
TAXI	0	-	0	-	-	-	0	0	2	0	-	0	0	3	5
JEEP	23	-	6	-	-	-	2	0	69	27	-	9	53	58	247
JEEPNEY	16	-	18	-	-	-	0	22	57	25	-	40	0	77	178
MOTORCYCLE	0	-	0	-	-	-	0	0	0	0	-	0	0	6	6
OTHERS	0	-	0	-	-	-	0	0	2	0	-	0	16	41	60
PERSON	106	-	285	-	-	-	292	279	430	181	-	350	1,026	1,400	4,349

- : Survey was not carried out.

Table 3.11.1 Water Supply Facilities (La Trinidad Water District)

MOTORS				
Location	HP Rating	Type	Hours operation	Remarks
a. Balili 1 (Old)	50	Belted close coupled	-	Not being utilizes due to low effeciency
	7.5	Belted close coupled	6	Used on seasonal months only
b. Balili 2 (Deep wall)	30	Submersible	20	
c. Cruz	5	Centrifugal	-	
	7.5	Centrifugal	10	

PUMPS				
Location	Discharge (GPM)		Type	Hours operation
a. Balili 1 (Old)	-	-	Belted close coupled	-
	100	130	Belted close coupled	6
b. Balili 2 (Deep well)	200	304	Submersible	20
c. Cruz	50	150	Centrifugal	-
	100	150	Centrifugal	10

RESERVOIRS				
Location	Capacity (cum)	Utilization	Construction	Remarks
a. Lubas	104.78	Storage/Distribution	1927	
b. Balili 1 (Old)	11.47	Sump tank	1977	
	89.26	Storage/Distribution	1977	
c. Cruz	250	Storage/Distribution	1982	
d. Ampasit	18.71	Storage/Distribution	1958	

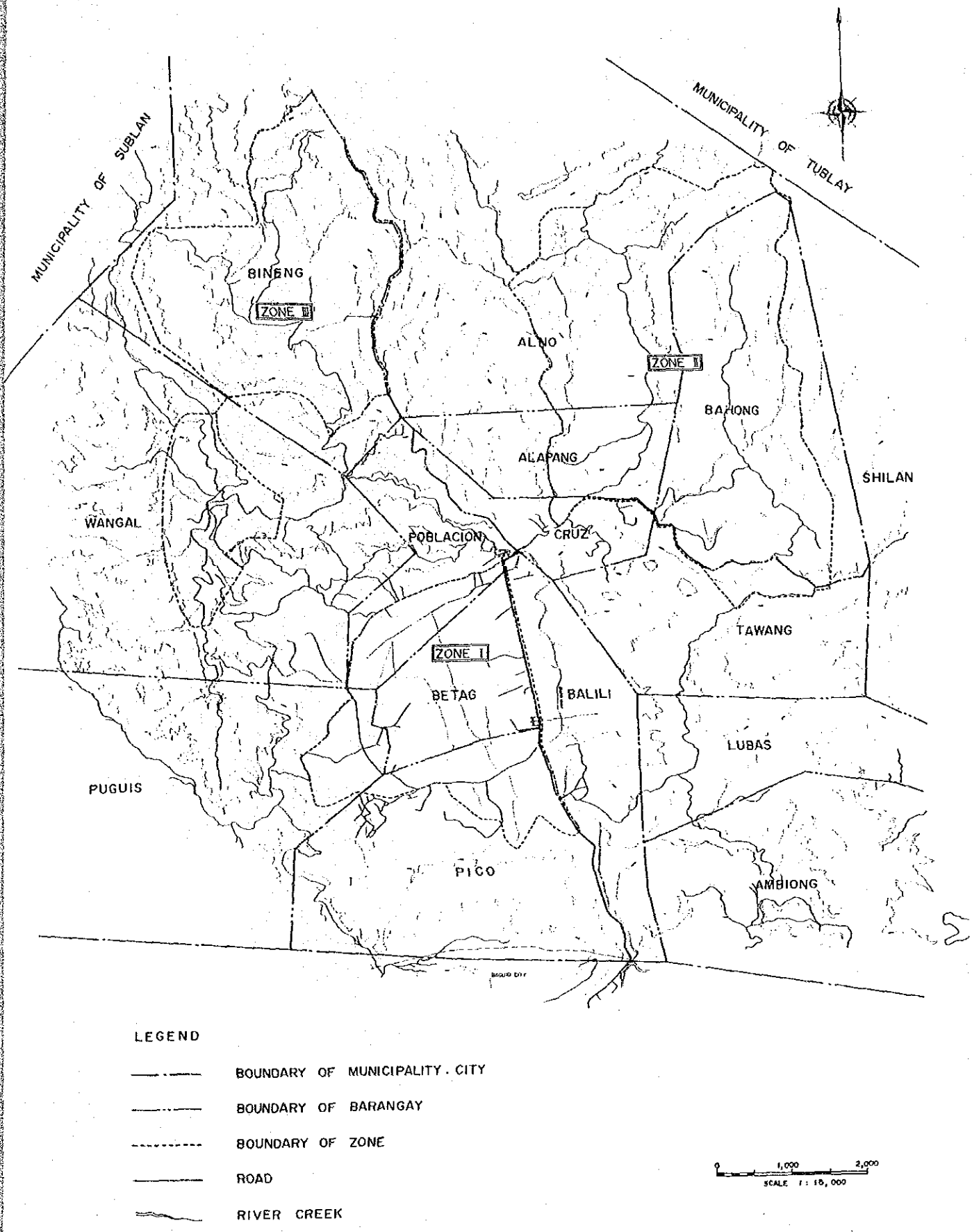
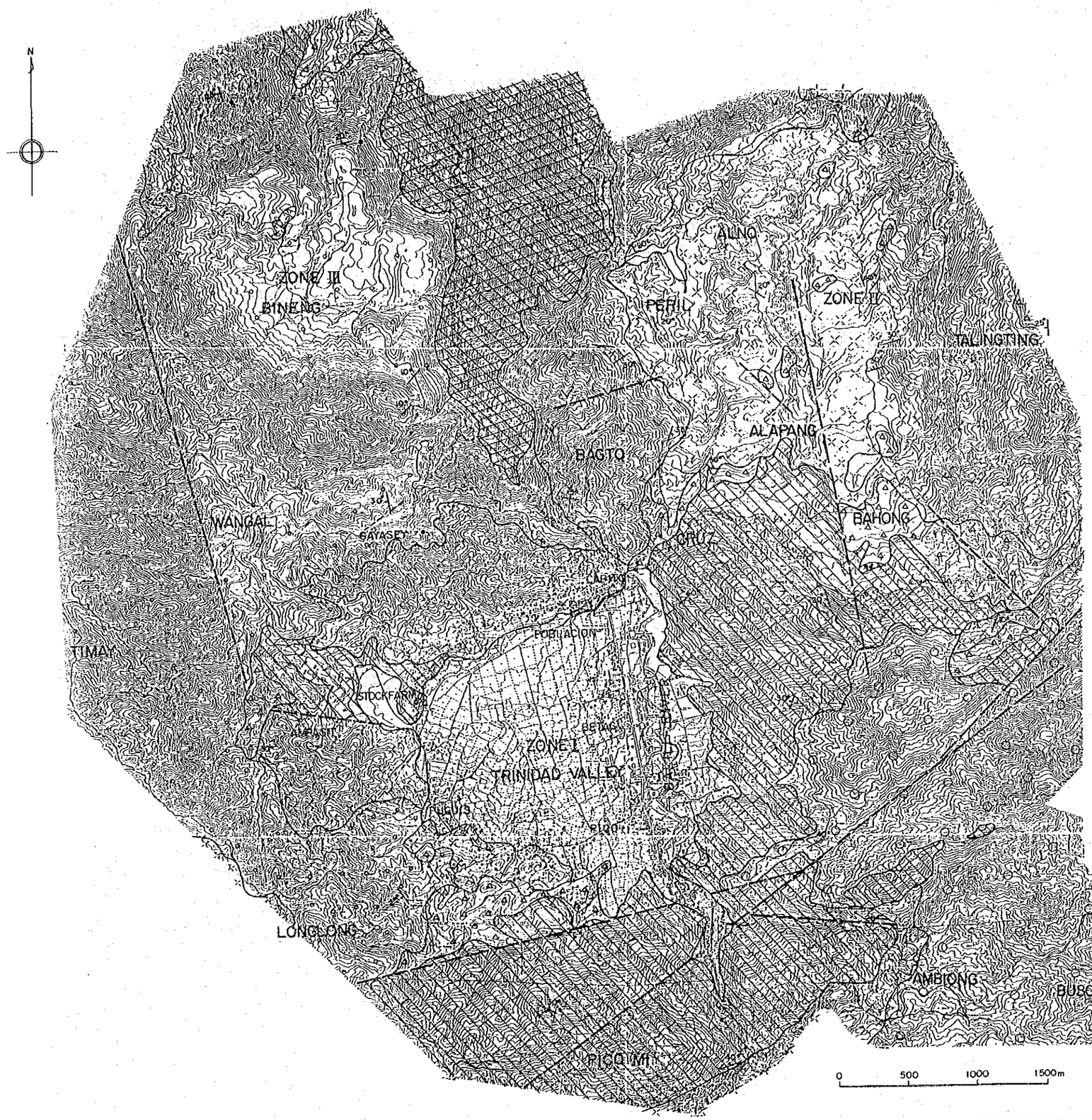


