4.2 Plan of Irrigation Facilities

4.2.1 Irrigation development plan

(1) General

In line with the basic concept and strategy for agricultural development, irrigation system should be facilitated, and water source should be also secured so as to increase productivity and profitability of agriculture. Inadequate facilities and several constraints for irrigation listed 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.

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

(Unit: ha)

Land Category	Zone I	Zone II	Zone III	Total
Upland crop field	199 (159)	235 (152)	60 (50)	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 to be acquired for proposed roads and irrigation facilities. The figure in the parenthesis is net beneficial area.

Irrigation period is mainly in dry season, but even in wet season the occasional water supply is necessary. Therefore in the design, irrigation period was decided to be continuous one year.

(2) Irrigation block and irrigation water requirement

The beneficial area has been divided into, thirteen (13) irrigation blocks 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 the 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. That for paddy fields is limited to 80 mm.

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

Irrigation blocks in each zone are illustrated in Fig.4.2.1 - Fig. 4.2.3.

(3) Irrigation system

Irrigation system for each irrigation block basically has its own water source composed of intake weir and small scale ponds. The intake weir will be constructed on stream to divert spring or running water effectively, and the ponds will increase the available water in the dry season by means of adjusting seasonal fluctuation of water diverted.

Zone I, wells planned for irrigation will be utilized to supplement irrigation water in the dry season where there is low potential of water source with surface water.

Even in Zone II, some of irrigation blocks being under the condition of low potential of development with surface water and locating close to proposed well for drinking and domestic water supply, are planned to supply irrigation water from the well when the need arises. (Each proposed well for drinking and domestic water supply has certain surplus of water due to the design with maximum daily water consumption and estimation after ten years.)

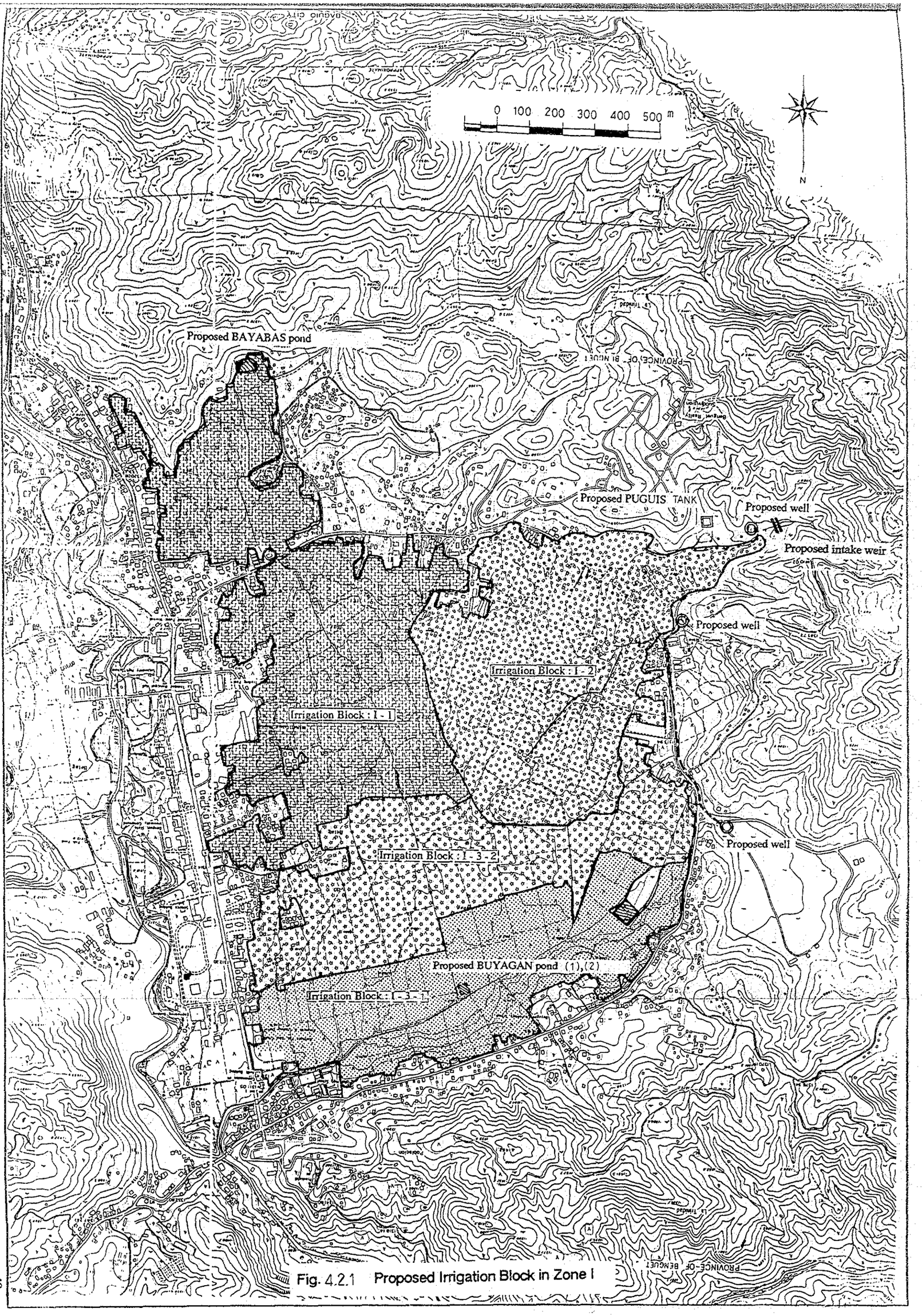


Fig. 4.2.1 Proposed Irrigation Block in Zone I

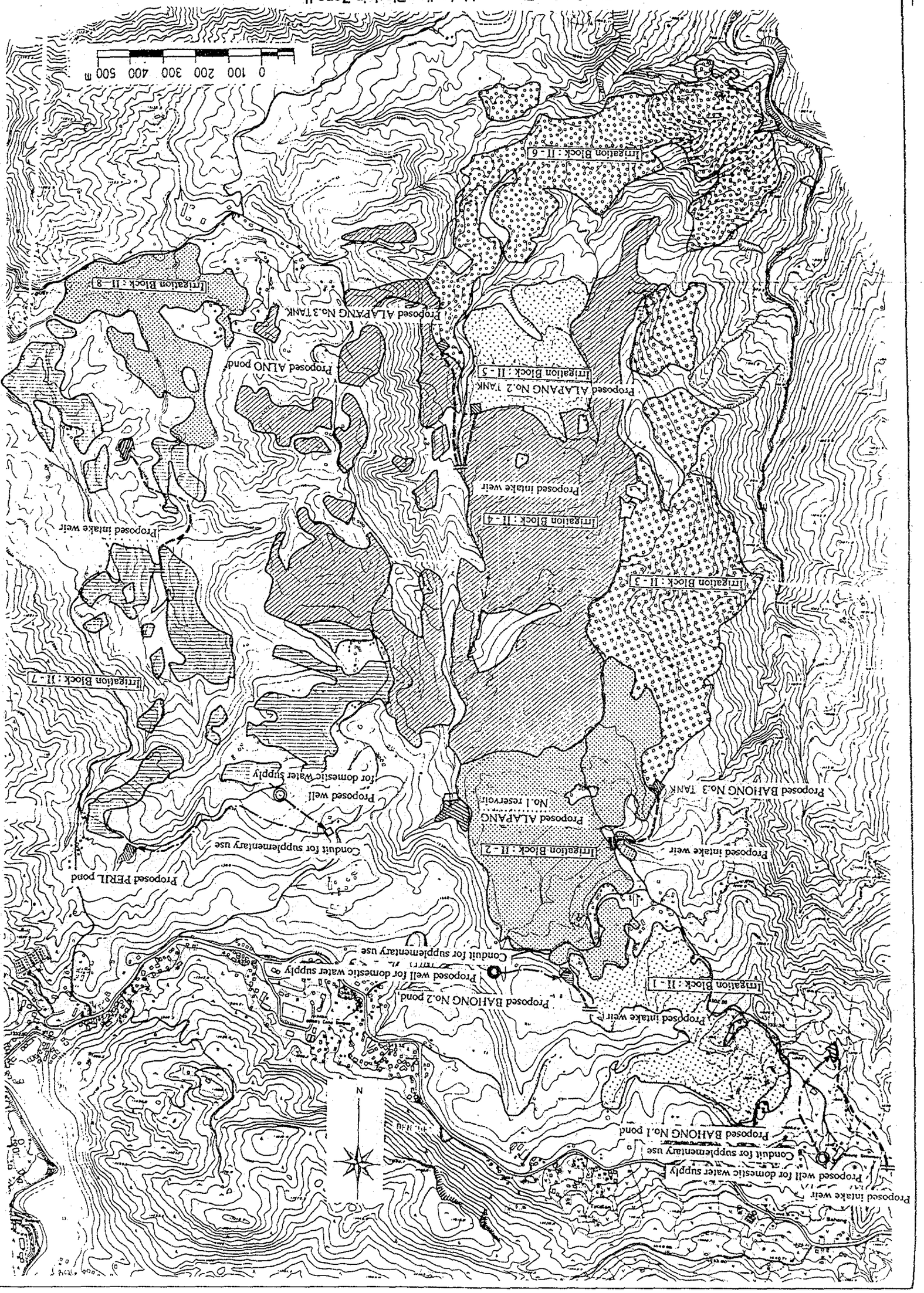


Fig. 2.4.2 Proposed Irrigation Block in Zone II

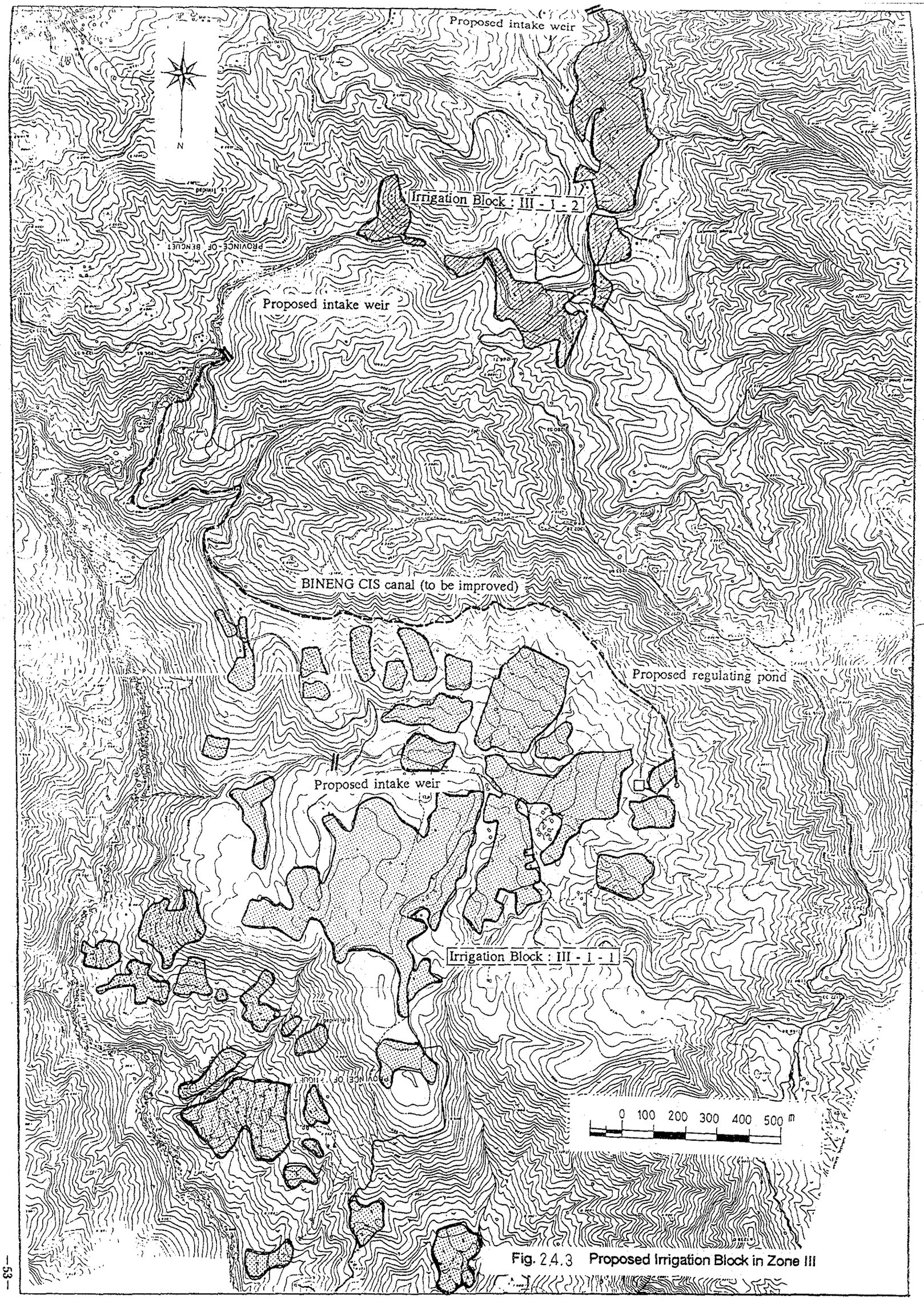


Fig. 2.4.3 Proposed Irrigation Block in Zone III

Irrigation water will be delivered to the each farm plots through proposed lateral conduit from proposed pond.