Fig. 3.2.1 Boundary of Barangays in the Study Area

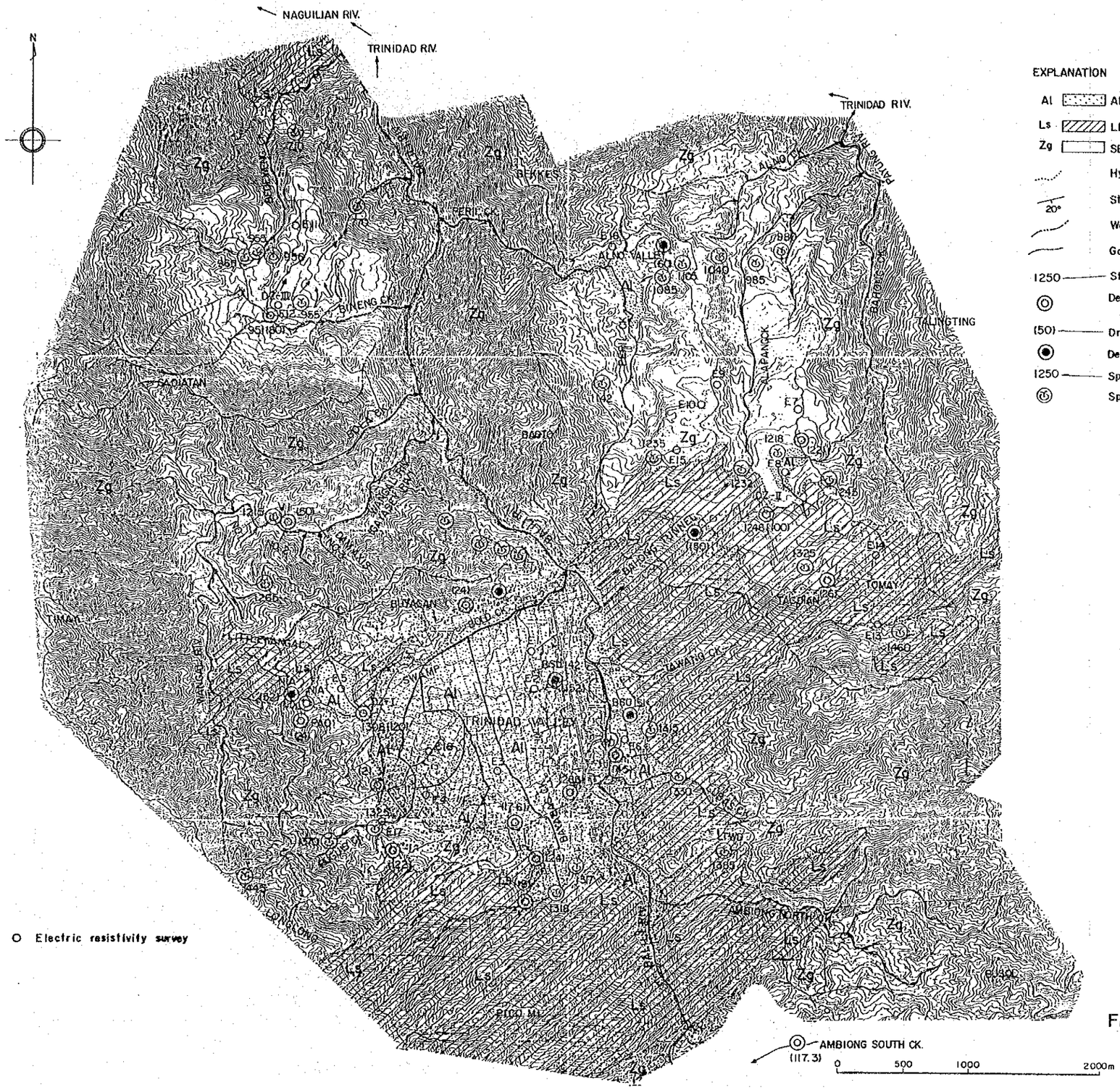


LEGEND

Quaternary	Al.	ALLUVIUM	
	Ls.dt.	LIMESTONE FRAGMENT	
Upper Miocene to pliocene	An.	ANDESITIC SEDEMENT	(KLONDYKE FORMATION)
	Ls.	LIMESTONE	(KENNON FORMATION)
Early Middle Miocene	Sh.	SHALE-SANDSTONE-TUFF	(ZIGZAG FORMATION)
	Cg.	CONGLOMERATES	
	Agl.	AGGLOMERATES-LAPILLI TUFF	
Upper Eocene	Ba.	TUFF BRECCIA-BASALTS	(HALF WAY CREEK FORMATION)

Geologic contact (approx.)
Strike and dip of beds
Fault

Fig. 3.6.1 Geological Map at La Trinidad, Benget



EXPLANATION

- Al — ALLUVIAL DEPOSITS (Aquiclude)
- Ls — LIMESTONE AREA (Permeable Zone)
- Zg — SEDIMENTARY ROCKS and/or PYROCLASTIC ROCKS (Fissure Water)
- Hydrogeologic contact (approx.)
- 20° — Strike and dip of beds
- Watershed boundary
- Gaining creek in which water is running in Feb. 1988
- 1250 — Static water level (meters in elevation)
- ◎ — Deepwell (existing)-DZ I, DZ II, DZ III, V-I ... Observation well installed by JICA Survey Team
- (50) — Drilling depth in meters
- ◉ — Deep well (closed)
- 1250 — Spring water level (meters in elevation)
- ⓢ — Spring (existing in Feb. 1988)

Fig. 3.6.2 Hydrogeological Map of La Trinidad, Benbuet

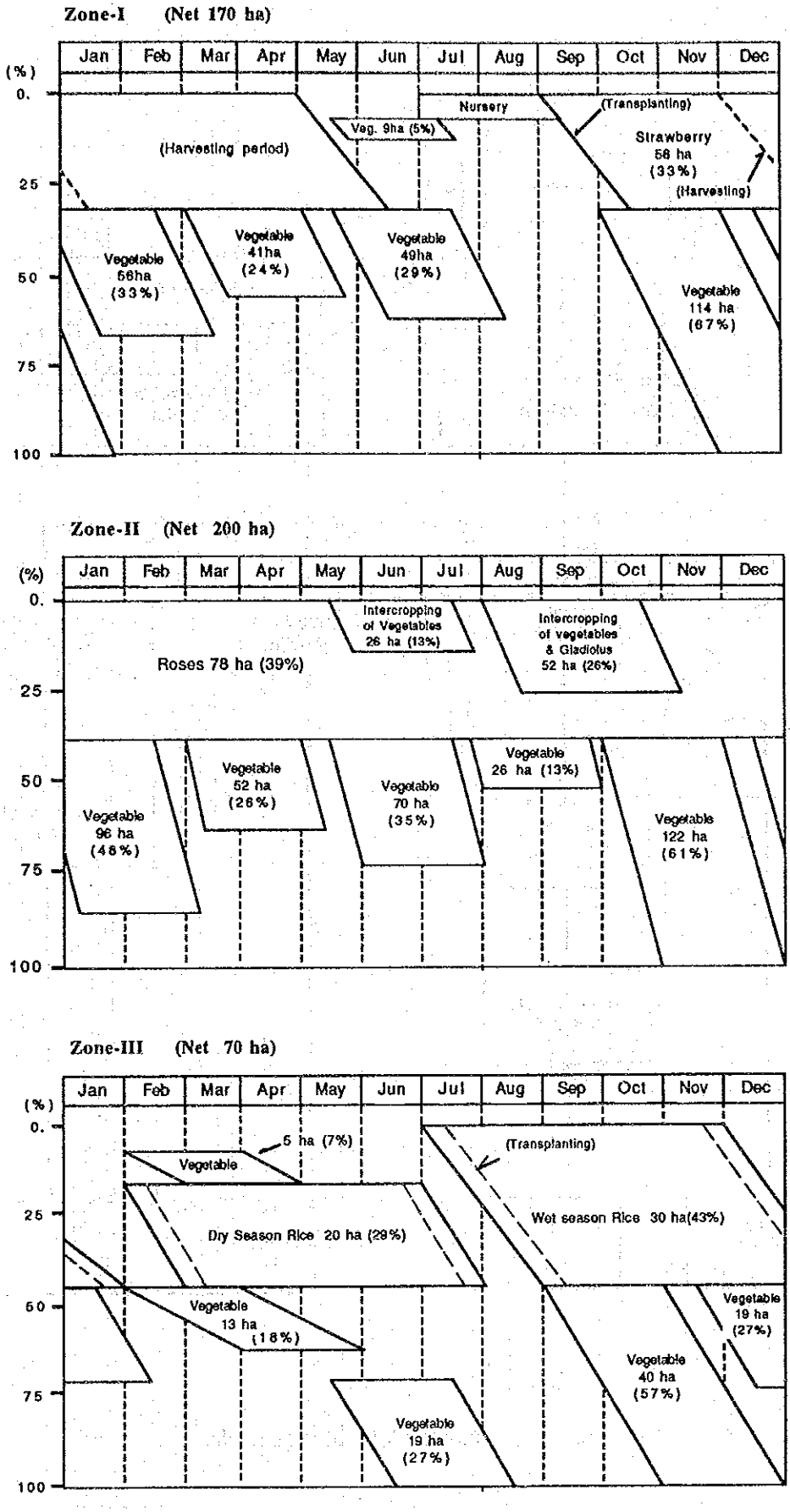


Fig. 3.8.1 Present Cropping Pattern in the Project Area

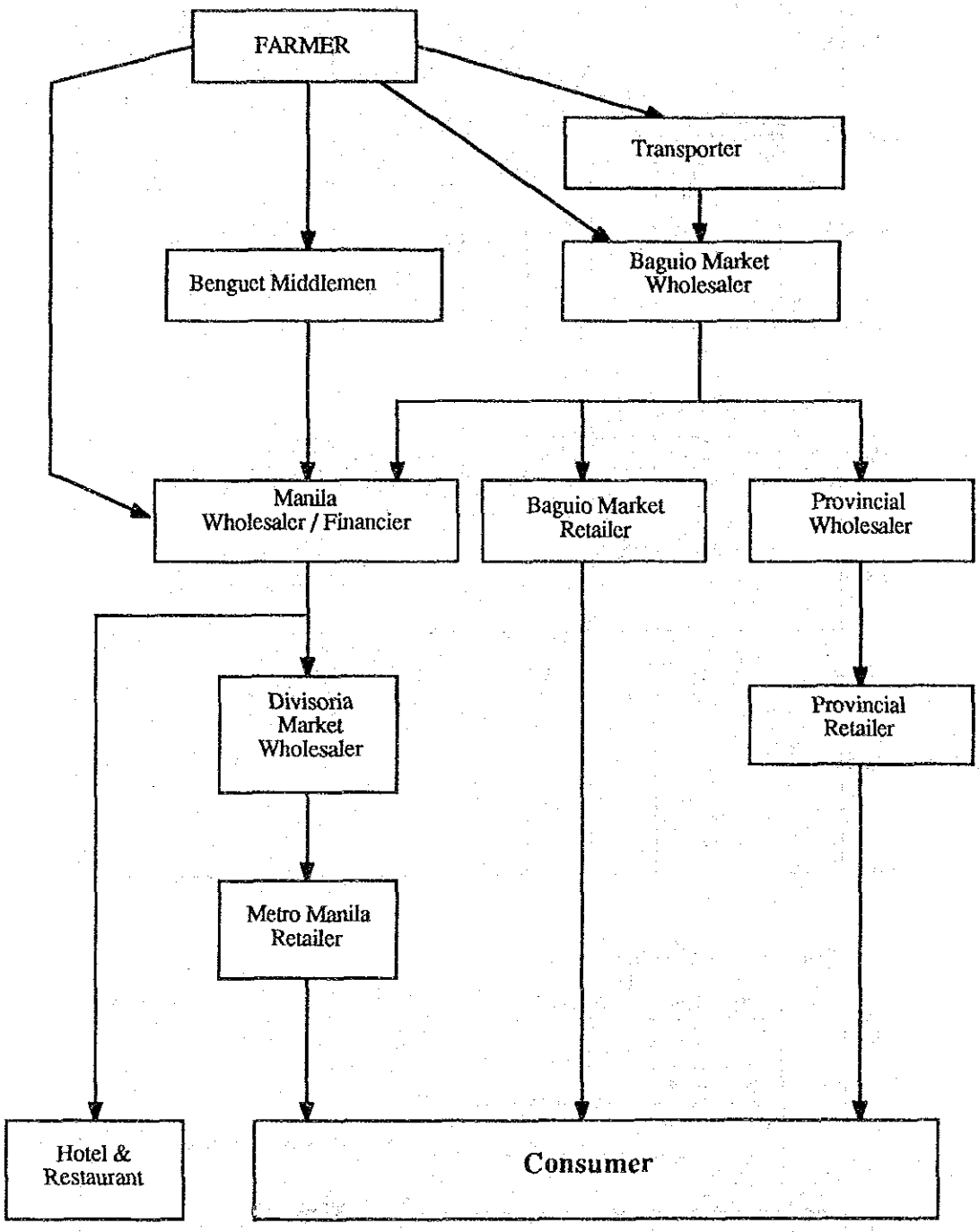


Fig. 3.8.2 Market Flow of Vegetables

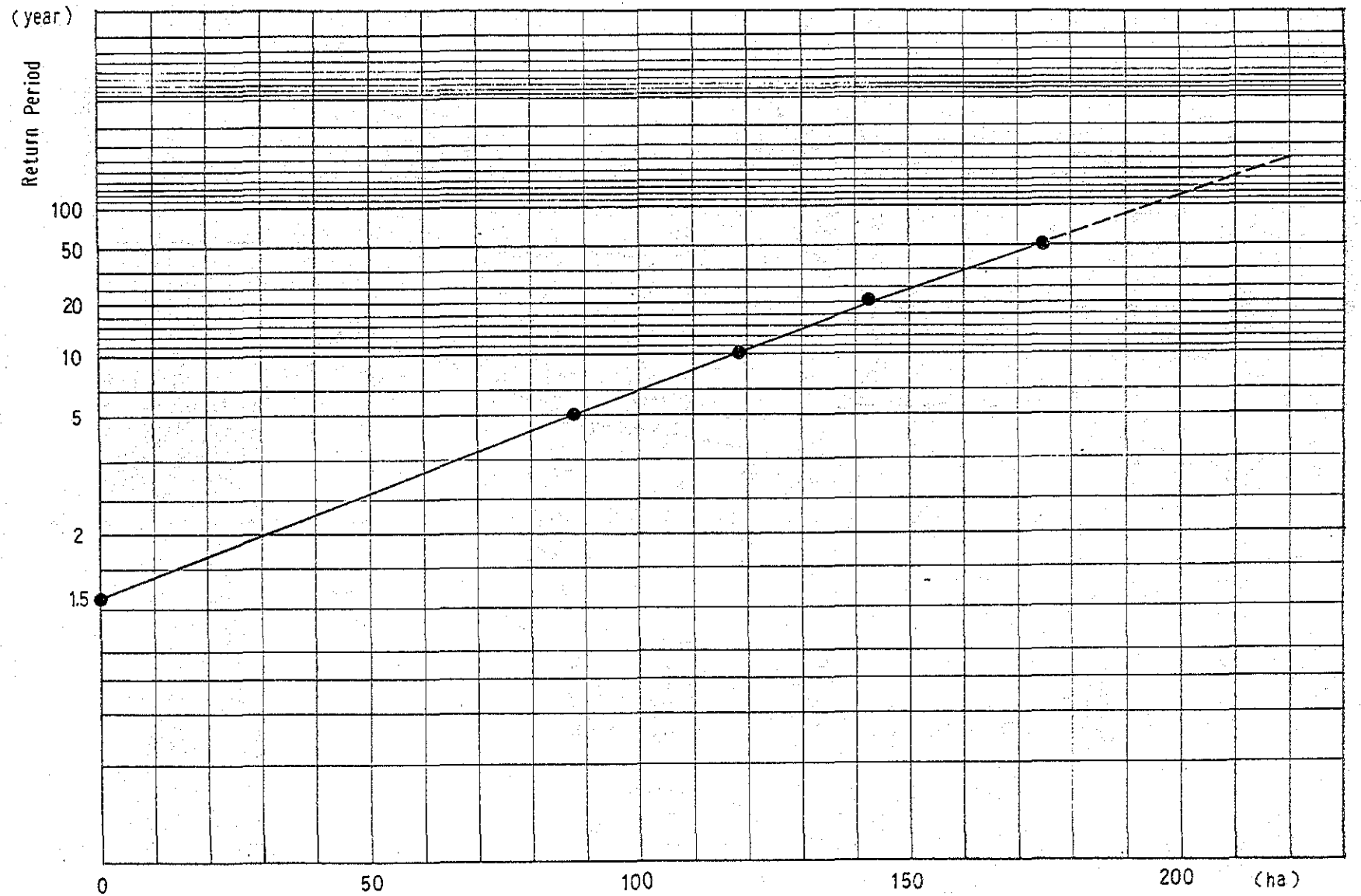
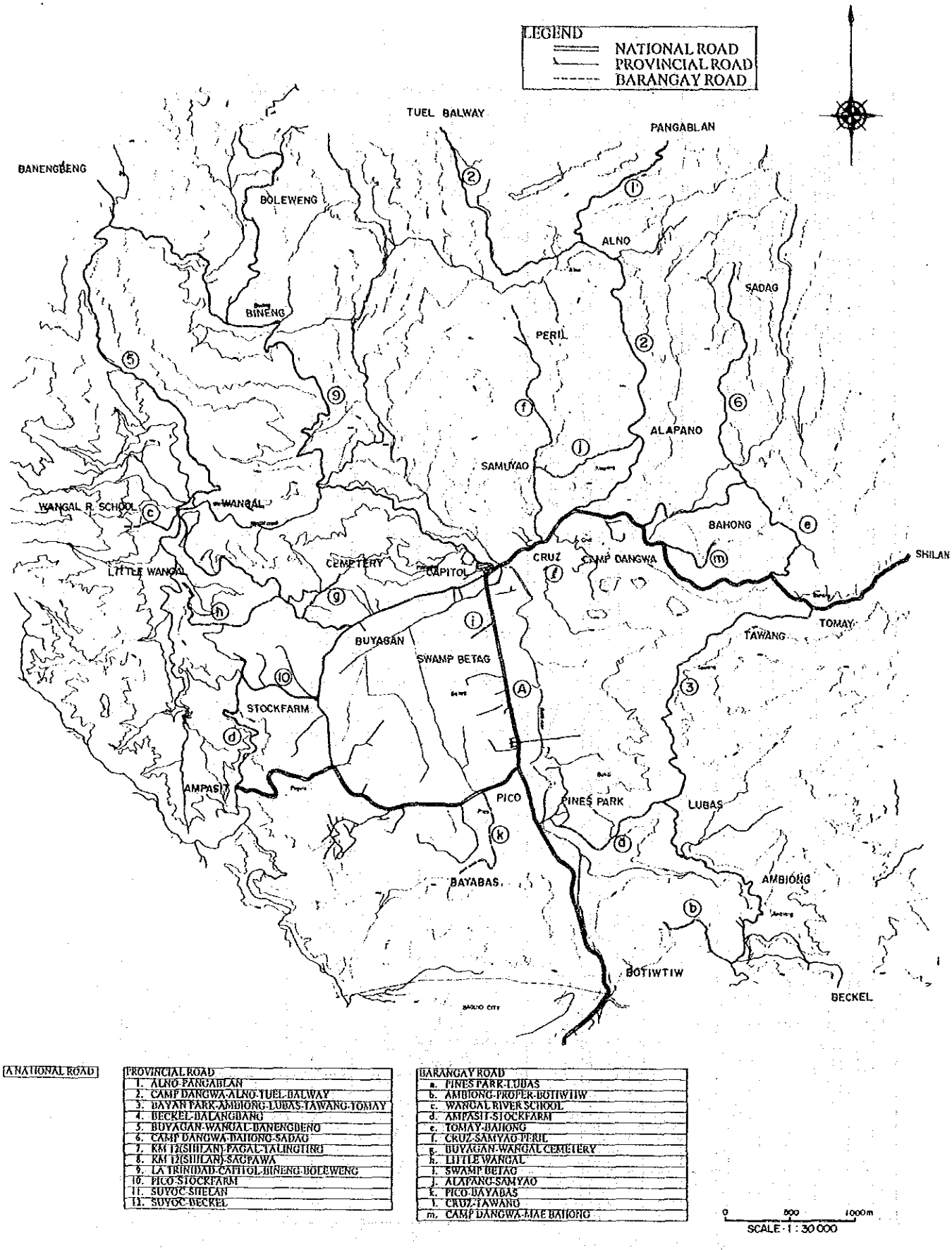


Fig.3.9.1 Relation between Return Period and Inundation Area



NATIONAL ROAD

PROVINCIAL ROAD
1. ALNO-PANGABLAN
2. CAMP DANGWA-ALNO-TUEL-BALWAY
3. DAYAN PARK-AMBIONG-LUBAS-TAWANG-TOMAY
4. BECKEL-BALANGBANG
5. BUYAGAN-WANGAL-BANENGBENG
6. CAMP DANGWA-BAHONG-SADAG
7. KM 12(SHILAN)-PAGAL-TALINGTING
8. KM 12(SHILAN)-SAGPAWA
9. LA TRINIDAD-CAPITOL-BINENG-BOLEWENG
10. PICO-STOCKFARM
11. SUYOC-SHILAN
12. SUYOC-BECKEL

BARANGAY ROAD
a. PINES PARK-LUBAS
b. AMBIONG-PROPER-BOTIWTIW
c. WANGAL RIVER SCHOOL
d. AMPASIT-STOCKFARM
e. TOMAY-BAHONG
f. CRUZ-SAMYAO PERIL
g. BUYAGAN-WANGAL CEMETERY
h. LITTLE WANGAL
i. SWAMP BETAG
j. ALAPANG-SAMYAO
k. PICO-BAYABAS
l. CRUZ-TAWANG
m. CAMP DANGWA-MAE BAHONG