The division tank will be provided at the terminals of the lateral conduit, of which valves to deliver irrigation water to each farm plot by farmers own self will be equipped. (Diversion tank will be constructed so as to command 5 ha farm lands on an average taking farm size in Project area into consideration.)

The schematic diagram of proposed irrigation system are shown in Fig. 4.2.4.

(4) Other facilities

At the Dinog Cave in Zone II, seepage water from the cave has been utilized for irrigation by scores of private tubes inserted disorderly.

In dry season, a temporary weir is constructed at the entrance to the Dinog Cave in the Balili river to take directly the river water. The Balili river water is not suitable for irrigation due to contamination. However, as far as utilizing seepage water at the cave it can be used as supplemental water source in the dry season from now on.

Accordingly, intake facilities at Dinog cave should be improved so as to be in good order to distribute stable water to every farmers.

4.2.2 Basic Design for irrigation facilities

In line with the basic concept of the design mentioned previously, irrigation facilities shown in Table 4.2.1 are proposed taking topographic condition and actual possibility of construction works i.e., accessibility or possibility of land acquisition etc. into consideration.

Basic Design for every kind of irrigation facilities are carried out as below.

(1) Intake Weir

1) Method of taking water

The difference of water level between dry season and wet season in every stream in the Project area is considerably large. Especially in dry season, natural intake is

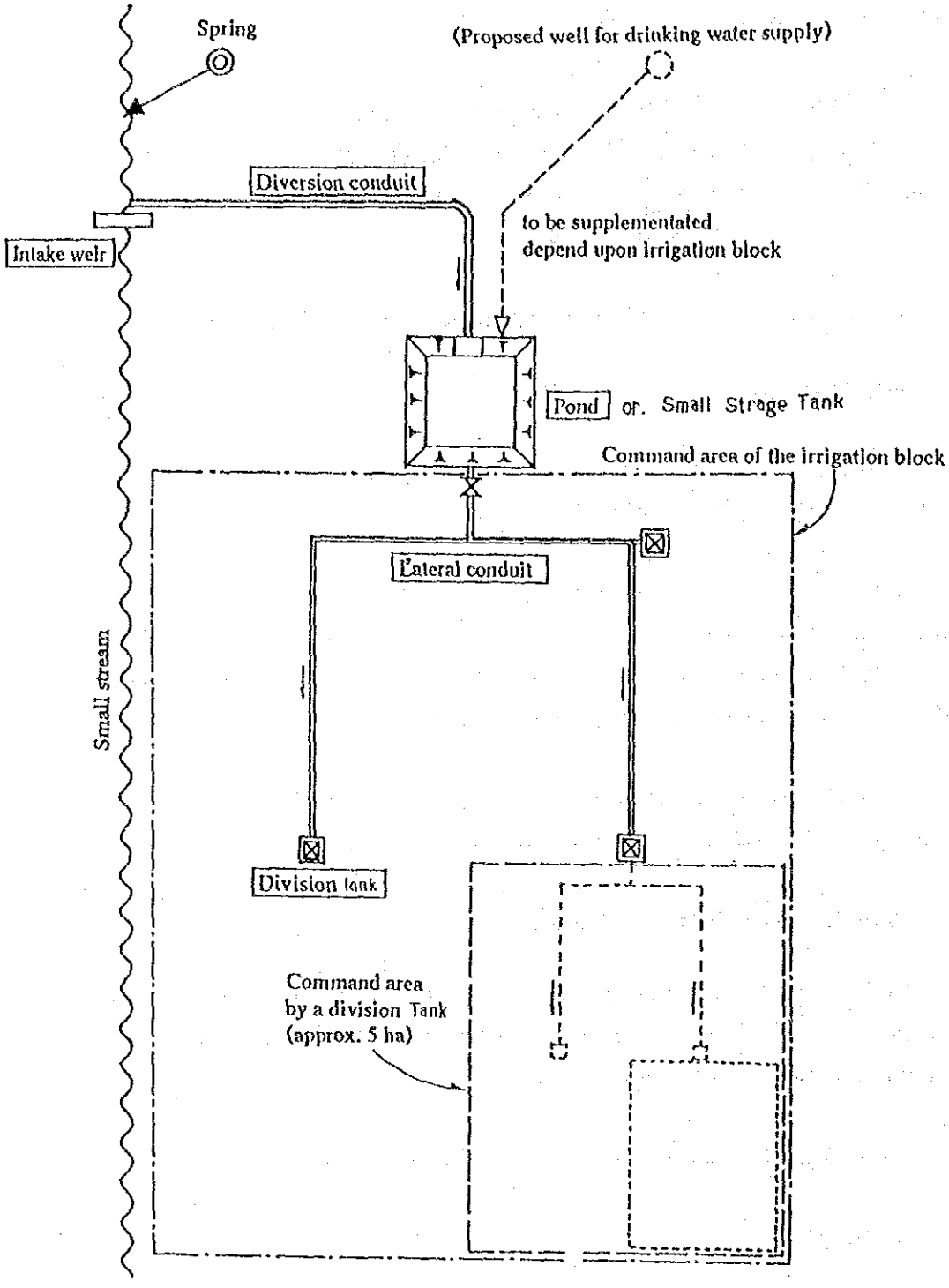


Fig. 4.2.4 Schematic Diagram of Proposed Irrigation System

Table 4.2.1 Summary for Proposed Irrigation Facilities

Irrigation Block	Water source Facilities					Diversion Conduit			Lateral Conduit			Division Tank *3	Access Road	
	Intake Weir	Pond	Pump Station (nos.)	Well (nos)	Supplementary Pipe (m)	Pipe (m)	Crossing (nos.)	Related Structure (nos)	Pipe (m)	Crossing (nos.)	Related Structure *2 (nos.)			
I-1	---	Bayabas pond	1										(Pond)	300
I-2	Puguis	(Storage tank x 1)		1	100	50		(S) 2	2,450	2	(S) 9 (A) 2	9 (B)	(Intake weir, well)	700
I-3	---	Buyagan (1), (2) Pond (Storage tank x 1)	3	2	950	700		(S) 2 (A) 2	3,300	4	(S) 10 (A) 10	10 (A)	(Buyagan (1) (Buyagan (2)	200 300
II-1	Bahong No. 1	Bahong No. 1 Pond			320	330		(S) 2 (A) 1	1,050	2	(S) 4 (A) 5	4 (A)	(Intake weir) (Pond)	400 250
II-2	Bahong No. 2	Bahong No. 2 Pond			270	200	1	(S) 2	1,150	2	(S) 6 (A) 5	6 (A)	(Intake weir) (Pond)	200 100
II-3	Bahong No. 3	(L) (Storage tank x 1)				200		(S) 4	(L) 2,050 (R) 60		(S) 7 (A) 10	(L) 6 (B) (R) 1 (B)		
II-4	---	Alapang No. 1 Pond						(S) 2	(L) 1,630 (R) 2,650		(S) 13 (A) 21	(L) 5 (B) (R) 8 (B)	(Pond)	400
II-5	Alapang	(Storage tank x 1)				150		(S) 3	1,750	6	(S) 7 (A) 8	7 (B)	(Intake weir)	800
II-6		(Storage tank x 1)				60		(S) 3	300		(S) 2 (A) 2	2 (B)		
II-7	---	Peril Pond			720			(S)1	2,320	3	(S) 5 (A) 11	5 (A)	(Pond)	150
II-8	Alno	Alno Pond				620		(S) 2 (A) 3	1,850	5	(S) 5 (A) 9	5 (A)	(Intake weir) (Pond)	300 400
III-1	Bineng CIS	(Regulating tank x 1)				1,500 (2,030.5)*1	(20)	(S) 3 (A) 4 ((V) 8 (W) 1)	590		(S) 3 (A) 2	3 (A)	(Canal)	500
III-1-1	Bineng	(Storage tank x 1)						(S) 3	420		(S) 2 (A) 1	2 (B)	(Intake weir)	100
III-1-2	Wangal	(L) (Storage tank x 1) (R) (Storage tank x 2)				50 50		(S) 6	(L) 930 (R) 700	5 2	(S) 7 (A) 8	(L) 4 (B) (R) 3 (B)		
Total	9 nos	Pond 8 nos Tank 9 nos	4 nos.	3 nos.	(ø80) 2,360	(ø150-500) 3,910	1 no.	(S) 35 (A) 10	(ø125) 23,200	31 nos	(S) 80 (A) 95	33 (A) 47 (B)		5,100

*1: Canal improvement of existing Bineng CIS canal (lining)
*2: S: Sluice valve, A: Air pipe, D: Depressed valve, V: Division works, W: Waste work
*3: (A) A type, (B) B type

ineffective due to low water level. Therefore, method of taking water with weir is proposed.

The intake of the weir will be posed in either one bank side or both bank sides depending on the location of commanding area.

2) Type of weir

Fixed type is selected as to all proposed intake weir because shallow rock bed were recognized at every proposed sites for the intake weir.

As to kind of weir, fixed weir is adopted for several reasons as follows:

i) steep longitudinal river bed
ii) no constraint for the securing flow area
iii) no gate would be installed so as to avoid troublesome operation.

Even with consideration of block water, Afflux at the stream is taken at most 1.5 meter so as not to obstruct smooth flowing especially in case of flooding.

3) Design amount of intake water

Amount of maximum irrigation requirement in a year is adopted as the design amount of intake water. However, considerations mentioned below should be taken in designing capacity of intake facilities.

i) to render water intake smooth even in drought season, because that river discharge at almost every proposed site is below the design amount of intake water in the dry season.
ii) to treader water intake of the range of above the design amount possible on safely taking condition in order to storage water to proposed pond in the wet season.

4) Design flood discharge

Design flood discharge is estimated by the rational formula with rainfall intensity on a scale of a 50 year return period.

The runoff coefficient is adopted 0.9, and concentration time is selected among 30 min, 1 hr and 2 hr in relation with below 1 km^2, below 2 km^2 and above 2 km^2, and above 2 km^2 of catchment area respectively.

Design flood water stage is settled as same as the ground level either of lower side of both. In connection with this, length of weir is decided.

Proposed intake weirs are shown in drawings attached at the end of this report, and dimensions for the proposed intake weirs are summarized as follows:

Dimension of Proposed Intake Weirs

Name of Proposed Intake Weir	Length of Weir (m)	Intake Water Level (EL.)	Design Amount of Intake Water (m^3/s)	Design Flood Discharge (m^3/s)
Puguis	7.5	1,336.5	0.0167	3.14
Bahong No. 1	10.3	1,351.2	0.0063	8.71
Bahong No. 2	11.0	1,245.5	0.0091	21.32
Bahong No. 3	16.0	1,214.0	(R) 0.0011 (L) 0.0090	53.44
Alapang	13.0	1,067.0	(R) 0.0038 (L) 0.0098	25.99
Alno	15.5	1,106.2	0.0034	24.82
Wangal (Bineng CIS)	38.0	1,191.0	0.0358	89.84
Bineng	14.5	949.3	0.0071	30.34
Wangal	16.0	1,257.7	0.0071	47.00

: Intake water level presented above is a crest elevation of fixed weir.
: Design amount of intake weir presented above is an amount of maximum irrigation requirement in a year.
: Design flood discharge presented above is an estimated peak discharge on a scale of a 50 year return period.

(2) Pond

1) Location and scale

The location of proposed ponds are decided so as to deliver water to each irrigation block by gravity. These are almost same as the locations decided in F/S in accordance with topographic condition.

Land acquisition for the pond especially farm land is severe problem for the construction because of small farm size (0.7 ha in Zone II on an average).