Fig.3.10.1 Existing Road Networks

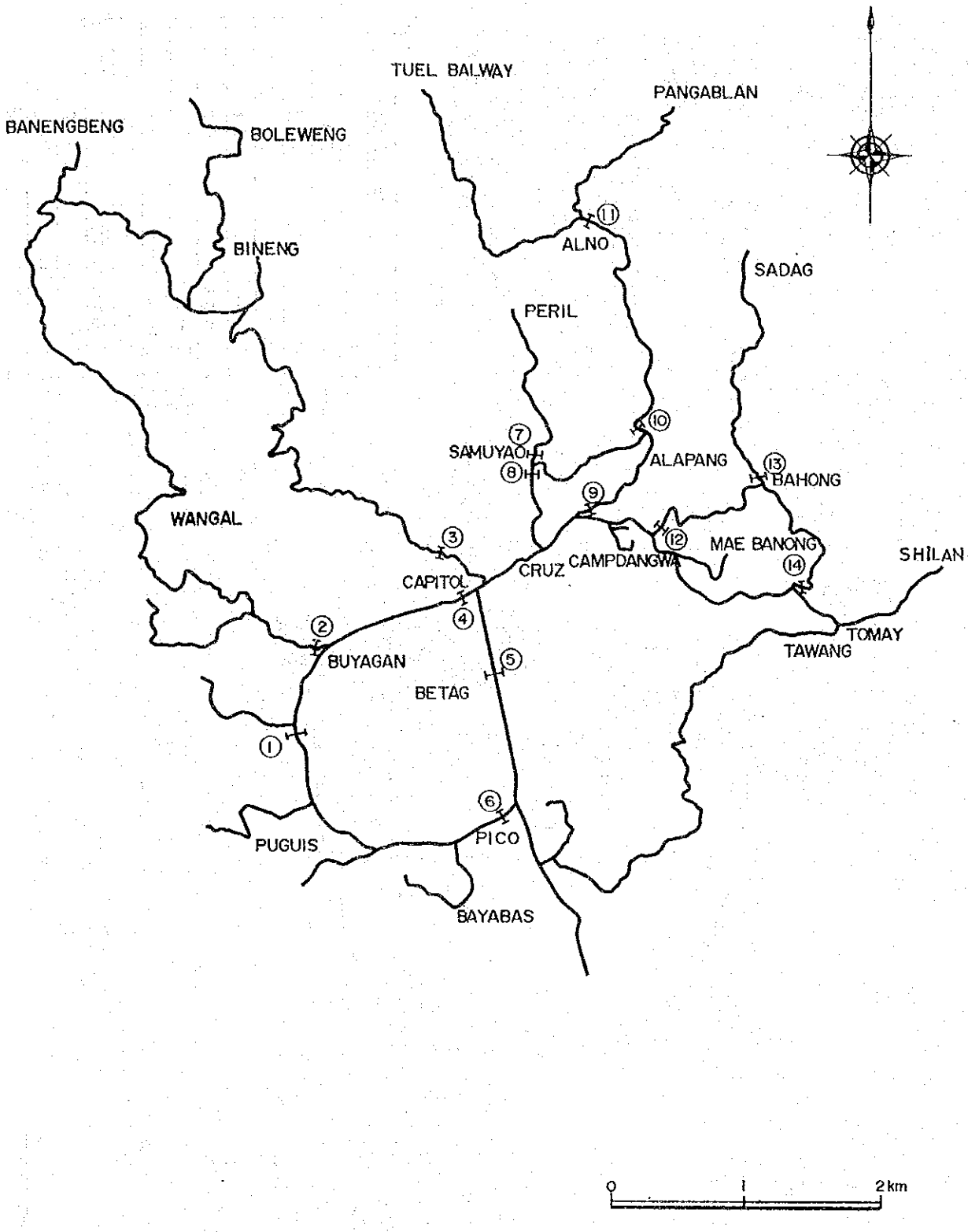
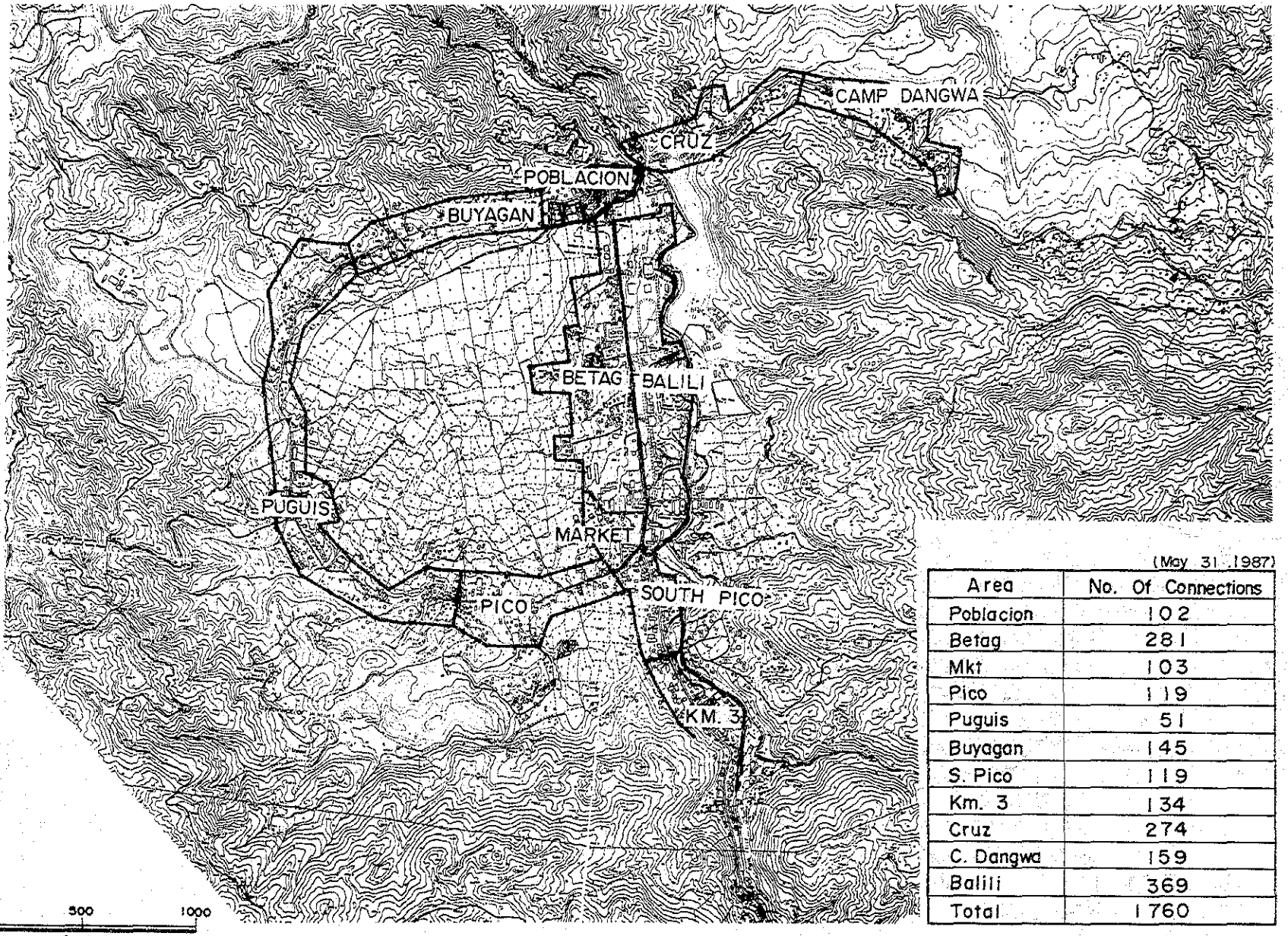


Fig. 3.10.2 Traffic Survey Points



(May 31 ,1987)

Area	No. Of Connections
Poblacion	102
Betag	281
Mkt	103
Pico	119
Puguis	51
Buyagan	145
S. Pico	119
Km. 3	134
Cruz	274
C. Dangwa	159
Balili	369
Total	1760

Fig. 3.11.1 Water Supply Area (LTWD)

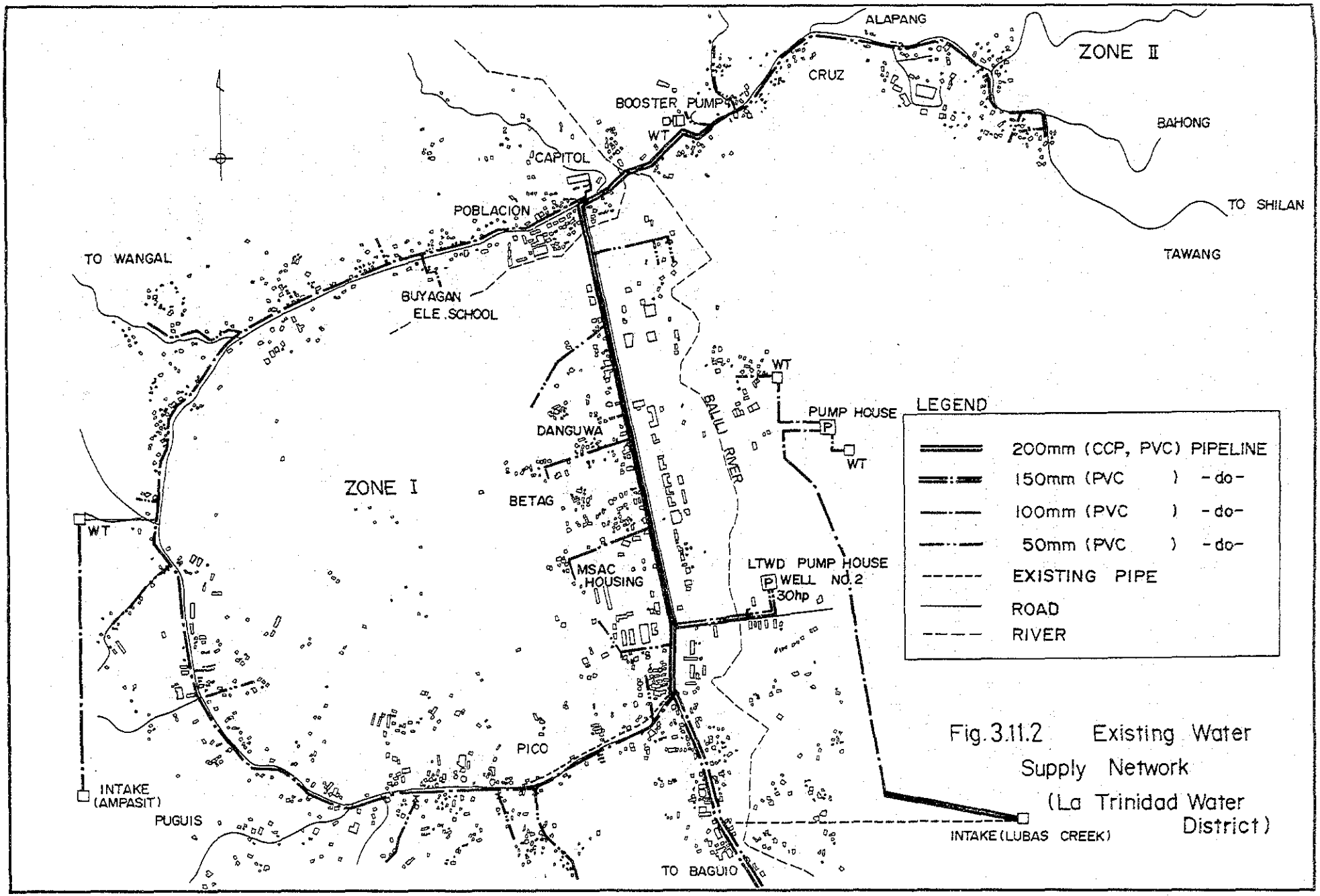


Fig. 3.11.2 Existing Water Supply Network (La Trinidad Water District)

CHAPTER IV PROJECT FORMULATION

4.1 Development Needs

(1) The Project area is the important production base for vegetables and cut-flowers, blessed with a region's most favorable highland climate condition. It supplies much fresh vegetables and beautiful flowers to the consumers in the Manila Metropolitan Area, the Ilocos Region, the Central Luzon Region and the other areas in the country, and these farm products largely contribute to the health and nutritional status of the population. Even now, supply of vegetables does not meet the consumer demand, and it is forecasted that vegetable demand will rise steadily due to the population increase and family income improvement. A plan to increase vegetable production in the Project area should be established to reduce the scale of deficiency against the growing demand.

(2) Vegetable and cut-flower cultivation of the Project area is concentrated on the flat land of La Trinidad Valley and the terraced farmland exploited on the steep slopes of limestone or conglomerate rocky hills. Agricultural, rural, and social infrastructures in the Project area remain poor, in the absence of proper improvement or rehabilitation work to assure better crop production against the severe physical conditions of the topography, heavy rainfall in the wet season, drought in the dry season, sloping land, lack of potable, domestic and irrigation water, and flooding.

(3) The Project area has 1,420 ha of land, with 620 ha of farm land, including 580 ha of upland and 40 ha of paddy field. The rural population is 21,978, the number of family units living in the area is 4,207, that of farm households 1,246, i.e., about 37 percent of the total number of households (1985 Data). The average farm size is simply estimated to be 0.8 ha per farming household. These small scale farmers are making every effort to cultivate vegetables under the prevailing severe water utilization conditions but only succeed in achieving an average of two or three crops in a year. This shows a poor crop intensity. Farm family income in one year is mostly totally spent, with only a small surplus of 1,000 pesos to 7,000 pesos remaining per farming household. From the above, it is clear that there is a real need to improve the income of the small farmers, to raise their living standards and to stabilize their livelihood.

(4) The following is an outline of the basic problem and the limiting factors in any attempt to ameliorate living conditions in the area. In view of these obstacles to the

smooth implementation of regional development, an integrated rural development project is required.

a. Annual flooding of La Trinidad Valley in the wet season is a serious problem. It is caused by the inadequate Balili river's flow capacity in conveying a flood discharge so that it will inundate La Trinidad Valley's flat lands which are themselves not provided with the adequate inland drainage system.

b. The Project area is subject to severe rainfall. The uneven rainfall distribution is characterized by plentiful rainfall of 3,240 mm in the wet six months from May to October and scarce rainfall of only 336 mm in the dry six months from November to April (BSU PAGASA). Owing to the undulating and steep topography and the prevailing limestone geology, the watershed has a very low retention, so that most of rainfall in the wet season will run off within the wet season. The river and creek water decreases to a significant extent in the dry season, with the result being a shortage in the water resources available for irrigation so that crop production is most unstable in the dry season.

c. During the dry season, the farmland area supplied with water from the Balili river amounts to 113 ha in Zone I, to 100 ha in Zone II, so that the total is 213 ha. This is equivalent to 40 percent of the gross total of the farm land in the Project area. Tests were performed to assess the quality of the water supply in both the wet and dry seasons on the basis of the appropriate Japanese standards for the quality of irrigation water and the quality of river water for conservation of livable environment. The results of these tests indicate that the water from the Balili river is not suitable for use as irrigation water so that the Project should develop an alternative water source to reduce the reliance on the Balili river for irrigation.

d. The existing rural roads pass mainly along hilltop ridges and steep slopes and have a very narrow width. Roads on steep slopes, in particular, are surfaced with limestone. This invites problems of erosion caused by rainfall, with resulting wheel slippage and skidding as the limestone dissolves and becomes slippery. Rural roads built on flat terrain are also inadequate for the traffic needs in the wet season due to insufficient drainage and a totally inadequate depth of the gravel paving.

e. The authority responsible for the drinking and domestic water supply in La Trinidad is the La Trinidad Water District (LTWD) which has a supply obligation mainly towards the household, commercial, industrial, and

educational sectors. The LTWD authority draws its water from a deep well of some 145 meters in depth. Though this water is of potable quality, the deep well has only a limited capacity so that the LTWD's service net cannot be expanded to cover also the rural areas falling within the scope of this Project. The LTWD authority is currently compelled to operate a daily rotation of supply cuts in the dry season due to the shortage of water production, a problem that is aggravated by the growing demand for water. This shortage of drinking and domestic water in the rural area within the Project area is bound to create serious problems.

f. Many barangay communities still lack the proper facilities to permit the implementation of activities designed to expand the introduction of agricultural technology on a broader scale, improve health measures, and create opportunities for better social communication, including farmer assemblies. Nor is the supply of electricity assured for all the rural areas of the Project area. This generates the urgent need to improve the as-yet-inadequate socio-environmental living conditions and to activate the rural economies by creating a better social infrastructure and upgrading the general socio-economic framework of these communities.

4.2 Primary Objectives of the Development Plan

The primary objectives of the Development Plan can be summed up as follows :

1. to promote agriculture based on the vegetable and cut-flower production as the principal type of crop best suited to the highland climate, land and soil conditions.

2. to increase the land productivity and enhance the labor productivity by providing agricultural infrastructure development for irrigation and drainage facilities, flood protection facilities, and rural road networks.

3. to raise the level of the farm income by way of ameliorating the farming system fitted with the provision of a better agricultural infrastructure and to achieve a greater stability of farm management through the strengthening and expanding of the support and service backup systems for the agricultural communities.

4. to improve a living environment base of the rural area through measures that will provide a more effective infrastructure with the establishment of

more efficient drinking and domestic water supply systems, rural electrification facilities, sewage disposal systems, waste and refuse collection, etc. so as to rise the living standard in the rural area.

5. to adopt measures designed to develop high-quality water sources for irrigation purposes to benefit vegetable production. These measures should result in a higher quality of agricultural produce in the La Trinidad area so that the farmer can achieve a higher added value after establishing a brand image of clean vegetables and thereby improve the family income. In particular, these measures should include the substitution of the current irrigation water supply from the Balili river by some alternative sources yet to be developed. This is of particular importance in view of the poor quality of the current water supply which is badly contaminated by sewage and drainage wastes from the Baguio City catchment area and the industrial wastes that are discharged into the Balili river from the factories and commercial enterprises in the Municipality of La Trinidad.

6. to create a sound socio-economic framework for the rural society though the provision of rural community centers (Barangay Halls) as a means of expanding the health and hygiene care services and promoting the introduction of more advanced agricultural and irrigation techniques and strengthening the communal irrigation organization, farmers' school and farmers' cooperative activities.

4.3 Project Formulation

While the area falling within the scope of this Project has a relatively advanced agricultural base for its highland farm production, it still faces many problems obstructing the course of further rural development.

Thorough field studies have revealed some major constraining factors in the implementation of development projects. These have been identified as follows : periodic flooding of the farming land during the wet season ; shortage of irrigation water supply of satisfactory quality ; deterioration of the existing irrigation water intake systems ; lack of water reservoir facilities ; inadequate road and associated systems ; lack of a proper rural road network ; shortage of drinking and domestic water ; insufficient use of agricultural technology by the farmer ; absence of rural community

centers as the basis for improved health care services and activities to enhance the existing agricultural and irrigation methods.

These problems have been carefully analyzed and studied in the light of the chief objectives of the present Project and the results have provided the basis for formulating the Development Project.

The principal aspects of the Project formulation are as follows :

1) Drainage improvement works (Zone I)

2) Irrigation improvement works including reservoir, pond, water tanks, well & pump and on-farm irrigation facilities (Zones I, II, III)

3) Sewerage canal construction works (Zone I)

4) Rural road improvement works and new construction of farm-to-market roads (Zones II, III)

5) Drinking and domestic water supply facilities works (Zones II, III)

6) Rural community center construction works (Zones I, II, III), and

7) Rural electrification works (Zone III)

CHAPTER V DEVELOPMENT PLAN

5.1 Agricultural Development Plan

5.1.1 Basic concept and strategy for agricultural development

The Project aims at uplifting incomes and living standards of farmers which are in line with the Government's agricultural development policies and strategies. Improvement of the prevailing farming system is set up as the basic agricultural development concept to increase productivity and profitability of the existing crops like vegetables and flowers, taking into consideration of present agricultural conditions and farmer's intention for development in the Project area.

In order to accomplish the basic concept mentioned above, the strategies for agricultural development are formulated as follows :

1) Unit yield and production of crops should be increased and stabilized through the introduction of improved technologies and farm management practices, coupled with strengthening of agricultural extension systems.

2) Planted area of crops should be expanded as large as possible with reduction of flooded area in the wet season and provision of available irrigation water in the dry season.

3) Regular and continuous supply of crops with even qualities should be attained through the guidance of extension team to minimize the variation of the crop prices.

4) Promote farmers' cooperative activities for marketing to get better bargaining power in the market.

5) Marketable amount of crops should be increased through reduction of transportation loss by rehabilitating of rural roads.

6) Extension activities should be activated through provision of vehicles, motorcycles and office equipments, and training of extension workers.

5.1.2 Beneficial area

There is no significant area of land for expansion of farm in the Project area, except steep land, and development of lands with a slope of more than 18° is prohibited since these lands are classified as non-alienable by the Presidential Decree. Therefore, the agricultural development concept of the Project is set up to improve the productivities of the existing crop cultivation. There is no notable change on land use in the Project area.

Out of the total gross agricultural land in the Project area of 620 ha, about 534 ha or 86% was selected as the benefit area of the irrigation development works from economic and technical aspects. The beneficial area in each zone are delineated below :

(Unit : ha)

Land use	Zone I		Zone II		Zone III		Total	
	P	B	P	B	P	B	P	B
Agricultural Land								
Upland field	210	199	310	235	60	60	580	494
(Net area)	(170)	(159)	(200)	(152)	(40)	(40)	(410)	(351)
Lowland rice field	0	0	0	0	40	40	40	40
(Net area)	(0)	(0)	(0)	(0)	(30)	(30)	(30)	(30)
Total	210	199	310	235	100	100	620	534
(Net area)	(170)	(159)	(200)	(152)	(70)	(70)	(440)	(381)

Remarks : P : Project area B : Beneficial area

5.1.3 Proposed cropping pattern

The Project area has been established as the major producer of temperate vegetables and cut-flowers with intensive farming system, and the farmers have much experience on irrigation farming of these crops. The present study clarified promising marketability of vegetables and cut-flowers, and the farmers' preference to continue and to improve present farming practices of these crops. Under these circumstances, the proposed cropping pattern is formulated fundamentally based on the present cropping pattern prevailing in the Project area.

The proposed cropping pattern of each zone is shown in Fig. 5.1.1. The proposed cropping pattern is formulated for full reflection of the project benefits like flood elimination in Zone I, irrigation development in all Zones. By the flood elimination, all of the Zone I area is expected to become possible to grow crops even in

the wet season. Irrigation development will increase productivity of crops and extends crop cultivation area to the maximum extent depending on the availability of irrigation water.

The cropping area under the with and without Project conditions are described as follows:

(Unit : ha)

Zone / Crops	Without Project	With Project	Increment by the Project
Zone I			
Strawberry	56	40	-16
Vegetables	249	500	251
Sub-total	305	540	235
Zone II			
Roses	60	59	-1
Vegetables	283	266	-17
Sub-total	343	325	-18
Intercropping vegetables & flowers	60	60	0
Zone III			
Rice	50	50	0
Vegetable	96	180	84
Sub-total	146	230	84
Total	794	1,095	301
(Intercropping)	60	60	0

Remarks; The cropping pattern for without project condition is assumed as same of the present patterns.

In Zone I, cultivated area of strawberry is decreased to 40 ha or 25 % of the whole area to generate maximum benefit maintaining the present production level. In Zone II, cultivated area of vegetables is decreased due to change of irrigation method (furrow irrigation) which require much irrigation water but increase crop productivity. In Zone III, cultivated area of crops is expected to increase 84 ha for vegetables in the dry season.

5.1.4 Proposed farming practices

Nutrient conditions of the soils, especially for pH, potassium, nitrogen and organic matters, have to be improved for growing most kinds of vegetables. Most soils in the Project area require raising the pH to the levels of between 5.5 and 6.5. Liming should be designed based on the result of the further detailed soil survey. As the same manner, fertilizer of phosphorus, potassium and nitrogen should be applied carefully

based on the soil chemical conditions. To determine the application amount of fertilizer, a combination of crops and soil conditions is considered to obtain the best yield of crops and also to manage economical farming. Some tentative farming practices for major crops are prepared as shown in Table 5.1.1 for desirable yield and return .

Besides the above mentioned improvement, a crop rotation system should be established to avoid damages by soil born diseases and nematodes which generally increase by continuous cropping of the same kind or family of crops in a particular field. Deep plowing of soils up to 25-30 cm or more is desirable for vegetable cultivation. Mulching is also one of effective practices for soil conservation, saving of irrigation water, reduction of some diseases infestation from the soil to plants, etc. As regards plant protection, insecticides and fungicides have to be applied. To control these pests and diseases, 3 to 4 times of chemical of applications are necessary during one cropping season. In selecting suitable agro-chemicals, the chemical toxicity which directly or indirectly affects human beings, should be taken into consideration.

5.1.5 Anticipated unit yield and production

In the without Project condition, the future anticipated unit yield of crops are set as the same levels of the present unit yield which are estimated on the average from 1984 to 1987 in La Trinidad. The anticipated unit yields with Project condition are estimated with reference to the unit yields of crops in La Trinidad during 1984 - 1987 as well as in the similar climate areas in Japan. The anticipated unit yield under the future with and without Project conditions are summarized below;

(Unit : ton/ha)

Crops	Unit Yield	Present	Without Project	With Project
Rice	ton/ha	1.9	1.9	2.5
Chinese cabbage	ton/ha	15.5	15.5	20.0
Lettuce	ton/ha	11.0	11.0	15.0
Baguio bean	ton/ha	7.5	7.5	9.0
Garden pea	ton/ha	3.0	3.0	4.5
Green onion	ton/ha	7.8	7.8	11.5
Strawberry	ton/ha	9.8	9.8	14.0
Celery	ton/ha	14.5	14.5	24.0
Rose	1,000 doz/ha	25.0	25.0	39.0
Gladiolus	1,000 doz/ha	14.8	14.8	15.0
Average of vegetables	ton/ha	9.9	9.9	14.0

In order to achieve the anticipated unit yield in the future under the with Project condition, it is very necessary that the farmers should be informed and trained on the improved farming practices supported by the research and extension services. The unit yields will increase gradually from the present level, and assumed to reach the target yield around the 5th year after completion of the Project.