In the field survey of the Basic Design study, the scale of proposed pond were fixed larger as possible within the limits of scale decided in F/S, in comparison with every alternatives.

In case no land for the construction can be secured, concrete storage tank is planned.

2) Basic plan and design

Ponds proposed in this Project (including storage tank) are listed as follows.

Irriga-tion Block	Site	Type	Storage Capacity (m^3)	Design Storage Water Level (m)	Catchment Area (km^2)	Remarks
I-1	Bayabas	Pond	550	1,318.0	1.40	Bayabas Pond
I-2	Puguis	Tank	(150)	(1,330.0)	(-)	(Puguis Pond)
I-3	Buyagan	Pond	4,000	1,308.5	1.60	Buyagan (1) Pond
	Buyagan	Pond	1,500	1,308.0	0.80	Buyagan (2) Pond
II-1	Bahong	Dam	2,400	1,337.0	0.10	Bahong No. 1 Pond
II-2	Bahong	Dam	3,500	1,230.0	0.48	Bahong No. 2 Pond
II-3	Bahong	Tank	(150)	(1,209.0)	(-)	(Bahong No. 3 Pond)
II-4	Alapang	Dam	18,000	1,201.0	0.35	Alapang No. 1 Pond
II-5	Alapang	Tank	(150)	(1,062.0)	(-)	(Alapang No. 2 Pond)
II-6	Alapang	Tank	(150)	(1,062.0)	(-)	(Alapang No. 3 Pond)
II-7	Peril	Dam	3,200	1,259.5	0.16	Peril Pond
II-8	Alno	Dam	2,500	1,092.0	0.10	Alno Pond
III-1-1	Bineng	Tank	(150)	(930.0)	(-)	
III-1-2	Wangal	Tank	(150x2)	(1,252.0)	(-)	

Each proposed pond are designed as described below.

a. Bayabas pond

Proposed site for Bayabas pond is the area including existing spring which has been utilized as an irrigation water source.

The dimension and shape of the proposed pond are fixed as follows:

i) The boundary of the site in south is demarcated up to the toe of existing slope behind existing pond.

ii) The boundary of the site in east is demarcated at the edge of house.

iii) The boundary of the site in other both direction are demarcated as secured as possible within limits of land acquisition.

The proposed pond is to be excavated due to topographic condition of flat crop field. The depth of excavation is 2.0 meter so as not to affect the existing pond bed from which spring water has been gushed. Slope gradient is 1:2.0 in consideration of soil property and stability of the slope. Stored water in Bayabas pond is supplied to Bayabas creek through a gate installed at the pond. Spillway for the pond is facilitated neighbor with the gate to drain in case of flood. The existing drain canal flowing in left side of the Bayabas creek, is bypassed to connect the Bayabas creek so as not to directly find its way into the existing pond.

Spillway which will spill over from the bypass canal to proposed pond in flood season, is proposed.

b. Buyagan pond

Buyagan pond (called Buyagan pond (1)) is set on upstream site of swamp area located upstream the Bolo creek. Complementary pond (called Buyagan pond (2)) of the Buyagan pond is proposed at the adjacent of the confluence of the Bolo creek and the Bayabas creek, in order to catch excess water of both creeks.

Buyagan pond (1) is sized so as to fit into the secured area (50 m x 100 m). Storage capacity is gained by excavating ground surface, and slope gradient is 1:3.5 in consideration of the characteristics of swamp area.

Furthermore, slope of the pond is protected by replacing with clayey soil at 1 m thick.

Buyagan pond (2) is also sized to fit into the secured area (50 m x 50 m).

Excavation of ground surface, and slope gradient 1:3.5 are adopted as same as Bayabas pond (1).

Intake facilities is required to introduce excess water of existing creek to Buyagan pond (2). Spillway is facilitated to prevent over storage. Due to lower elevation of the sites of both Buyagan (1) and (2) ponds, pump stations with low water head (approximately 5 m of total head) are required to deliver water to upper portion.

c. Bahong No. 1 pond

Bahong No. 1 pond is formed with a small earth dam at narrow valley. Slope of the dam is 1:2.0 in upstream side and 1:1.5 in downstream respectively, in considering of low dam height of 6 m. Drain works is provided at the toe of downstream slope.

Reservoir area is excavated with a slope of 1:1.5 as much as possible, in order to enlarge the storage capacity. No water flows are seen at the site, however, spillway is facilitated releasing run off in flood season.

d. Bahong No. 2 pond

Bahong No. 2 pond is formed with a small earth dam at waste agricultural land in gently-sloping narrow valley. Dam axis was decided so as not to intrude downstream farm land in consequence of the discussion with land owners.

The dam is designed with 6 m dam height as same type as Bahong No. 1 pond.

e. Bahong No. 3 pond

Storage tank is provided instead of construction of pond.

f. Alapang No. 1 pond

The dam is built in upstream Alapang creek to stop and reserve flowing water. Concreted gravity dam type is adopted in consideration of steep river bed gradient. (If fill type were adopted, construction of the dam seems difficult on protecting the toe of downstream slope.) The dam height above foundation

excavated about 2 m from present river bed, is 12 m. Waste way works without gate is sized based on estimated flood discharge (15 m^3/s).

Left side bank reservoir area is excavated to enlarge the storage capacity of the reservoir, because excavation of right side bank is uneconomical due to outcrop of rock.

g. Alapang No. 2 pond

Storage tank is provided instead of construction of pond.

h. Alapang No. 3 pond

Storage tank is provided instead of construction of pond.

i. Peril pond

Dam is built lower part of confluence of streams. Concreted gravity dam with low height is provided, and maximum storage water depth is limited up to 5 m in consideration of stability of foundation, because land sliding has occurred at the upside of the site.

Boundary of reservoir area is adjusted and excavated with taking countermeasure for closed farm land from extension of erosion. And the pot of the slope is protected so as not to cause erosion to the adjacent farm land.

j. Alno pond

Dam is built in stream with both steep sloping sides and forms a pond. The dam height is decided at 6 m due to the elevation of farm land extending in right bank. Dam type is earth fill with the shape as same as Bahong No. 1 pond.

(3) Diversion conduit

Diversion conduit is a pipe line to conduct water from proposed intake weir site to proposed pond (or storage tank), which is steel pipe laid underground.

Diameter of the conduit is decided so as to flow the discharge of filling the pond within one day.

(4) Lateral conduit

Lateral conduit delivers water from proposed pond (or storage tank) to proposed division tank as terminal facility.

The conduit is steel pipe laid underground with flowing capacity of 24 hour supply to the benefited farm block.

As to related structures, sluice valve, air pipe, crossing structure at a point of intersection with creek, and pressure-reducing valve at the points specially required are provided.

(5) Division tank

As terminal facilities, division tank is provided in every about 5 ha farm land on average. The tank is made of concrete with several hydrants so that farmers themselves can deliver water with their own tube connected to the hydrants.

The division tank has the capacity of regulating the difference between water quantity run through lateral conduit supplying 24 hr a day and water requirement delivered through the hydrants 12 hr a day. For irrigation block providing storage tank, the division tanks (type B) are proposed with 100 m^3 capacity through this manner.

In case of irrigation block providing pond with certain storage capacity, division tank (type A) with 12 m^3 capacity, that is approximately equal to the water requirement per one hour, is provided. In this case, the pond itself has a function of the regulation.

(6) Wells for irrigation water supply

In Zone I, wells for irrigation water supply of 20 liter/sec. Three wells listed below are proposed referring to results of test drilling and hydrogeological survey.

No.	Site	Elevation (EL. m)	Proposed Depth (m)	Diameter (m/m)	Probable yield (estimate) (lit/min)
1	Stock farm	1,314.6	90	350	350
2	Puguis	1,352.0	100	250	450

3	Puguis	1,314.0	120	350	450

(7) Supplementary use of wells for drinking and domestic water supply

In three irrigation blocks in Zone II, i.e., II-1, II-2 and II-7 is irrigation water supplemented from wells for drinking and domestic water supply. Ponds (or storage tank) of these irrigation blocks are connected to the distributing tanks of the wells with steel pipe conduit laid underground.

(8) Improvement of Dinog-cave

Intake facilities of Dinog-cave is improved. Distributing tank which can supply every farmers with water evenly are provided at just under the Dinog-cave.

The consideration was paid in decision of the site so as not to prevent present water use because plenty of tubes have been inserted to Dinog-cave in a mess.

4.3 Rural Roads

4.3.1 General

Roads to be improved and newly constructed are located in Zone II and Zone III where steep mountainous area extents, as typical topography of Cordillera mountainous districts. Most of existing roads had built along the ridge or the side of the mountains. The alignment and slope are restricted by the topographic condition.

6.2 km of present roads have longitudinal slope of more than 15 gradient percent out of the total length 23 km surveyed . Some part shows more than 30 gradient percent.

Although the Project area has much precipitation, more than 3,500 - 4,000 mm per year, road drainage facilities are not well equipped. Therefore, the road surfaces are paved with calcareous stone for erosion control, but this causes wheel slip on the road and consequent traffic inexpediency. In this circumstances, any vehicles can move only at the speed as same as walking.

Roads requested to be improved have been functioned not only as important traffic ways for residents but also as indispensable route of transportation for agricultural product.

In consideration of the importance, whole roads requested for the improvement are to be refined. Furthermore, road of Cruz - Samuyao route is newly decided to be additionally improved.

The improvement for the route had been refrained to request because that land sliding was apprehended to proceed the corruption of the road.

In the B/D Study, the apprehension for the land sliding was dissolved for the reason that the section of the road expected land sliding was limited only about 50 m, and the drain to be planned would function well to protect from the land sliding.

Location of roads to be improved are shown in Fig. 4.3.1.

As to new construction roads, three (3) routes are decided to construct among requested five (5) routes. The particulars for the routes are described as follows:

Zone II 1) North Sadag - East Alno route

The land for the proposed route considering any alternatives could not be secured because of the difficult land acquisition of farm land occupied the whole area. The construction of this route is resigned.

2) Sadag - East Alno route

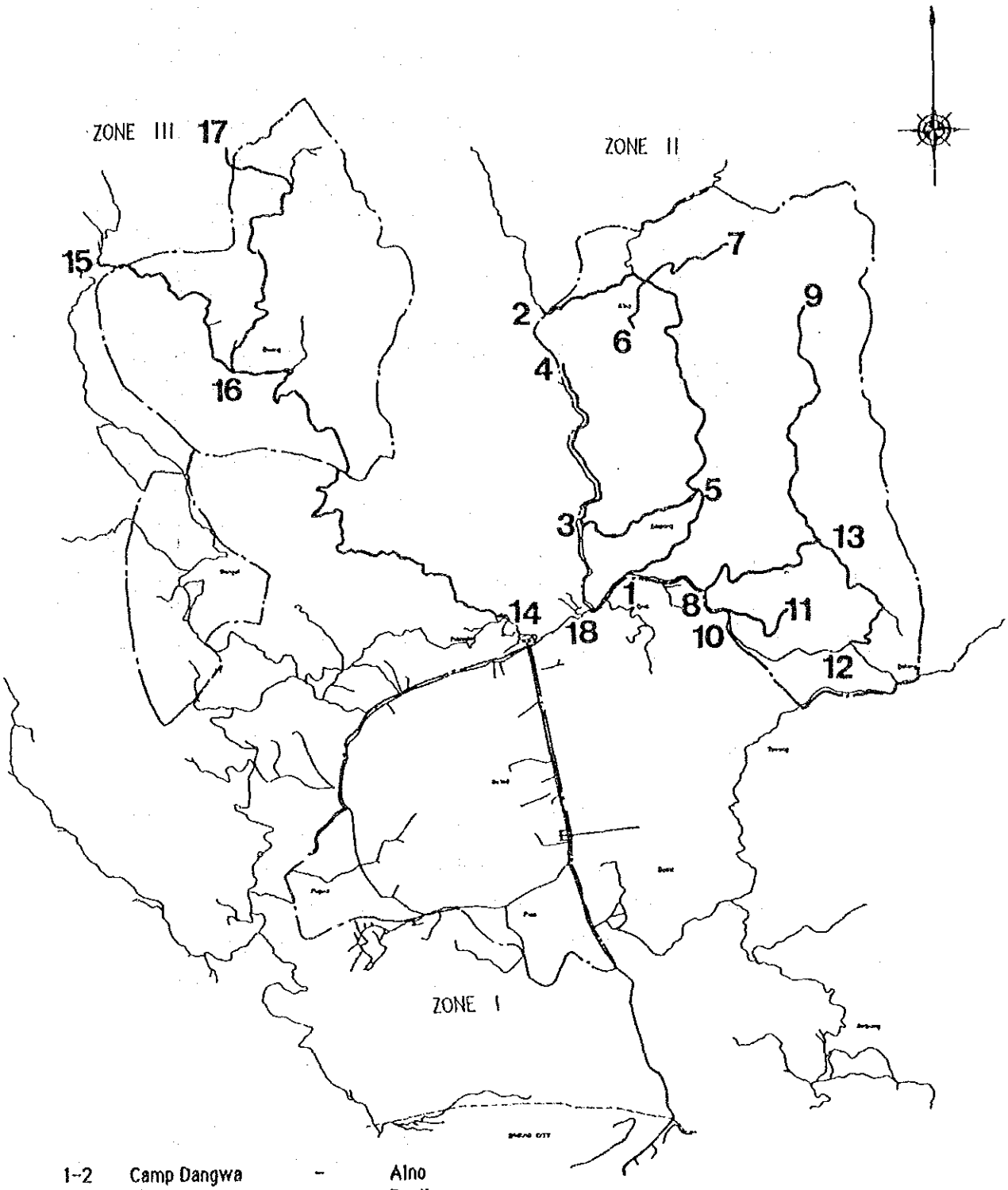
This route is decided to construct as the request.