The production of crops under the future without and with Project conditions were estimated by multiplying the anticipated unit yield with the future cropping area. These are presented in Table 5.1.2, and summarized as follows :

Crops	Unit	Without project	With project	Incremental
Strawberry	ton	549	560	11
Rose	1,000 doz	1,500	2,301	801
Rice	ton	95	125	30
Vegetables	ton	6,441	13,600	7,159
Flower	1,000 doz	148	150	2

5.1.6 Supply and demand of vegetables

Ilocos and Central Luzon regions plays an important role as a supply source of temperate vegetables to Metro Manila as well as the whole Philippines, although the production of the regions are far below the demand of Metro Manila and the regions. Total demand of vegetables in Metro Manila, Ilocos and Central Luzon regions in 2000 will increase by about 300,000 tons or 35% of the demand in 1986 as shown in Table 5.1.3. However, incremental production of vegetables in the Project area, about 7,200 tons would be equivalent to only about 2.4% of the demand increases in the three regions. Considering the advantage of the cool climate in the Project area which is suitable to temperate vegetable cultivation, marketability of these products will be promising and the highland area will have to increase vegetables production as much as possible in order to fulfill the gap between supply and demand.

5.1.7 Agricultural support system

The major objective of this Project is to improve and stabilize the farmers' economy through increased productivity and profitability of agricultural production based on already established crops such as vegetables and flowers. This objective will be achieved by rehabilitating existing irrigation systems, expanding the area served by

irrigation facilities and improving accessibility from farm to the market as well as strengthening of agricultural support services.

Although most of the agricultural support systems for these services have already been established in and around the Study area with Government Promotion, the following matters should be realized in order to sustain full accomplishment of the Project objective :

1) To strengthen agricultural extension services to extend improved farming practices to farmers in building up a closer connection with agricultural research institutes on vegetables and cut-flowers,

2) To strengthen inter-agency coordination among different organizations involved in rural development such as BPI, Department of Agriculture, BAS, BSU, etc.,

3) To promote the establishment of farmers groups for operation and maintenance of irrigation and drainage system at the on-farm level,

4) To encourage credit services of farmers cooperative, and

5) To promote production planning based on demand and supply projection in order to avoid periodic over-supply which may lower the price and waste of products

(1) Agricultural extension services

Among the agricultural support systems, priority should be given to the extension services in view of its role in coordinating activities between research institutions and farmers, transfer of knowledge, planning of production, strengthening of farmers' organization, etc. The existing extension system will be strengthened through the following measures :

1) Establishment of contact farmers and demonstration/trial farm

Contact farmers shall be utilized for on-farm demonstration and on-farm trials. They shall be selected from each barangay in the Project area. Demonstration / trial farms would have the following functions :

a) To evaluate new varieties of currently grown, high value and traditional crops

b) To explore new high value crops for the area

c) To test and introduce new or existing farming technologies applicable to the situation

d) To help farmers make appropriate varietal choices for their farming systems

The demonstration / trial farms will be cared by the contact farmers who shall be closely guided by extension workers in all on-farm practices.

2) Linkage with research

Extension activities of the research institutes and linkage between research and extension are limited and existing research findings have yet to reach the farmers. The extension service can close these gaps through the development of the cooperative relationship with these institutes.

The strategy of a research-extension linkage is to utilize the existing organizations like HARRC agencies located in and around the Project area.

The extension workers shall get a close contact with the research agencies in order to :

a) collect information on new varieties of crops for which verification trials have been conducted,

b) take new technologies which seems to be superior to existing practice,

c) request consultation for the problems which arise in the area, and

d) propose new research programs for the problems which require further study.

3) Production program

To reduce the price variation, constant supply of vegetables with an even quality is important along with the continuous supply throughout the year. The extension worker should guide farmers to regulate vegetable production by mean of :

a) estimating monthly production of vegetables by monitoring the planted area,

b) coordinating with BAS Baguio to provide timely market information services, and

c) Making production program in the area based on the past records of production, prices, planted areas and harvesting period.

4) Strengthening of farmers' association

In order to improve the bargaining position of farmers, farmers' cooperatives will be strengthened or newly established under the guidance of extension workers. These farmers' cooperatives will have following functions :

a) Cooperative marketing of production, and

b) Credit assistance to farmers

Rural community centers planned in the Project will be used for meeting of the farmers' association as well as farmers' school room. The farmers' cooperative will eventually be able to generate funds for further strengthening or upgrading their association.

(2) Proposed organization of extension system

The proposed organizational structure of the extension system in the Project is presented in Fig. 5.1.2. HIRDP Special Project Section for extension services will be established in the Provincial Agriculturist Office of the Province of Benguet. The present Provincial Agriculturist will be responsible for the management of the HIRDP Special Project Section as well as routine office activities. Four extension technicians and one information officer will be assigned to the Project. The increased extension technicians shall concentrate their activities inside the Project area. The information officer will be in charge of collecting and disseminating of daily prices information, and of compiling pamphlets on agricultural matters. Two drivers will also be recruited for the operation of vehicles.

5.1.8 O & M for extension system

(1) O & M equipment

Vehicles are one of the most important inputs to the extension system, as they provide the mobility required for field visits of extension workers, transportation of farm inputs to the fields of contact farmers, etc. Two four-wheel drive vehicles including one jeep and one pick-up truck, and three motorcycles will be procured and stationed at the HIRDP extension office. All vehicles will be operated under a pool arrangement.

The office will also procure office equipments and furniture, instructional equipment such as audio visual aid, and basic agricultural equipment necessary for field extension works. The kinds of O & M equipment and their procurement costs which were estimated at about 930,000 pesos are shown in Table 5.1.4.

(2) Annual O & M cost for extension system

Annual operation and maintenance cost comprises salaries for staff increased, cost for operation, repair and maintenance of O & M equipment. The annual O & M cost is estimated at about 301,000 pesos as shown in Table 5.1.5.

5.1.9 Farm economy

After implementation of the Project, more irrigation water and extension services would be provided to all farmers in the Project area, and crop productivity would improve remarkably. As a result, a significant increase in farm income would be expected in future with Project condition.

The impact of the Project on the beneficiary farmers was examined analyzing the farm budget of typical representative farmers with average farm size. The results of the farm budget analysis are shown in Table 5.1.6 and 5.1.7, and are summarized below.

(Unit : pesos/year)

Items	Zone I		Zone II		Zone III	
	Without	With	Without	With	Without	With
Farm size (ha)	0.87		0.70		0.91	
Net farm area (ha)	0.70		0.46		0.65	
Total cultivated area (ha)	1.32	2.39	1.02	0.99	1.35	2.13
Total Net Income	56,900	129,000	52,500	83,000	33,600	82,500
Net Farm Income	52,700	124,800	49,500	79,900	28,000	76,900
Non-farm Income	4,200	4,200	3,100	3,100	5,600	5,600
Total Expenses #	50,200	80,600	45,900	53,200	32,600	53,300
Net reserve	6,700	48,400	6,600	29,800	1,000	29,200

: Including irrigation water fee.

Total net income under the with Project condition would be expected to increase 1.6 to 2.5 times as compared in future under the without Project condition. The annual net reserve under the future with Project condition would also remarkably increase as compared with future without Project condition. The increase in net reserve would enable farmers to pay the irrigation water fee and would also offer them incentives for further development.

5.2 Irrigation Development Plan

5.2.1 General

In line with the basic concept and strategy for agricultural development, irrigation system should be facilitated so as to increase productivity and profitability of agriculture. Inadequate facilities and several constraints for irrigation presented below were found in the Project area.

1) Uneven seasonal distribution of rainfall,

2) Shortage of irrigation water during the dry season,

3) Inadequate irrigation facilities,

4) Advance of contamination for river water, especially the Balili river.

Beneficial area for irrigation is shown below, which was demarcated in the Project area excluding the inconvenient aspects.

(unit:ha)

Land category	Zone I	Zone II	Zone III	Total
Upland crop field	199 (159)	235 (152)	60 (40)	494 (351)
Lowland rice field	0 (0)	0 (0)	40 (30)	40 (30)
Total	199 (159)	235 (152)	100 (70)	534 (381)

: These figures exclude land acquisition for proposed roads and irrigation facilities.
The figure in the parenthesis is net beneficial area.

Wet season is also included in the subject term for irrigation and so is the dry season, because irrigation water has sporadically supplied even in the wet season.

5.2.2 Irrigation block and irrigation water requirement

The beneficial areas, thirteen (13) irrigation blocks have been identified in terms of the present irrigation system and topographic conditions, the average area of which is about 30 hectares. Irrigation systems were individually planned for every irrigation block.

Major soil types of the Project area are silt loam or loam with basic intake rate at 10 - 20 mm per hour. Loamy sand soil partly extends over Zone II area.

Consumptive use of crops was estimated with daily evaporation multiplying crop factor (Kc) of each crop. Average consumptive use was respectively calculated, i.e., strawberry 2.8 mm/day, vegetables 2.6 mm/day, rose 3.2 mm/day. Rice will be planted in Zone III area even with this Project. The paddy field water requirement was estimated at 6.4 mm/day in the wet season, and 7.4 mm/day in the dry season. The puddling requirement was 100 mm with 10 days puddling period.

Effective rainfall for highland crops during crop growth is 80 percent of daily rainfall exceeding 5 mm, and limited to total readily available moisture at 40 mm. The that for paddy fields is limited to 80 mm.

Design irrigation efficiency for crop field was 0.65 on the assumption that surface irrigation method would spread over the whole Project area. In the case of paddy field, this was taken as 0.85.

5.2.3 Water source availability

At present, Balili river water is one of the major water sources besides the small creeks and springs. Balili river water, however, should not be used for irrigation due to its contaminated water quality. In the Project area, the annual amount of the surface water deducting Balili river water is approximately 4,699,000 cu.m in the dry season, 36,434,000 cu.m in a year. About 23 percent of the quantities said above, i.e., 1,080,000 cu.m in dry season, 1,219,000 cu.m in a year are being used for irrigation at present. This affords ample scope for irrigation water source development by means of construction of intake weirs and ponds.

As for the Dinog Cave in Zone II, directly introducing of Balili river water in the dry season by temporarily damming up at the Balili river is not recommendable due to unsuitable water quantity of the river water. However, only seepage water of the Dinog Cave without such directly introducing is considered available for irrigation hereafter.

In addition to the above, groundwater is available in considerable quantities. It would be introduced so far as circumstances permit in view of economy and hydrogeology.

5.2.4 Water source development plan

Based upon advantageous cropping pattern from agricultural aspects, it is suggested that water sources should be developed in such a manner so as to adopt surface irrigation method that is consistent with the proposed cropping pattern.

Water source development is basically composed of improvement of intake weirs and construction of ponds or small reservoirs. The construction of ponds inside of each irrigation block is assumed to be permissible to a maximum of 70,000 cu.m in total, because of difficulties of land acquisition and topographic conditions. Despite the fact that dam reservoirs can be constructed in the middle reaches of the Wangal creek in the case of huge irrigation water required, this was assumed to be rather expensive owing to the construction of big dam, and long diversion conduits, and the necessity of boosted conveyance of irrigation water by pump to Zone I and a part of Zone II.

In accordance with several conditions mentioned above, three alternatives for irrigation development listed below are proposed. Optimum irrigation plan is to be determined among the alternative plans through economic evaluation.

Alternative A : to aim at enlarging the irrigable area and term only by construction of intake facilities. Farm ponds having only regulating capacity are also proposed.

Alternative B : to aim at enlarging the irrigable area and term by construction of intake facilities and irrigation ponds which may have a reservoir capacity topographically permitted as large as possible.

Alternative C : to accomplish full development in irrigable area and term. Dam reservoir is required in the Wangal creek as a main water source.

Results of the comparison of the alternatives are listed as follows :

Alternative	Planted area (ha)*	Major irrigation facilities
A	1,082 (217)	9 intake weirs, and farm ponds for regulating with 10,000 cu.m capacity in all.
B	1,155 (217)	8 intake weirs, and 11 nos.ponds with 68,500 cu.m. capacity in all.
C	1,312 (217)	Concrete dam with 30 m dam height, diversion conduit of 6.8 kms length, lifting pump with 12 cu.m/min ,180m head.

* : Figures in the parenthesis owe to drainage improvement but irrigation.

Economic comparison of the alternatives are shown below, which were evaluated based on the ratio of Benefit by Cost (B/C).

Alternative	Construction cost (103 ₱)	Annual O&M cost (103 ₱)	Incremental benefit (103 ₱)	B/C
A	60,008	1,135	18,124	1.90
B	67,750	1,248	20,854	1.95
C	210,800	2,563	32,120	1.01

*: Above B/C was calculated with discount rate rate at 10%.

Accordingly, Alternative B has been chosen as the most economic alternative with the highest B/C at 1.95.

With the optimum plan i.e., Alternative B, about two thirds of farmlands in Zone I and Zone II would be supplied with irrigation water for applying surface irrigation practice even in severe drought months i.e., from January to April. In all farmland in Zone III, full area and full term irrigation would be completed with good effect of improvement of existing Bineng CIS irrigation facilities.

Summary of water balance of the optimum plan is shown in Table 5.2.1.

5.2.5 Proposed irrigation facilities and preliminary design

Location of each irrigation block and major irrigation facilities are shown in Fig. 5.2.1 to Fig.5.2.3.

In Zone I, direct intake from the Balili river should be replaced with newly proposed wells, because of proceeding of contamination for the Balili river water. Supplementary use of the remaining production from the wells planned for domestic water supply, has been proposed for a few blocks where land acquisition for enlarging the pond capacity is difficult. In Zone III, no pond has been planned for storage, because only improvement intake weirs and existing irrigation canal would be effective.

Proposed irrigation system inside of irrigation block is shown in Fig. 5.2.4.

Irrigation water drown in by the proposed intake facilities flows into the proposed pond through diversion conduit. Storaged irrigation water in the pond flows down through lateral conduits, and is divided to several delivery conduits at the division box.

Preliminary designing for the irrigation facilities was carried out as mentioned below.

The proposed pond has been designed as a small storage dam type constructing on the streams if topographic conditions and stream's form are allowable. In case not allowable, a combination of intake and pond has been designed. Design capacity of the pond was decided on the basis of the second water shortage volume during eleven years for the water balance calculation, adding 15 percent losses.

Proposed intake weirs would be built with concrete on the river or creek. These weirs have been designed as fixed type, no gate would be installed.

Afflux at the stream is taken at most 1.0 meter so as not to obstruct smooth flowing especially in flooding.

Proposed diversion conduits are to be designed as 200 - 300 mm diameter steel pipes so as to introduce water to the extent of filling the pond with water in less than one or two days. The capacity of the lateral conduits has been decided at 1.0 litter/sec/ha of maximum design unit water requirement, multiplying commanded area of each lateral conduit. Proposed water tank is on-farm and terminal facilities for multi-purpose which can apply the surface irrigation method as well as usual practice. The water tank would be made of concrete with 4 m^3 capacity, installed on average 1.0 hectare of farm land each.

Delivery conduits connecting division box on the lateral canal with each water tank, have enough flowing capacity more than 1.0 litter/sec per one commanded farm area so that the proposed pond may regulate the variation of water demand in every water tank.

The number of proposed facilities of each irrigation block is listed in Table 5.2.2, and summarized as follows :

Item	Quantity of proposed facilities
Intake facilities	8 intake weirs
	2 diversions
Diversion conduit	3,000 meters
Pond	11 nos. (68,500 m^3)
Lateral conduit	25,050 meters
Division box	120 nos.
Delivery conduit	30,000 meters
On Farm Water tank	595 nos.
Others	3 deep wells in Zone I
	1 regulating pond in Zone III
	Rehabilitation of Bineng CIS canal with intake weir

5.3 Drainage Improvement Plan

5.3.1 General

Drainage improvement plan should be proposed for Zone I where serious drainage problems exist. A back flow from the Balili river into the Bolo creek has occurred because the water stage of the Balili river rises higher than that of the Bolo creek. The rising water stage due to the lack of flowing capacity in the Balili river as well as the Bolo creek was concluded to be the major cause of inundation.

Besides these, partial inundation has occurred here and there because of the partly narrowed sections of the creeks and inadequate road crossing facilities.

These constraints for drainage should be improved on a scale of a five year return period.

The design discharges are 85.8 m^3/s at the Bolo creek, 282.8 m^3/s at the Balili river which is before the confluence of the Bolo creek, and other creeks and facilities have been designed with the specific design discharge of 16.2 $m^3/s/km^2$.

5.3.2 Proposed drainage works and preliminary design

Preliminary design for major drainage works, i.e., Balili river improvement work and Bolo creek improvement work, has been carried out as mentioned below.

The river improvement for the Balili river is 425 meters long. Design river bed gradient is decided at 1/450 to flow smoothly and to prevent scouring.

Design cross section of the river is with 16 meters bed width, and with 1:2.0 side slope.

River bed of the river has to be excavated more than 2 meters at crossing of the national road, so as not to obstruct the inflow from the Bolo creek, when flood with a five year return period occurs. Since the cross section becomes narrow at the point, river lining with retaining wall is required to obtain sufficient flowing capacity.

Moreover, there is a temporary weir site on the Balili river upstream of the confluence with the Bolo creek to divert irrigation water to the Dinog cave in the dry season. The site is necessary to maintain river bed elevation as it is. In order to maintain river bed as mentioned above, a consolidation dam is proposed at the beginning point of the river improvement.

The river improvement for the Bolo creek is 1,400 meters long with 10 meters bed width, 1:1.0 side slope. Design river bed gradient is decided at 1/1,000.

River bed of the creek has to be excavated 2 meters on an average so that design water stage of the Bolo creek will not exceed the lowest field elevation along the creek.

Present undulated alignment should be aligned, and strengthened with retaining wall downstream of the creek.

Installation of a sluice gate is proposed on the middle stream of the Bolo creek to maintain water stage in dry season as intaking water smoothly.

Proposed drainage works are summarized below :

Items	Quantity
Improvement of the Balili river	Total length : 425 meters (river bed width 16 meters, side slope 1 : 0.5) improved length with retaining wall : 250 meters, side slope 1:0.6, consolidation dam :1 no.
Improvement of the Bolo creek	Total length : 1,400 meters (river bed width 10 meters, slide slope 1 : 1.0)
Reform of cross section in the Bayabas creek	Total length : 500 meters (for the part of the creek with less than 5 meters river bed width)
Others	Road crossing structure : 2 nos. (in the Bayabas creek and the Pico creek) Improvement of edged bending portions in the Puguis creek

5.4 Development Plan of Rural Roads

5.4.1 Basic concept

The basic concept of the development plan of rural roads is to contribute to the following objectives :

1) realization of highly productive agriculture
2) buildup of the regional economy
3) improvement of social capital
4) improvement of rural infrastructure for settlement development

5.4.2 Route location

Improvement of the existing rural roads and new construction of farm to market roads in the Project area will be designed in harmony with the natural conditions, dimensions and configurations of the beneficiary areas, layout and the structure of the existing roads and conditions and density of traffic. Basically, the scheme aims to

improve synthetically the regional agricultural productivity and to accelerate the activation of social activity by forming an effective road network.

a. Zone I

In Zone I situated in a flat area, urbanization is well advanced, and road rehabilitation and maintenance are also well executed by DPWH and Provincial office. Each barangay is communicated by the national and provincial loop roads. For these reason, a development plan concerning to the road rehabilitation and new construction in Zone I is not schemed.

b. Zone II

Roads are constructed only on the ridge and the side of mountains in Zone II. Roads for agricultural transportation in agricultural lands and communication roads between barangays are very scarce. This has been a serious obstacle to regional development. Thus, rehabilitation works of existing roads and construction of new roads to form a road network are planned in order to improve agricultural productivity and to accelerate regional social activities. The construction of a total length of 18.9 kms comprising 13.9 kms of the rehabilitation road and 5.0 kms of the construction road should be executed in Zone II.

c. Zone III

Maintenance condition of the road between the Capitol and Bineng is very poor. This is a serious obstacle to traffic communication and regional development.

Thus the scheme should comprise rehabilitation works for this road. In addition to this, the road between Bineng and Boleweng which is the main road for transportation of agricultural products in Zone III, as well as the new road construction which connects each road mentioned-above stretching down the Bineng Plateau are planned.

The road length of the rehabilitation and new construction road is given below:

	Existing road length	Rehabilitation road length	Total length
Zone II	13,900m	5,000m	18,900m
Zone III	8,700m	2,800m	11,500m

5.4.3 Preliminary design of the rural road

(1) Basic design criteria

A road standard section is determined in consideration of the following factors:

1) Traffic volume estimated at the Project target year (10 years hence) and type of design vehicles
2) Design speed

a. Designed daily volume

Daily design capacity of the traffic volume of the rehabilitated roads and newly constructed roads at the Project target year is estimated to be 150 - 500 cars per day on the assumption that a yearly rate of increase of vehicles in 5 percent against the present traffic volume of 100 - 300 cars per day.

b. Type of design vehicles

Design Vehicles are as follows :

Vehicle	Vehicle width
Passenger car	1.7m
Truck (below 2ton)	1.7m
Jeepney	2.0m

c. Design speed

Design speed is 30 km/hr (kms per hour). If necessary, due to topographic conditions, it can be reduced to a minimum of 20 km/hr.

(2) Standard section of the road

In consideration of the basic criteria as above-stated, the following dimensions are derived for a road standard section ;

a) Roadway width : 3.0 meters
b) Shoulder : 0.5 meters for each side of the road
c) Soft shoulder : 0.5 meters guarding the top of slope against collapse.

In due regard to the fact that the Project area has a seasonal heavy rain, the roadway and shoulder parts of the roads shall be paved in principals.

(3) Longitudinal profile of the roads

Longitudinal profile of the existing roads shall not be changed because of the topographical restriction and the increase of a large amount of construction cost involved.

The maximum longitudinal gradient of the roads shall be designed at 8 percent for the newly constructed roads.

(4) Pavement and drainage facilities

As the Project area has heavy seasonal rainfall, severe road surface erosion by rain occurs on the steep roads. Therefore, the roadway of the existing rural roads shall be improved with concrete pavement and appropriate drainage facilities such as a gutter shall be equipped.