3) North Bahong - Alapang Proper route

The land for the proposed route considering any alternatives could not be secured because of the difficult land acquisition. The construction of this route is given up. However, some part of this route is temporarily constructed as an access road for the construction of Alapang No. 1 pond.

4) West Alno - Peril route

This route is decided to construct as the request.



1-2	Camp Dangwa	-	Alno	
3-4	Samuyao	-	Perit	
3-5	Samuyao	-	Alapang	
6-7	West Alno	-	East Alno	
8-9	Camp Dangwa	-	Sadag	
10-11	Camp Dangwa	-	Mae Bahong	
12-13	Tomay	-	Bahong	
14-15	Capitol	-	Bineng	-Japos
16-17	Bineng	-	Boleweng	
3-18	Cruz	-	Samuyao	

Fig. 4.3.1 Routes of existing roads to be improved

Table. 4.3.1 Gradient Slope of Existing Roads

(Unit : m)

Route	Gradient Slope (%)							Length
	0.0— 4.9	5.0— 9.9	10.0—14.9	15.0—19.9	20.0—24.9	25.0—29.9	30.0—	
II								
1) Camp Dangwa-Alno 1-2	1,500	1,300	950	200	0	50	0	4,000
2), 8) Cruz-Samuyao-Peril 18-3-4	500	500	450	200	100	0	200	1,950
3) Samuyao-Alapang 3-5	450	250	200	150	0	0	0	1,050
4) West Alno-East Alno 6-7	500	350	150	350	300	0	0	1,650
5) Camp Dangwa-Sadag 8-9	950	550	750	750	350	0	0	3,350
6) Camp Dangwa-Mae Bahong 10-11	400	200	50	50	0	0	0	700
7) Tomay-Bahong Proper 12-13	200	500	200	350	0	0	50	1,300
III								
1) Capitol-Bineng-Yapos 14-15	1,600	1,250	1,650	1,550	100	100	100	6,350
2) Bineng-Boleweng 16-17	700	350	350	500	600	100	0	2,600
	6,800	5,250	4,750	4,100	1,450	250	350	22,950

Zone III 5) Boleweng - Lower Bineng route (Bineng route)

This route, is decided to construct a part of the request in viewpoint of economy. (In the partially resigned route, access to farmlands is topographically almost impossible and needs great construction cost.)

The routes of roads of new construction are shown in Fig. 4.3.2.

The routes to be newly constructed have relatively steep longitudinal slope due to the difficulties of land acquisition. Accordingly, concrete paving is required in all sections.

4.3.2 Basic Design for rural road

(1) Basic design criteria

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

b. Type of design vehicles

Design vehicles are as follows:

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

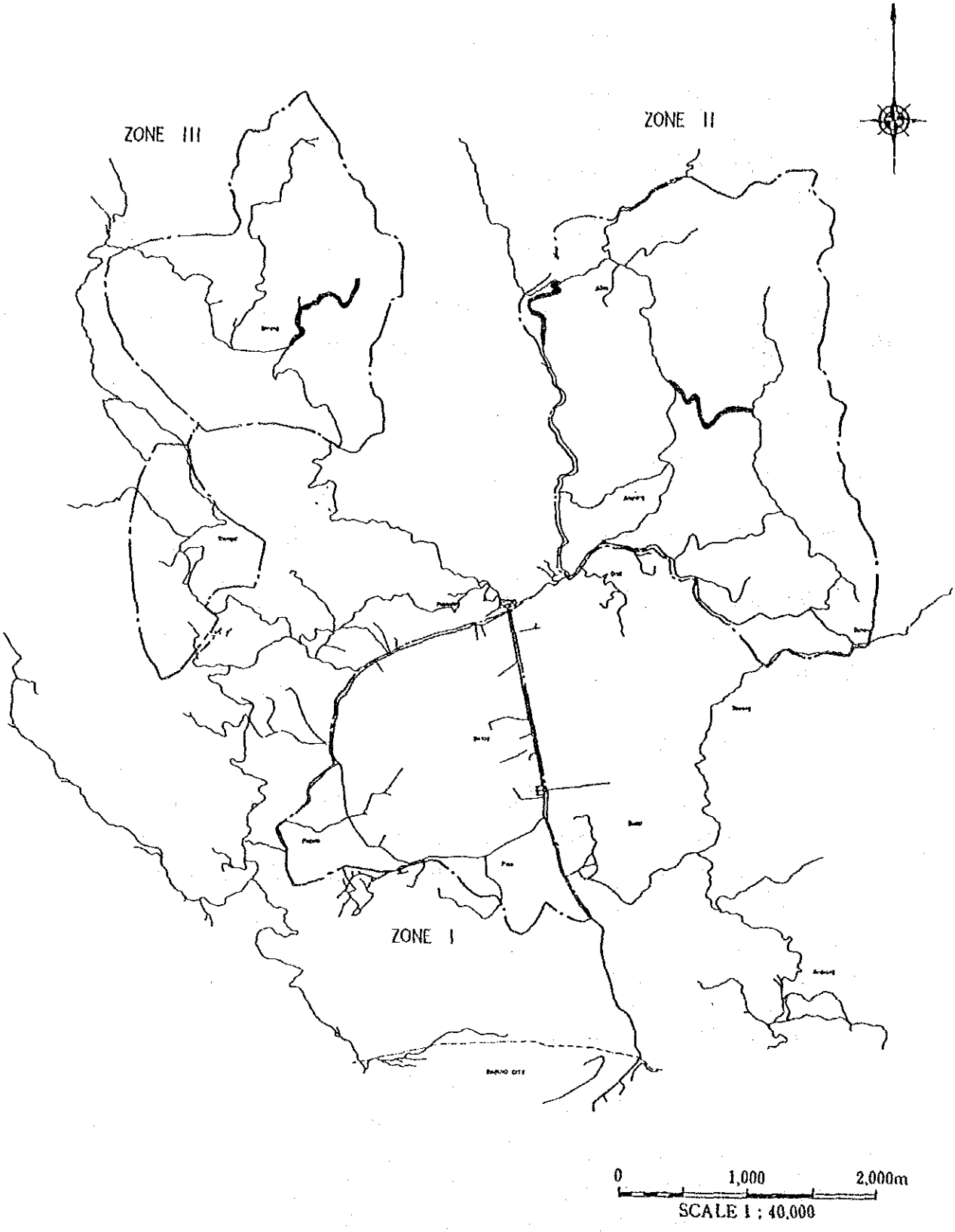


Fig. 4.3.2 Routes of new construction roads

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) Routes for improvement and new construction

Road routes for improvement and new construction are listed as follows:

Routes for construction

Route		Length
Zone II		
1)	Camp Dangwa - Alno route	4.0 km
2)	Cruz - Peril route	2.2 km
3)	Samuyao - Alapang route	1.1 km
4)	West Alno - East Alno route	1.7 km
5)	Camp Dangwa - Bahong Proper - Sadag route	3.4 km
6)	Camp Dangwa - Mae - Bahong route	0.7 km
7)	Tomay - Bahong Proper route	1.3 km
Zone III		
1)	Capitol - Bineng Proper - Yapos route	6.4 km
2)	Bineng Proper - Boleweng route	2.6 km
	Total	23.4 km

Route for new construction

Route		Length
Zone II		
1)	Sadag - East Alno route	1.1 km
2)	West Alno - Peril route	0.7 km
Zone III		
1)	Bineng route	0.9 km
	Total	2.7 km

(3) Standard section of the road

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

a) Roadway width : 3.0 meters
b) Shoulder : 0.5 meter for each side of the road
c) Soft shoulder : 0.5 meter 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 principle.

Nevertheless, in some very steep sloping area, a road of narrowed cross section with roadway width of 2.5 - 3.0 m including shoulders is obliged to design for feat of slop failure on the long cutting slop, especially in wet season.

(4) Longitudinal profile of the roads

Longitudinal profile of the existing roads has not be changed because of the topographical restriction and the possible increase of construction cost involved.

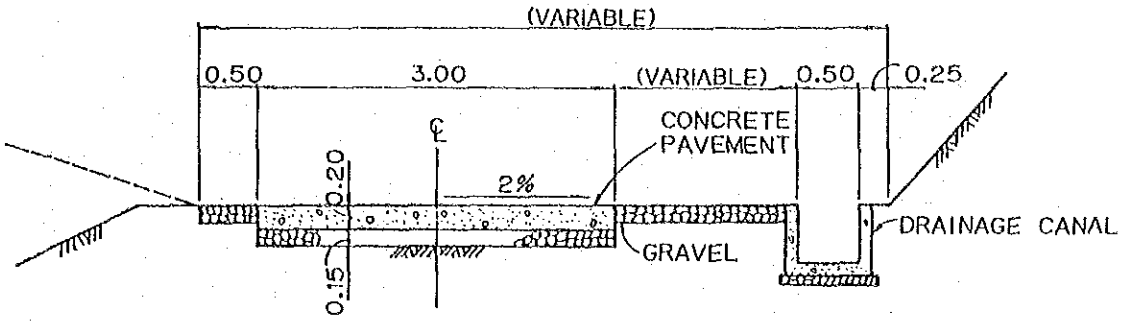
The maximum longitudinal gradient of the roads are basically designed to be 8 percent for the newly constructed roads expect for some steeper routes which another proper alternatives could not be secured due to difficulty of land acquisition.

(5) Pavement and drainage facilities

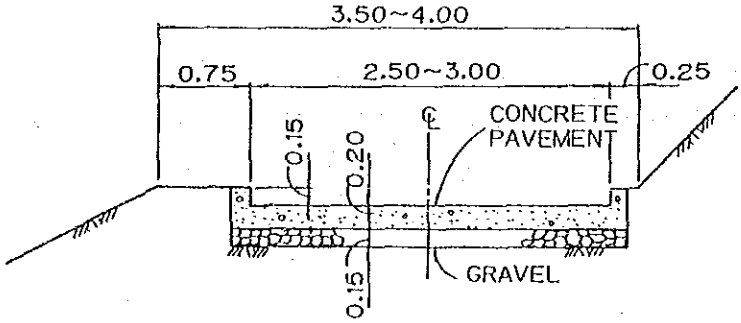
As the Project area has heavy seasonal rainfall, severe road surface erosion by rain occurs on the steep roads. Therefore, the roadway of the existing rural roads shall be improved with concrete pavement and appropriate drainage facilities such as a gutter shall be equipped.

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.

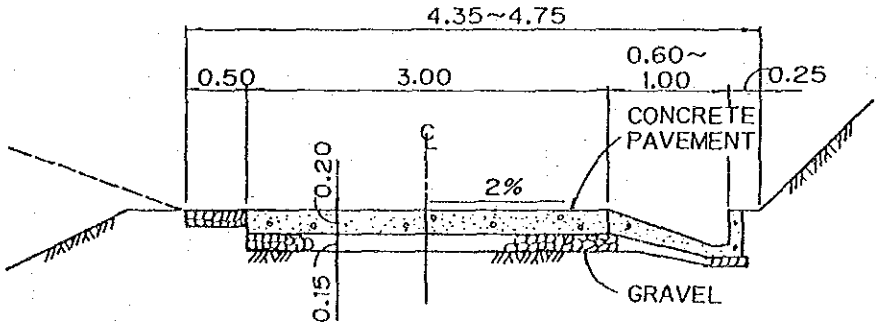
As for the newly constructed roads, the drainage facilities such as gutters shall also be involved, and the roads shall be paved with concrete.