In case that the equipment of the gutter will give disadvantages or difficulties due to a topographic condition, a double function road combining roadway and waterway will be adopted. The length of those double function road will be 1.5 kms (7 percent), out of the total rehabilitation road length 22.6 kms.

As for the newly constructed roads, the drainage facilities such as gutters shall also be involved, and the roads shall be paved with gravel.

The standard sections of the roads are shown in Fig. 5.4.2.

5.5 Development Plan of Drinking and Domestic Water Supply Facilities

5.5.1 General

La Trinidad Water District (LTWD) is serving domestic water to Zone I and a part of Zone II. LTWD has no extension plan of water supply in Zone II and Zone III.

The present water supply is approximately 80 lit/capital.day including the system losses according to the LTWD data. Main water sources outside the service area in Zone II and Zone III are springs, groundwater and water wagons at present, as well as the springs gives a lower yield in the dry season to impede the daily life in these areas.

Thus, there is an urgent need to develop the domestic water supply systems in Zone II and Zone III.

5.5.2 Design terms

(1) Service area

Service area comprises Zone II except for LTWD service area and Zone III shown in Fig. 5.5.1.

(2) Designed population

Total service population of 11,000 is estimated to show an annual growth rate of 6 percent on the target year 1998 on the basis of present population data indicated in Table 5.5.1. Detailed designed population in the service area is shown in Table 5.5.2.

(3) Water use

The domestic water includes miscellaneous water for agriculture, such as livestock use, crop washing water and water for spraying fungicides.

(4) Water consumption

Average water consumptions are estimated as follows :

a) Drinking and domestic water supply

	Water Consumption	Remarks
Residences	120 lit./capita.day	Including 20 % loss
School	24 lit./capita.day	- ditto -
Clinic, public facilities	1,000 lit./place.day	- ditto -

b) Miscellaneous water use for agriculture

— Livestock

	Water Consumption	Remarks
Cattle	30 lit./no.day	Including 20 % loss
Pig	15 lit./no.day	- ditto -
Domestic fowl	0.5 lit./no.day	- ditto -

c) Crop washing water : 500 lit./10 a. including 20 % loss

d) Water for spraying fungicide : 500 lit./10 a. including 20 % loss

e) Total water consumption

Total water consumption is estimated as follows :

Items	Average water consumption (cu.m./day)	Maximum water consumption (cu.m./day)
1. Drinking, domestic water	1,500	1,800
2. Miscellaneous water use		
— Livestock	40	60
— Washing (Spraying) water	130	200
Total	1,670	2,060

5.5.3 Preliminary design

Deep wells are adopted as the water source because of their steady characteristics of groundwater in terms of the water quantity and quality. The water supply facilities consist of deep wells, pumps' water conduit facilities, purification facilities and distributing facilities.

(1) Deep wells

Domestic and drinking water service areas were divided into seven (7) areas comprising six (6) areas in Zone II and one (1) in Zone III as shown in Fig. 5.5.2 and Fig. 5.5.3. Each service area will be supplied by one (1) deep well, and seven (7) deep wells will be connected each other forming the domestic and drinking water supply systems of the Project.

From the results of the pumping up tests, the available yield capacities were estimated at 450 lit./min. in Bahong (Zone II) and 780 lit./min. in Bineng (Zone III). The design yield capacity of a planned deep well was determined at 200 - 250 lit./min.. This figure was derived from the yield capacity of test well in Bahong using a safety factor around 2.0 with consideration of the hydro-geological conditions in the Project area.

Based on the above, the delineation of the service area was decided.

(2) Water purification facilities

The chlorination should be executed for potability, and the filtration facilities are also required for the muddy and tubid water. The capacity of the facilities is decided with the filtration velocity of 5 m/day.

(3) Distributing facilities

Distributing facilities comprise distributing tank and water conduit and supply pipes. Common water faucets would be applied to the terminal residential area with five (5) houses or more.

Proposed facilities are summarized hereunder :

a) Deep well	
— Number of deep well	7 nos. (Zone II 6 nos. Zone III 1 no.)
— Diameter of casing pipe	ϕ 200mm
— Well depth	70 m (average)
b) Pump	
— Pump type	Submersible pump
— Design discharge	200 litters/min. (average)
— Total head	70 - 100 m
— Required motor output	7.5 kW
c) Water conduit pipe	ϕ 80mm diameter
d) Water purification facilities	Chlorination and filtration basin (as the need arises)
e) Distributing tank	7 nos. 150 cu.m. each
f) Distributing pipe	ϕ 80 - 150mm diameter
g) Terminal common water faucet	for use of a group of 5houses or more

Water supply facilities are illustrated by diagrams on Fig.5.5.4, Fig.5.5.5, and the flow chart of water supply facilities is shown in Fig.5.5.6

5.6 Rural Electrification Plan

5.6.1 Problems

Rural electrification in all of the municipalities of Benguet is expected to be the 100 percent before 1990 in line with the expansion of BENECO in coordination with the National Electrification Administration (NEA). According to BENECO official, one constraint in the attainment of this goal is finance, and another constraint is fast rising cost of electric power.

5.6.2 Power demand for rural electrification

A family number of 3,131 or 70 percent of the total number of families were energized in the Project area in 1985. Or around 1,305 number of families await the electric service delivered into their home. Present annual power demand for electrification in the whole Project area is calculated with the consumption rate of 92 kWh/month(domestic houses) prepared by the NEA, as follows :

Power Demand = 1,305 x 0.8* x 92 x 12 = 1,152,576 = 1,200,000 (kWh)/year

*0.8 = Approximate ratio of household number/family number in the Project area.

5.6.3 Hydropower potentiality study

Hydropower potentiality is studied to utilize a head along the Balili river. The possibility of hydropower generation at intake site which will locate about 300 meters downstream from the Provincial Capitol is outlined below:

Total head	:	200	m
Effective head	:	180	m
Maximum output	:	3,700	kW
Firm output	:	260	kW
Annual power generation	:	15,000	MWh
Maximum discharge	:	2.6	m^3/sec
Firm discharge	:	0.18	m^3/sec
Discharge utilization factor	:	50	%

The internal rate of return (IRR) is studied preliminary to evaluate the hydropower development of the Balili river, and the IRR around 1 percent is estimated

under conditions below. Hydropower development is not considered in the Project because of polluted water quality and economic aspects.

		(Million Peso)
Construction cost	:	450
Annual O/M cost	:	5
Annual benefit (*)	:	27

(*) Annual benefit is estimated using present power rates of BENECO.

5.6.4 Rural electricity supply plan

There is no electric power supply in Zone III, and this is one of the major constraints for smooth development of Zone III. The inhabitants of Zone III desire electricity supply strongly. On the other hand, hydropower development of the Balili river is judged to be inefficient due to economic aspects and water quality. Thus the extension of transmission lines to Zone III from the existing distribution lines is proposed as rural electrification measures. At present power cuts occur mostly during summer periods in and around the Project area, due to low power generation. Therefore, existing distribution lines can afford to supply electric power to Zone III except power cuts periods in summer.

The salient features of rural electricity supply works are as follows ;

Poblacion-Bineng Line	:	6.0	km
Distribution Voltage	:	3.2	kV

Note : Location of extended transmission line is shown in Fig. 5.6.1.

5.7 Inland Pollution Protection Plan

5.7.1 Garbage disposal

Constantly garbage dumping has been found at several creeks in the Project area. These hinder flowing function as well as living environment. Reinforcing of garbage truck and pickup, and establishing of water disposal pit are inevitably required in company with enlightening habitants on garbage disposal.

As for the proposed dump site, it should be decided from the viewpoint of environmental impacts, property conditions and dumping capacities, etc.. Taking into considerations above mentioned, the existing dump site in Wangal might be changed to the suitable new one, because the existing dump site is located near houses of Wangal to be harmful to the inhabitants. The new dump site shall be decided by the Municipal Government in accordance with the improvement of rural roads.

Projections for total solid waste to be generated and collected within La Trinidad on 1996 and 2000 are summarized as follows :

Year	1996	2000
Population to be served (Persons)	54,575	61,424
Solid waste generation rate (lit./person/day)	2.69	2.97
Residential vol. to be generated (cu.m./day)	147	182
Residential vol. to be collected (cu.m./day)	97	135
Commercial/Industrial vol. to be collected (cu.m./day)	5.5	6.5
Institutional vol. to be collected (cu.m./day)	2.0	2.0
Total vol. to be collected (cu.m./day)	105	144
No. of trucks needed 7 cu.m. (nos.)	4	5
No. of pickup needed 4 cu.m. (nos.)	2	2

(La Trinidad, Benguet)

5.7.2 Sewage

In the surrounding residential area in Zone I, stagnating waste water discharged from the residents considerably hinders living environment, such as nasty smell, or spreading of epidemic.

Irrigation water and shallow groundwater are also contaminated with the waste water. As a countermeasure for the sewage and improvement of living environment, sewage canal is proposed for exclusive use of sewage removal.

The facilities are concrete canal of 5,000 meters of total length comprising two lines, which flow into the Bolo creek gathering sewage. As the design discharge is matched with the design discharge of domestic water supply, it decided at 0.1 m^3/s.

The sewage canal will be provided with a type of closed concrete culvert so as to prevent from inflow of rainfall water, and installed inlet facilities every 100 meters of the canal.

5.8 Rural Community Center Plan

5.8.1 Necessity of rural community center

One of the basic principles of the Project is to develop and activate rural society and economy. And it is realized by the improvement of agricultural and social infrastructure, strengthening of agricultural supporting system and extension services. To achieve these purposes effectively, the multi-purpose buildings are necessary for discussion, diffusion and training of appropriate technology, health service, planning and assessment of development programs and projects in the barangays. Rural community centers are planned in this context. Perspective of rural community center is shown on Fig. 5.8.1.

5.8.2 Planned rural community center

The barangay is the basic unit/area of rural development, so the planning of rural community center is examined by each barangay. The following seven (7) rural community centers are selected based on the presence of multi-purpose buildings and the percent of farm family to total family.

Barangay Related to Project Area

Zone	Barangay	Total (A) Family	Farm (B) Family	Percent (B/A)	Existing Multi-Purpose Buildings
Zone I	Betag	531	125	24	Municipal Hall
	Pico *	1,091	297	27	None
	Poblacion	704	100	14	Provincial Hall
	Puguis *	436	145	33	None
Zone II	Alapang *	265	146	55	None
	Alno *	190	152	80	None
	Bahong *	372	186	50	None
Zone III	Bineng *	156	109	70	None
	Wangal *	187	126	67	None

Source : Family Survey 1985, Rural Health Unit.

* : Barangay selected to build in rural community center.

5.9 Procurement of O & M Equipment

The following operation and maintenance equipment would be procured to accelerate the Project activities.

1) Equipment for the Project office
2) Equipment for the garbage disposal
3) Equipment for the agricultural extension service

(1) O & M Equipment for the Project office

Vehicles are the most important equipment for the smooth acceleration of the Project activities. Three (3) four-wheel drive vehicles including two (2) jeeps and one (1) pick-up truck, and three (3) motorcycles will be procured and stationed at the HIRDP office. Office equipments, furniture and instruction equipment such as audio visual aid, and micro computer for data processing, moreover, meteorological observation equipment and water quality test equipment will be procured at the HIRDP office. The procurement costs were estimated at about 2.4 million pesos in total. (see Table 5.9.1)

(2) Equipment for the garbage disposal

Two (2) garbage trucks will be procured and stationed at the municipal office, La Trinidad. The procurement costs were estimated at about 1.6 million pesos. (see Table 5.9.2)