STANDARD SECTION



STANDARD SECTION
(WATERWAY ROAD)



STANDARD SECTION
(NEW CONSTRUCTION ROAD)

Fig. 4.3.3 Standard Section of Roads

Table 4.3.2 Continuous Road Length with Gradient Slope Less Than 3 %

No.	Route	No.	Slope 0 - 3.0 %	Slope 0 - 3.0 %			
				More than 150 m	More than 200 m	More than 250 m	More than 300 m
Zone II							
1)	Camp Dangwa - Alno route	1-2	1,000 m	450 m	450 m	250 m	0 m
2), 8)	Cruz - Samuyao - Peril route	18-3-4	250 m	0 m	0 m	0 m	0 m
3)	Samuyao - Alapang route	3-5	200 m	150 m	0 m	0 m	0 m
4)	West Alno - East Alno route	6-7	350 m	200 m	200 m	0 m	0 m
5)	Camp Dangwa - Sadag route	8-9	650 m	350 m	200 m	0 m	0 m
6)	Camp Dangwa - Mae Bahong route	10-11	250 m	0 m	0 m	0 m	0 m
7)	Tomay - Bahong Proper route	12-13	150 m	150 m	0 m	0 m	0 m
Zone III							
1)	Capitol - Bineng - Yapos route	14-15	1,000 m	400 m	250 m	250 m	0 m
2)	Bineng - Boleweng route	16-17	250 m	0 m	0 m	0 m	0 m
Total			4,100 m 17.9%	1,700 m 7.4%	1,300 m 5.7%	500 m 2.2%	0 m 0.0%

(6) Paving material

As a paving material, three kinds of material are normally given i.e. concrete, gravel and asphalt. Asphalt should abandoned for the reasons mentioned below.

1) Durability for severe natural conditions is remarkably low.
2) Maintenance is considered costly.
3) Asphalt is difficult to procure in the Project area.

Gravel paving is concluded to be disadvantageous rather than other kinds of paving in the road section with longitudinal gradient of more than 3 gradient percent for the reason that paved gravel on the road will be washed away in the wet season, and it will be required to repair in every year in order to maintain certain road condition.

Whole road to be constructed are paved with concrete including 4.1 km (18% of the total road length) gentle slope routes with longitudinal gradient of less than 3 gradient percent. Because, the gentle routes occupy will give smooth driving.

The sequential length of the roads with longitudinal gradient at 3% is listed in Table 4.3.2, and standard section of the road is shown in Fig. 4.3.3.

4.4 Drinking and Domestic Water Supply Facilities

4.4.1 General

Water sources in the Municipality of La Trinidad can not meet the needs for the water development now and future. The Balili river is not suitable for the water source from the viewpoint of water quality. Only 20 percent of the total families are supplied from the waterworks system of LTWD; the remaining 80 percent are still in want of a continuous and safe water supply. Domestic water sources of La Trinidad Municipality in 1985 are summarized as follows:

Type	Family served	%
Waterworks*	1,221	19.8
Public Deep Well	491	8.0
Public Shallow well	181	2.9
Private Deep Well	976	15.8
Private Shallow Well	154	2.5
Public Spring	1,170	19.0
Stream Flow	1,967	32.0
Total	6,160	100.0

Source: RHU La Trinidad 1985
* La Trinidad Water District (LTWD)

Water consumption as well as the capacity of sources can not be quantified in as much as the residents have different water sources.

In addition to the scarce water sources, its potability is one factor which needs immediate attention. The majority of the water sources are open springs which are open to waterborne viruses/organisms which affect the respiratory tract and gastro-intestinal parts of the human body, so that adequate water treatment is required. Indigenous water treatment being practiced by a minority of the residents is boiling the water before drinking.

The water supply system is well equipped in Zone I. The production, however, can not be relied upon to adequately support the needs for increasing water consumption. Water supply to the high elevated area is not attained because of lack of the water capacity and low pressure in the dry season.

Meanwhile, Zone II and Zone III areas are out of the service area by LTWD, so that the majority of inhabitants secure the water from springs and shall ground water. As the land of Zone II and Zone III descends toward the north, only few springs in low elevation area provide stable water throughout the year. Nevertheless, springs in the high elevation area have no water yield in dry season because of the drawdown of the ground water surface.

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

As the domestic water supply systems, facilities listed below are required to install.

System	Facilities	Remarks
Water source	Deep wells	To yield water
↓		
Water purification	Chlorination	To purify water
↓		
Distribution	Distributing conduit	Steel pipe
↓		
Regulation	Distribution tank	Concreted structure with 150 m^3
↓		
Delivering	Delivering conduit	Steel or PVC pipe
↓		
Supplying	Terminal common water faucet	for use of a group of 4 - 5 hours or 20 - 30 residents

4.4.2 Basic Design for Drinking and Domestic Water Supply Facilities

(1) Service area

Service area comprises Zone II except for LTWD of six (6) service blocks and Zone III of one (1) service block shown in Fig. 4.4.2 and Fig. 4.4.3, which are demarcated in consideration of population, water consumption and boundary of each Barangay etc.

(2) Designed population

Total service population of 11,000 is estimated supposing an annual growth rate of 6 percent until target year 1999, 10 years after 1989, on the basis of present population data.

(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:

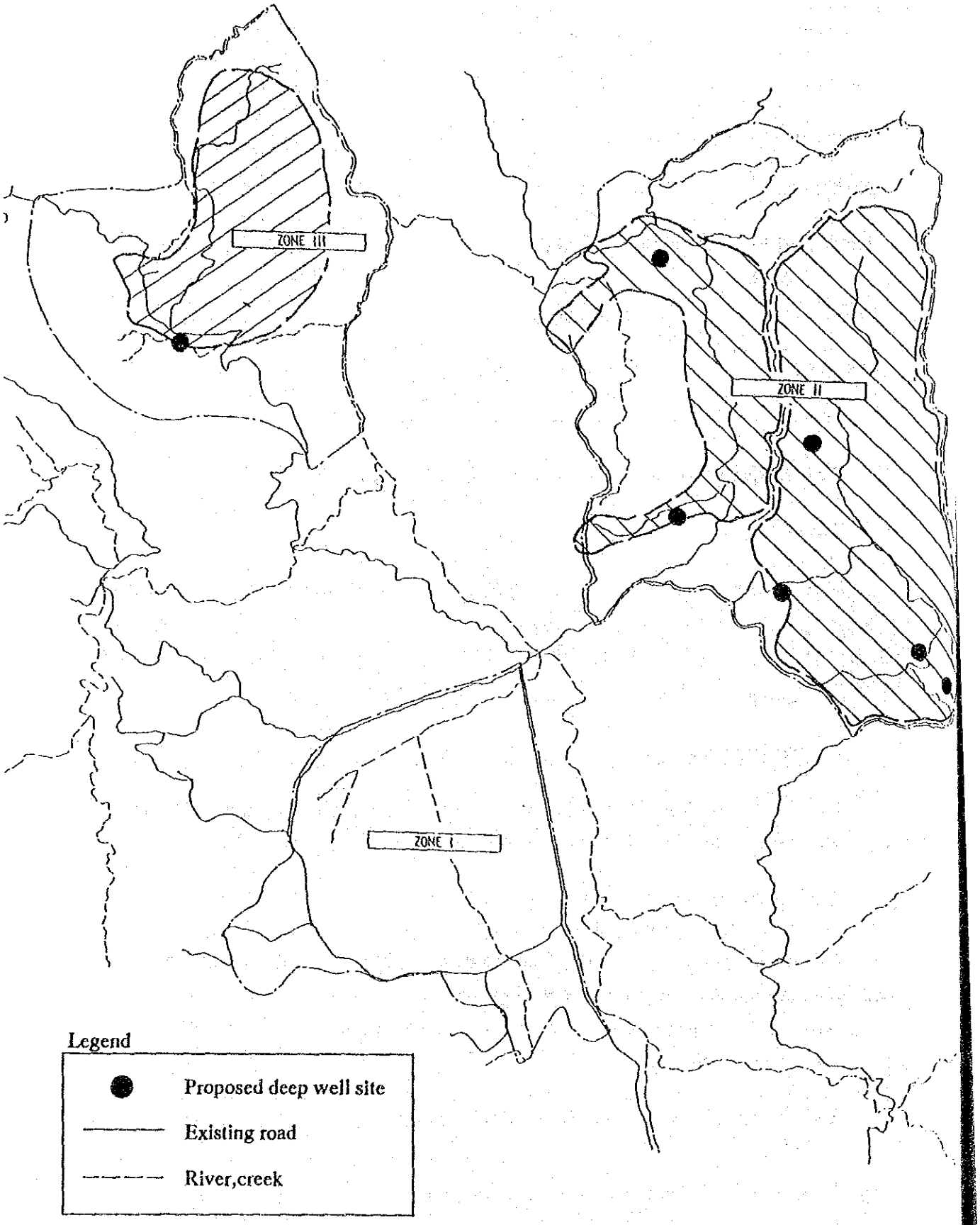


Fig. 4.4.1 Water Supply Area

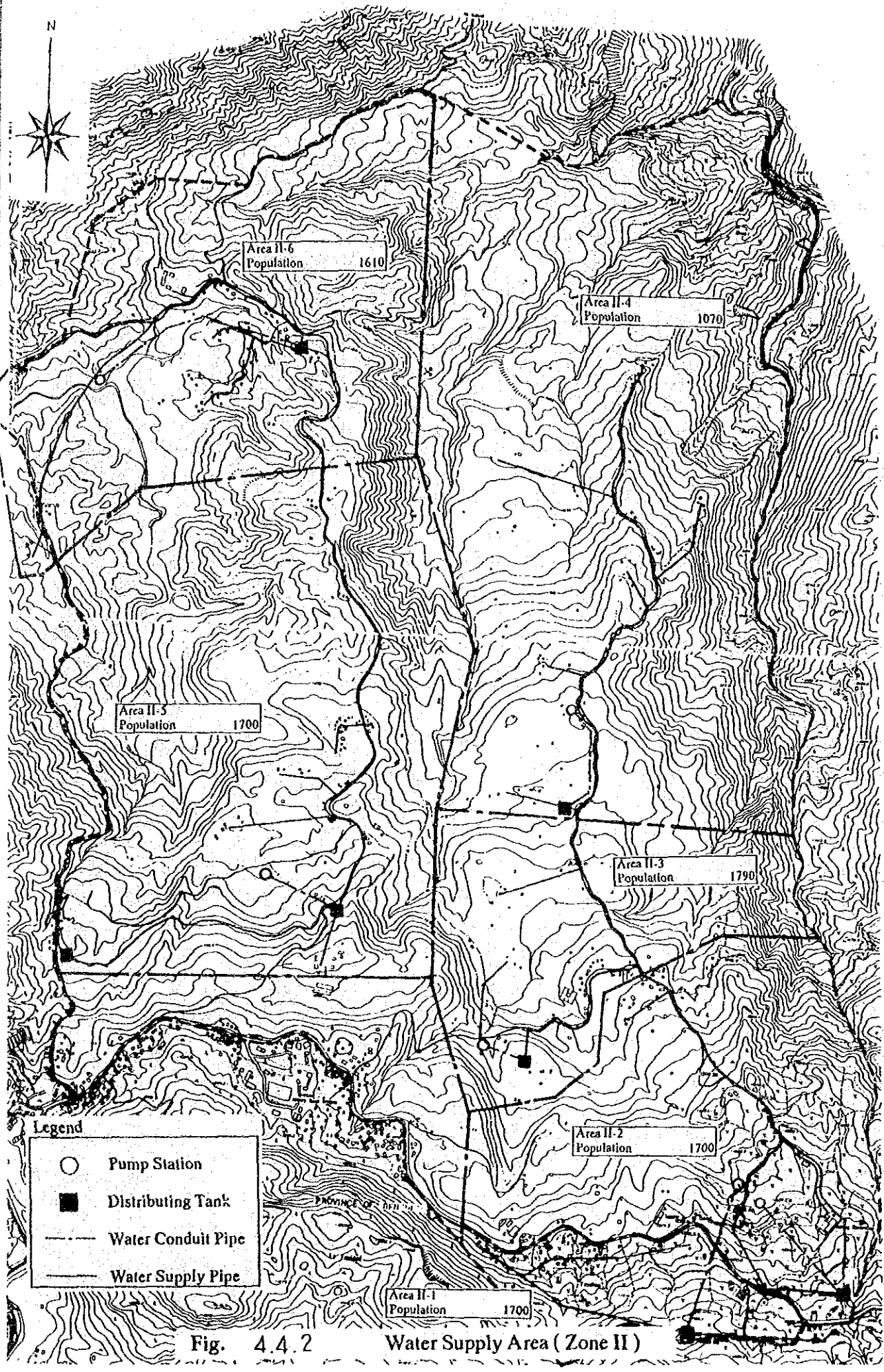


Fig. 4.4.2 Water Supply Area (Zone II)

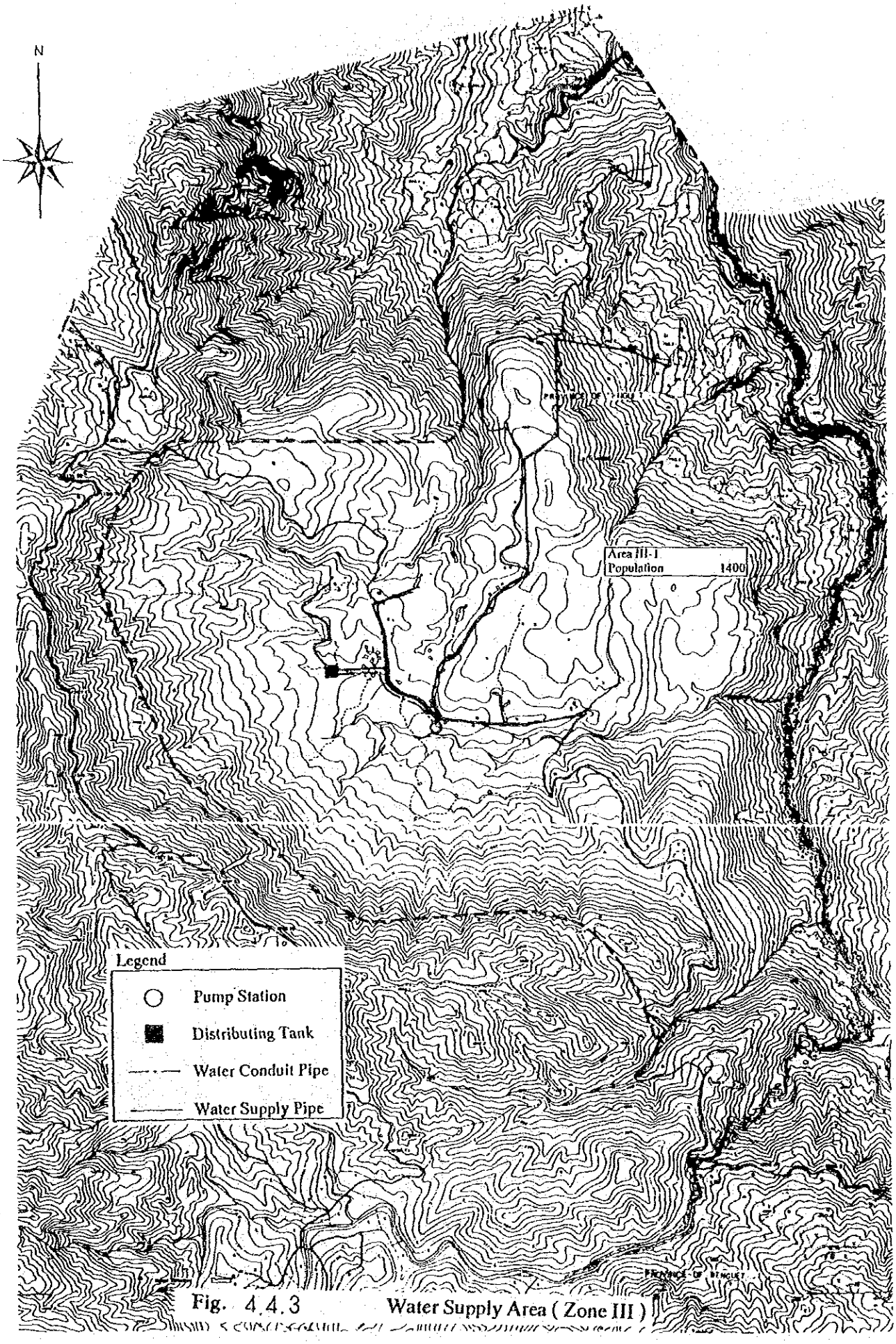


Fig. 4.4.3 Water Supply Area (Zone III)

a) Drinking and domestic water supply

	Water Consumption	Remarks
Residents	120 lit/capita.day	Including 20% loss
School	20 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/capita.day	Including 20% loss
Pig	15 lit/capita.day	- ditto -
Domestic fowl	0.5 lit/place.day	- ditto -

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

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

The consumption of potable and household water has been estimated, referring to LTWD's target in the decade plan, at 100 lit./capita-day with 20 percent loss in consideration of the present water consumption including operation losses.

(5) 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	1,700
2. Miscellaneous water use		
- Livestock	50	70
- Washing (spraying) water	150	200
Total	1,700	1,970

(6) Design of water source facilities

Water source facilities for drinking and domestic water supply were decided in consideration of several matters described below.

a. Quality and quantity of water

Two kinds of water sources are supposed, one is surface water of spring and stream, and another is groundwater. As surface water has become remarkably little in the dry season and contaminated in some measure, reservoir, certain sedimentation basin and filtration facilities are required in order to supply water with good quality and quantity.

On the contrary, groundwater use through deep well dose not require such investments.

b. Water purification method

As mentioned above, sedimentation basin and filtration facilities besides chlorination facilities are required in case of adopting surface water as a water source. These facilities need systematical organization and expense.

c. Location of water source

Streams and springs holding possibility to supply water are located in lower project area. In ease of utilizing such water source, pumps with total head of 150 - 200 m are required to distribute water to high altitude service blocks of Zone II.

On one land, as for undergroundwater, wells to yield water with total pumping head of 40 - 80 m in average are available in the service area.

d. Water rights

Almost all water of streams and springs have been utilized, and these have strong habitual water rights. On the contrary, no water rights has been established on groundwater.

However, it is required for new utilization of groundwater to confirm not to affect present water level of the sites adjoining proposed wells.

e. Possibility of extension in future

In viewpoint of possibility of extension, utilization of groundwater will be regarded as advantageous in consideration of matters mentioned above.

As to a water source for drinking and domestic water supply of this Project, groundwater (deep well) is concluded to adopt as s result of examinations above.

(7) Deep wells

Domestic and drinking water service block were divided into seven (7) blocks comprising six (6) blocks in Zone II and one (1) in Zone III as shown in Fig. 4.4.2 and Fig. 4.4.3.

The design yield capacity of a planned deep well was determined to be 200 - 250 lit./min. from the results of the pumping up tests.

(8) Water purification facilities

The chlorination facilities are provided to proposed deep wells as a water purification facilities for maintaining of potability. Chlorine is injected by the liquid chlorine cylinder that has been popular way in the Project area.

In case of deep aquifer as the source, no sedimentation basin and filtration facilities are necessary due to pured groundwater.

(9) Distribution facilities

Distributing facilities comprise distributing tank made of concrete and water conduit and supply pipes. The tank is sized to 150 m^3 which is water amount of 12 - 14 hour's supply of daily water consumption.

(10) Terminal facilities

Common water faucets are provided for supplying water to the terminal residential area with 4 - 5 hours or 20 - 30 residents.

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	ø200 mm - ø250 mm
	- Well depth	80 - 100 m
b)	Pump	
	- Pump type	submersible pump
	- Design discharge	200 - 250 liters/min.
	- Total head	40 - 80 m
	- Required motor output	7.5 kW
c)	Water conduit pipe	ø75 mm diameter
d)	Water purification facilities	Chlorination (7 nos.)
e)	Distributing tank	7 nos. 150 cu.m. each
f)	Distributing pipe	ø75 - 150 mm diameter
g)	Terminal facilities	Common water faucet

4.5 Drainage Facilities

4.5.1 Drainage improvement plan

In the low-lying parts of Zone I, farmers are currently deterred from growing crops for fear of flood damage so that the inadequate drainage in this area is a major impediment to increase agricultural production in Zone I.

During the flooding periods, the Balili river, the main drainage canal, has a high water level so that the flowing capacity of the Bolo creek is substantially reduced, giving rise to backwater from the Balili river to the Bolo creek in accordance with the extent of precipitation.

The river bed elevation of the Balili river at the confluence with the Bolo creek is EL. 1,305.1 m, and the water stage at the same point is estimated at EL. 1,310.0 m on a scale of a two year return period.

Water in the low-lying parts of Zone I can not be drained to the Balili river for the reason that the lowest elevation of crop field along the Bolo creek is EL. 1,308.5 m.

The rising water level 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.

A provable flood discharge of the Balili river with 31.4 km^2 catchment area at the confluence (Balili river basin 24.6 km^2, Bolo creek basin 6.8 km^2) are estimated as follows:

(Unit: m^3/s)

Return Period	Provable flood discharge of Balili River
2 years	254
5 years	349
10 years	498
20 years	577
30 years	612
50 years	679
100 years	771

4.5.2 Basic Design for Drainage Facilities

(1) Design flood discharge

Principal constraints for drainage should be improved on a scale of a five year return period so as not to be inundated in Zone I in flooding.

Design flood discharge of every river and creeks are decided as follows:

(Unit: m^3/s)

River and Creek	Design Flood Discharge
Balili river (upstream of the confluence with Bolo cr.)	282.2
Balili river (downstream of the confluence with Bolo cr.)	349.0
Bolo creek	85.8
Bolo creek (upstream of the confluence with Bayabas cr.)	37.8
Bayabas creek	40.3

(2) Improvement plan

The improvement portion of the Balili river is 600 meters long. Design river bed gradient is decided to 1/450 for the upstream confluence, 1/300 for the downstream confluence, to flow smoothly and to prevent scouring.

Design cross section of the river has 16 meter's bed width, and has slope gradient of 1:0.6 at the upper reach of the bridge of national road, and 1:0.5 at the down reach of the bridge.

Though river bed of the Balili 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, excavation of the river bed at the crossing is kept about 1 meter in order to protect the foundation of existing piers of the bridge. Accordingly, concrete retaing wall to be constructed in the Balili river so that flow from the Bolo creek flows into the Balili river at the downs reach of the bridge.

Furthermore, narrowed river section of the Balili river at the bridge is to be facilitated with concrete retaining wall to increase flowing capacity of the section.

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 1,500 meters long with 8 meters bed width, 1:1.0 side slope. Design river bed gradient is decided to be 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 of the Bolo creek should be aligned, and strengthened with retaining wall with side slop gradient 1 ; 0.6 at downstream of the creek.

As cross sections of the Bayabas creek have narrowed in about 600 m length of upstream from the confluence with the Bolo creek, there sections are improved with 5 meters bed width 1 : 1.0 side slope and 1 / 1,000 of design river bed gradient.

Moreover, installation of a sluice gates are proposed on the both upstream of the Bolo creek and the Bayabas creek to maintain water stage in dry season as taking water smoothly.

4.6 Village Sewage Facilities

4.6.1 General

Stagnating waste water discharged from the residents considerably hinders living environment, such as nasty smell, or spreading of epidemic along the alignment of the East sewage canal among requested east and west sewage canal. Irrigation water and shallow groundwater are also contaminated with the waste water. As a countermeasure for the sewage and improvement of living environment, East sewage canal is urgently required for exclusive use of sewage removal.

On the contrary, residents area along the alignment of the west sewage canal is not so being hindered living environment in comparison with the East sewage canal, in spite of the fact that even the area is supposed to progress the urbanization and to increase the urgency of taking countermeasure for the hindrance. Accordingly, only East sewage canal is proposed to construct among both requested sewage canals.

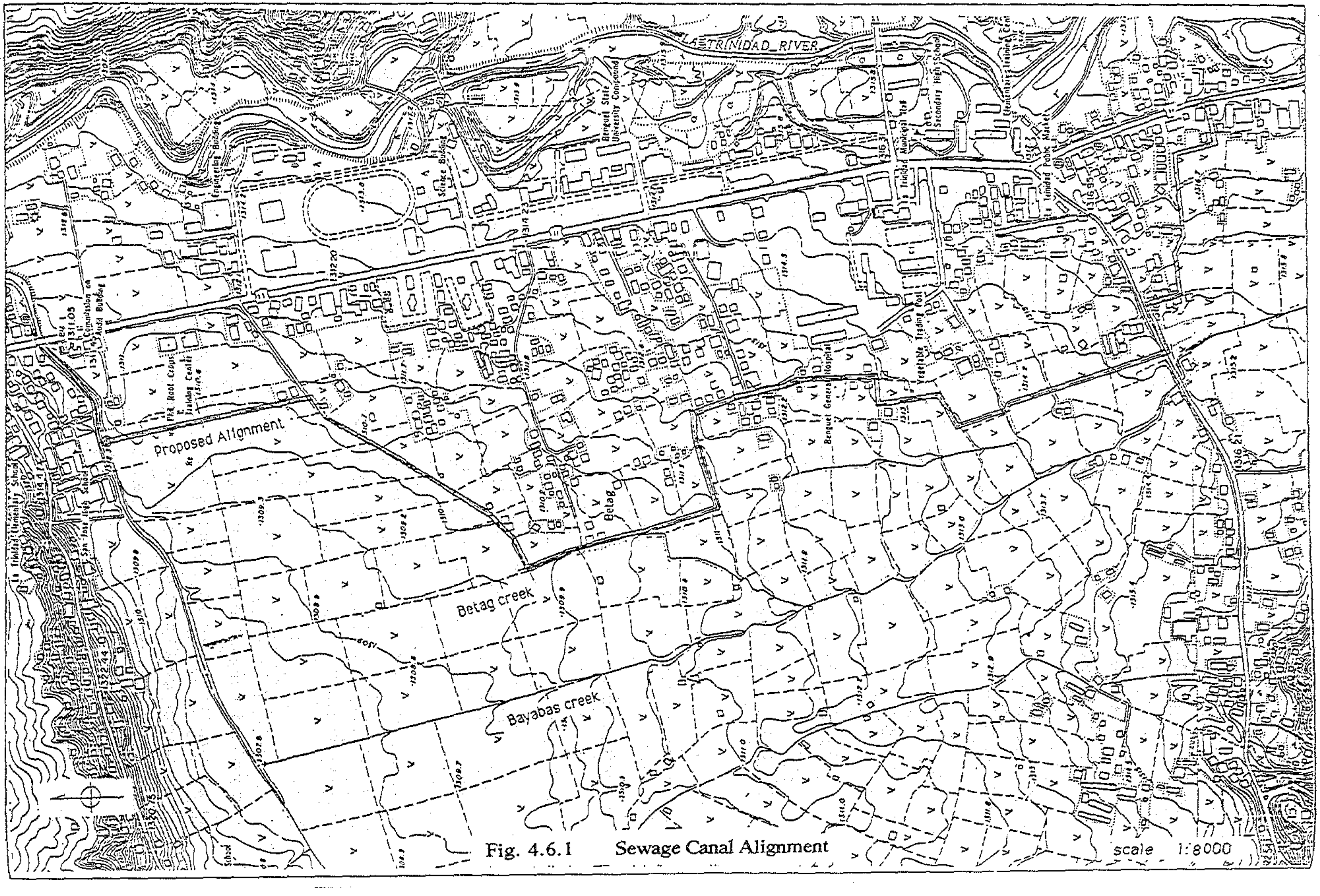


Fig. 4.6.1 Sewage Canal Alignment

Not only residential area of the East sewage canal but also residential area of the West sewage canal planning as a drastic measure for the sewerage problem will be required in future which should be carried out by GOP own self.

4.6.2 Basic Design for village sewage canal

(1) Design sewage discharge

The design sewage discharge is decided to be 0.1 m^3/s on the basis of amount of living water for the residential area in consideration of sewerage from commercial area and rain water unavoidably flowing in the sewage canal.

(2) Alignment of sewage canal

Residential area along national road in the of Zone I, has been thickly settled and progressed contamination has progressed with sewerage from the residents.

The alignment of the East sewage canal is taken following the boundary of present and predicted residential area as shown in Fig. 4.6.1, in viewpoint of land acquisition and construction.

(3) Structure of the sewage canal

Covered concrete flume type with 0.5 m width and 1.0 m depth is basically adopted (such a section with longer lengthwise is advantageous to prevent from flowing rain and to catch sewerage). Considering the longitudinal profile and allowable width for the construction, all along the alignment the concrete flume can not be provided but some sections of the alignment culvert should be adopted. Moreover, some sections along the Betag creek need construction as one body with improvement of Betag creek.

Along the all alignment, inlet facilities for sewerage are provided at intervals of about 100 m.

4.7 Rural Community Center

4.7.1 General

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. However, no building for utilization of farmers in general exist in the Zone.

Zone II had a population of about 6,300 and Zone III of about 1,600 in 1985. Some of barangays have barangay health center. Even these centers, however, can not be operated properly due to lack of potable water and medical appliances. As for the educational facilities, such barangay except for that of Cruz has an elementary school. No buildings for utilization of farmers in general also exist.

Accordingly, common multi-purpose for building such as activities of rural life, preservation of health, agricultural extension and training are required. The common building (rural community center) will function well for smooth operation of the Project besides such multi-purpose use.

4.7.2 Basic Design for rural community center

(1) Confirmation of the barangays to be constructed rural community center

The rural community center is provided in Barangay which is the minimum individual unit of an administration. As a result of examination with standards e.g. existence of multi-purpose facilities, ratio of number of farm household in total numbers of household, seven (7) community centers are proposed in each seven (7) barangay described below.

Barangay to be facilitated rural community center

Zone	Barangay	Total Household (A)	Farm Household (B)	% (B/A)	Existing Multi-purpose Building
Zone I	Betag	531	125	24	Office of the Municipality
	Pico *)	1,091	297	27	no
	Poblacion	704	100	14	Office of the Province
	Puguis *)	436	145	33	no
Zone II	Alapang *)	265	146	55	no
	Alno *)	190	152	80	no
	Bahong *)	372	186	50	no
Zone III	Bineng *)	156	109	70	no
	Wangal *)	187	126	67	no

Data source: Family Survey 1985, Rural Health Unit, La Trinidad

*) : Barangays to be proposed construction of the rural community center.

(2) Laying out of rooms and floor area

a. Multi-purpose hall

Capacity of the hall is decided as one third of the number of farm household.

Capacity of community center proposed in Pico is 80 persons, others are 50 persons. Supposing that exclusive floor area is 1.8 m^2 one person, 150 m^3 total floor area is required for Pico, 90 m^3 for others.

b. Room for practical activity

Two rooms are individually provided for taking practical activity of farmers e.g. clinic, individual farm management counseling, agricultural extension services, etc.

Each room is accommodated 16 m^2 (4 m x 4 m) floor area.

c. Storeroom

Storeroom for keeping documents, materials and equipments which are utilized in common use is provided. The storeroom is 16 m^2 floor are proposed.

d. Water supply system

Room for kichnette is required with water faucet in 6 m^2 (2.5 m x 2.5 m) floor area.

e. Toilet

12 m^2 (6 m^2 x 2) floor area is required for the toilet.

f. Corridor

20 m^2 (2 m x 10) floor area is occupied for corridor.

Total required floor area are 240 m^2 and 180 m^2 for Pico and others respectively.

(3) Equipments installed in the community center

Only desks and chairs for the multi-purpose hall are equipped in viewpoint of availability for public and various purposes.

(4) Plan for utility

Each community center has purpose and frequency for utilization in each components as mentioned below.

1) Irrigation:

- Explanation for constructed irrigation system (frequent, just after completion)
- Seminar for technical matters (once a month)
- Regular assembly for strengthening of irrigator's association (twice a month)
- Meeting for water use arrangement (anytime)

2) Agriculture:

- Seminar for agricultural technic (once a month)
- Counseling for agricultural management (once a month, and anytime)

3) Protection of rural environment

- Educational activity for garbage treatment (anytime)
- Explanation for utilization of constructed sewage canal (frequent, just after completion)

4) Drinking and domestic water supply

- Explanation for utilization of drinking and domestic water supply facilities (frequent, just after completion)

5) Others:

- Conference assembly of barangay (twice a month, anytime)
- Counseling for improvement of rural life (once a month)
- Clinic counseling (anytime)
- Farmer's cultural activities (several times a week)
- Refuge space when in case (rare)

Accordingly, proposed community center will be utilized almost every day for any purposes including farmer's cultural activities which will be spread in obedience to farmer's intention.

As mentioned above, proposed community centers could be expected to become important bases for farmer's activities on rural life improvement and agricultural progressing.

4.8 Equipments and Materials to be Granted

4.8.1 Vehicles for implementation and, operation and maintenance

a. 4 wheel-drive jeep ..... (two (2) nos.)

The vehicles will be utilized for carrying out periodic facility inspections, consultations with the Barangay grassroots populace and coordination activities with the different concerned agencies during and after construction. Considering the distances to be traversed and the multiplicity of works and facilities as well as the farmers' convenient time, vehicles are believed urgently needed for the success of the project.

Taking the frequency of utilization of the jeeps into consideration, two (2) 4 wheel-drive jeep are settled upon.

b. 4 wheel-drive pick-up ..... (two (2) nos.)

The vehicles will facilitate the mobility of field agricultural extension staff and technicians in the timely delivery of required agricultural inputs and technical services in the promotion and prosecution of HIRDP agricultural projects in the different barangays.

Moreover, the vehicles will also be utilized for transportation of materials and other necessary equipments for the maintenance of proposed facilities and civil works. Two (2) 4 wheel-drive pick-up are required.

c. Dump truck (4 t, 2 t) ..... (one (1) each no.)

The dump trucks will be utilized for maintenance of irrigation facilities, roads and other civil works.

Transportation of excavated sediment materials from the pond, earth materials caused by sliding along the roads, gravel and stone to maintain the rural roads and garbage and other obstacles which cause constraints to the smooth flow of irrigation canal, drainage canal, and creeks, will be inevitably required.

The dump trucks of 4 t and 2 t are necessary for the important purposes.

The contents and frequency of the utilization of proposed vehicles for each unit of HIRDP O&M office are presented below:

Frequency of Utilization of Vehicles

Unit in LT/HIRDP O&M Office		Objects	Vehicles	Frequency
Rural Community Center Unit	:	Patrol	(Jeep)	Once a week
		Repair and maintenance	(Jeep)	Irregular
Irrigation Facilities Unit	:	Patrol	(Jeep)	Once a week
		Arbitration of water use	(Jeep)	Any time
		Technical instruction	(Jeep)	Any time
		Removal of disposed garbage in the creek	(Dump truck)	Once a month (in each area)
		Dredge of sediment in the pond	(Dump truck)	Once a half year (in each pond)
		Repair of the pond	(Dump truck)	Irregular
Drainage Unit	:	Maintenance	(Pick-up)	Several times a year
Agricultural Extension Unit	:	Activities for the services	(Jeep, Pick-up)	Every day
		Holding of seminar	(Jeep)	Often
		Demonstration of new agricultural technology	(Pick-up)	Irregular
Inland Pollution Control Unit	:	Education for garbage treatment	(Jeep)	Continuously carried out
Domestic Water Supply Unit	:	Patrol	(Jeep)	Once a week
		Maintenance	(Jeep)	Once a month
		Technical instruction and arbitration	(Jeep)	Any time

Rural Road Unit	:	Patrol	(Jeep)	Once a month
		Maintenance	(Pick-up)	Any time
		Cleaning of road drain	(Pick-up)	Once a half year (in each route)
Administrative Unit	:	Transportation	(Jeep)	Any time

4.8.2 Equipments for operation and maintenance

a. Photo-copy machine ..... (one (1) unit)

One photo -copy machine is equipped in O&M office for data and documentation arrangement.

b. Micro-computer ..... (one (1) unit)

One micro-computer is equipped in O&M office for monitoring and evaluation of the Project, and for agricultural data arrangement such as farm economic analysis.

4.8.3 Equipments for meteorological observation

It is very important to reflect the meteorological analysis to the practical scheduling of the Project on the basis of actual meteorological record.

The equipments for meteorological observation listed below are settle upon for purposes of such as flood forecasting and water management.

Automatic rainfall gauge ..... (one (1) unit)
Automatic wind velocity and direction meter ..... (one (1) unit)
Sunshine meter ..... (one (1) unit)

4.8.4 Equipments for water quality testing

Water quality testing for drinking water supplied by proposed drinking and domestic water supply facilities is required to keep good sanitation.

Only easier testing equipments are procured as listed below.

Turbidity meter	(four (4) units)
Remained chlorine meter	(four (4) units)
pH meter	(one (1) unit)
Test paper for general and Colin Bacillus	L.S.

CHAPTER V PROJECT IMPLEMENTATION

5.1 Executive Agency of the Project

PGB will be assumed an executive agency of the Project implemented on the Grant Aid basis. PGB will take care of the plan of the construction and whole affairs concerned.

The signer of the Philippines side for the Exchange of Notes (E / N) of the Project is Minister of Foreign Affairs of the Philippines, the Notes will be prepared by the PGB as well.

PGB will also carry out the contracts and proceedings e.g., consultant contract for the detailed design and supervision, construction contract, banking arrangement.

In process of the execution of the Project, the government authorities, DPWH, NIA, DA and LTWD as a public corporation, will support PGB from a viewpoint of their own specialities on the examination of the Basic Design and Detailed Design, and check of documents to be prepared for the construction works.

During construction of the Project, LT/HIRDP Project Office which is established in PGB with staffs experienced field survey with B/ D study team, will be functioned to smooth execution.

5.2 Proposed Construction Works

The construction works to be implemented are composed of proposed works itself presented below and temporary works concerned with such main works.

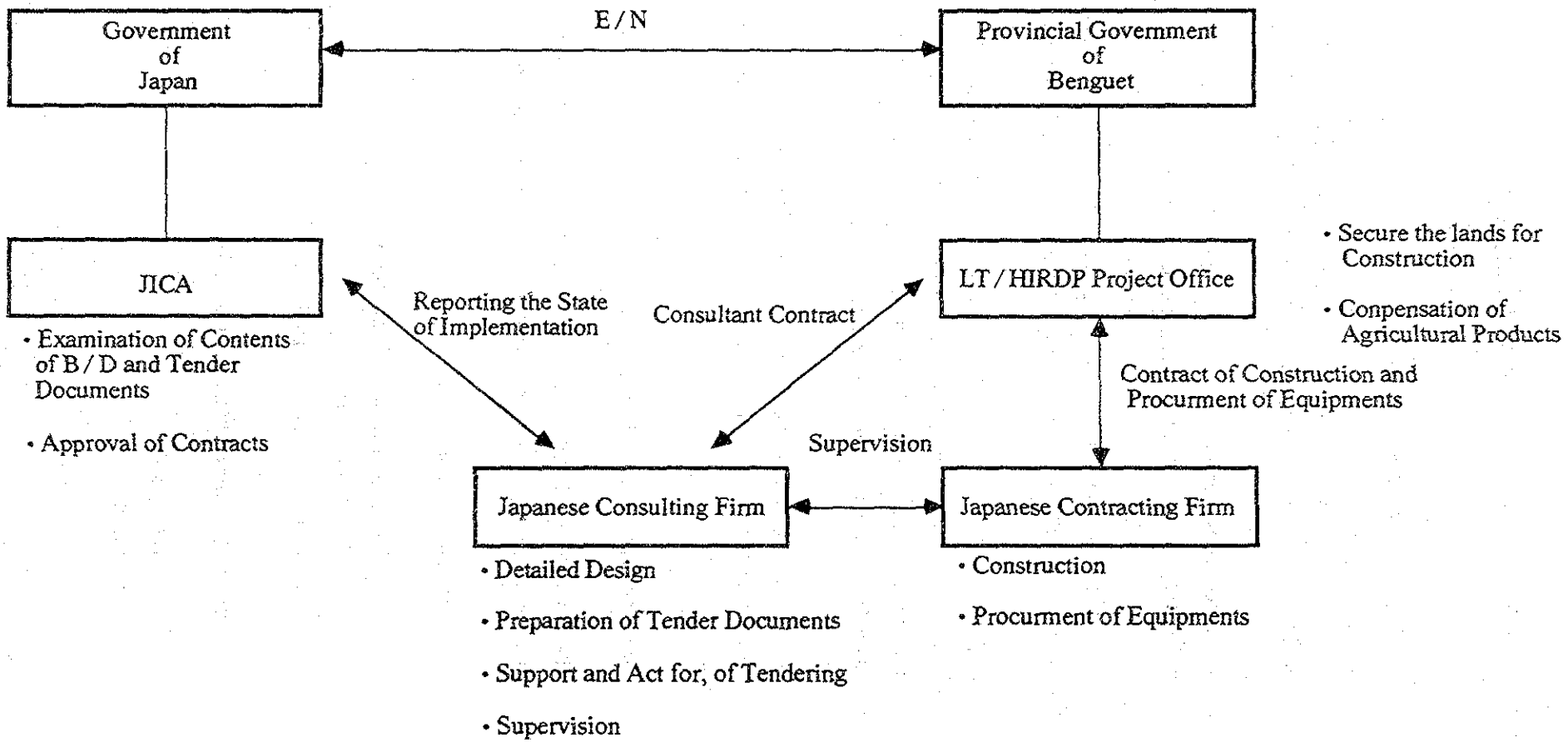
a. Drainage facilities (Zone I)

1)	River improvement (3 streams)	2,500 m
2)	Regulation gates	2 nos.
3)	Construction of a consolidation dam	1 set

b. Irrigation facilities (Zone I, II and III)

1)	Intake weirs	9 nos.
2)	Ponds	8 nos.

Fig. 5.1.1 Functions for Implementation of the Project



3)	Storage tanks (inc. Regulation tank)	9 nos.
4)	Small pump stations	4 nos.
5)	Deep well for irrigation water supply	3 nos.
6)	Diversion conduit and supplementary conduit from well (inc. Related structure)	4,770 m
7)	Improvement of Bineng CIS irrigation facilities	1 set
8)	Lateral conduit	23,200 m
9)	Division tanks	80 nos.
10)	Improvement of distribution facilities at outlet of Dinog-cave	1 set

c. Village sewerage facilities (Zone I)

1)	Sewage canal	2,450 m

d. Rural roads (Zone II, III)

1)	Improvement of rural roads	23.4 km
2)	New construction of rural roads	2.7 km

e. Drinking and domestic water supply facilities (Zone II, III)

1)	Deep well (inc. related facilities)	7 sets

f. Rural community center (Zone I, II and III)

1)	Rural community center	7 nos.

Moreover, equipments presented below are proposed on the main purpose of operation and maintenance.

1)	Vehicles	6 nos.
2)	Equipments for implementation, operation and maintenance	1 set
3)	Equipments for meteorological observation	1 set
4)	Equipments for water quality testing	1 set

5.3 Construction Plan

5.3.1 General

After signing of the Exchange of Notes (E/N) for the Project, an agreement between PGB and a Japanese foreign exchange bank will be concluded in accordance with the Notes.

PGB will implement the Project using a Japanese consulting firm (the Consultant) and Japanese contractor firm (the Contractor).

5.3.2 Plan for the Construction

Annual rainfall in the Project area has been recorded 3,500 - 4,000 mm, and 89% of that concentrates in the wet season.

A few remarkable typhoons have been attacked the Project area in a year. When typhoon, heavy rainfall continues in a few days with maximum daily rainfall of 700 mm. Number of rainy days in a month have been recorded at 20 - 29 days in the wet season from May to October.

Workable days for the construction taking suspension days caused by rainfall into consideration, are obtained as presented below. In the period from June to September in the wet season, the workable days are estimated about 10 days in a month. The construction works for ponds and drainage improvements are almost regarded impossible in the wet season due to flooding. As for the construction of rural roads, smooth execution of construction will be hampered.

Workable Days

(days)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
30	27	28	23	12	10	9	6	9	17	24	29	224

BSU PAGASA (1977 - 1987)

Daily Rainfall Intensity (mm/day)	Suspension of Work (day)
0 - 5	0
5 - 10	1
10 - 30	2
30 - 100	3
more than 100	4

Sites of the construction are widely extended within the Project area, and holding plenty of kinds of construction works.

Poor condition of existing roads which will be utilized for traversing vehicles to conveying materials, labors, and evacuating spoiled soil, restricts smooth implementation of the construction.

As maximum only 4 ton truck are available for accessing to Zone II and Zone III, capacity of construction are necessarily fixed by the constraints.

Effective scheduling of the construction works in order to minimize idle time of vehicles are unconditionally required because the roads allow only one way passing.

Taking these matters into consideration, basic principles for the construction planning are presented below.

1) Construction of rural roads will be commenced at the outset in Zone II and Zone III. The work will be continued in wet season so as to complete the construction earlier as much as possible. Taking carefully countermeasures for heavy rain is required.

2) As for the construction of irrigation facilities, constructing the works in Zone I will be ahead of others, due to easiness of accessing. The works in Zone II and Zone III will be followed the completion of construction works of rural roads. However, piping works for irrigation to be installed under the road should be constructed together with construction of the rural roads.

3) In the wet season, construction works for deep wells and community centers will be mainly carried out because of taking construction works within the site limited.

4) Drainage improvement works should be concentrically carried out in dry season.

5) Construction works of Buyagan pond and sewage canal in Zone I will be commenced after realization of smoothly draining by the completion of drainage improvement works.

6) Concrete required for construction will be produced by a batching plant. The construction plan should be built arranging required term of concrete for each works so as to minimize the scale of the batching plant.

5.3.3 Plan of the supervision

Consultant contract for the supervision is concluded between PGB and a Japanese consulting firm.

Contents of the supervision are to cooperate PGB to conclude justifiable contract for the construction, to realize the intention of every designing, to render to match constructing with the contract etc. as presented below.

1) Cooperation for construction contract

Selection of contractor, decision of contract form, preparation of tender documents, examination of bill of quantity, witnessing to tendering of the construction, etc.

2) Approval and inspection of contract drawings

Check of materials and specification, examination of the equipments procured, etc.

3) Advice for construction

Examination of construction schedule, advice to contractor for technical matters, report on construction progress to client, etc.

4) Cooperation for arrangement of approval to pay

Examination of request for payment during and after the construction, cooperation for arrangement of the payment, etc.

5) Witnessing in the inspect

Examination of specification during and after the contract, advice to contractor for the specification, etc.

Consultant will make their contracts complete being issued an authorization to pay, after confirming the complete execution of the construction, and witnessing transfer of the implemented facilities.

5.4 Implementation Schedule

It is considered that the Project can not be completed within a current fiscal year for the reasons presented below.

1) The construction are composed of various works and extended whole Project area.

2) In the wet season (especially from June to September), it has rained in almost every day. The efficiency of construction is remarkably decreased in the season.

3) Heavy equipments to be effective to shorten the construction period can not be utilized for taking construction works of rural road due to the restricted existing road condition.

4) Construction works but rural roads can not be smoothly executed at the commencement of the Project because that roads to be utilized as access road for the works are also the objects to be improved.

Taking these matters into consideration, it is recommended for the implementation of the Project to divide two phases. The term of works for the first phase in which fundamental works of the Project will be constructed, is estimated at 12 months. Though the most economical schedule for the first phase could be formulated in longer than 12 months by minimizing of the scale of temporary construction facilities with leveling of the some uneven quantities of works, the term of the first phase of 12 months is decided in line with the principal of Japan's Grant Aid unadapting such a minimization. The term of work for the second phase is estimated at 12 months as well as the first phase, in which several works left will be constructed.

The first phase will be completed taking processes presented below.

a. Detailed design

Tender drawings and documents are prepared for 3 months on the basis of the B/D study report. During detailed design, three times meeting at the inception, interim and final of the term will be held with PGB personnel concern.

b. Tendering

The tendering activities are composed of the public notice, pre-qualification of contractor, cost estimation, and constructing. Period required is about 3 months.

c. Construction

After conclusion of contract, the construction will be commenced with approval of GOJ. Supposing that smooth procurement and transportation of equipments and materials are executed as schedule, the construction of first phase will be completed within a current fiscal year.

The second phase will be completed taking processes presented below.

a. Detailed design

Tender drawings and documents are prepared for 2 months on the basis of the B/D study report. During detailed design, three times meeting at the inception, interim and final of the term will be held with PBG personnel concern.

b. Tendering

The tendering activities are composed of the public notice, pre-qualification of contractor, cost estimation, and constructing. Period required is about 1 month.

c. Construction

After conclusion of contract, the construction will be commenced with approval of GOJ. Supposing that smooth procurement and transportation of equipments and materials are executed as schedule, the construction of second phase will be also completed within a current fiscal year.

Fig. 5.4.1 Implementation Schedule

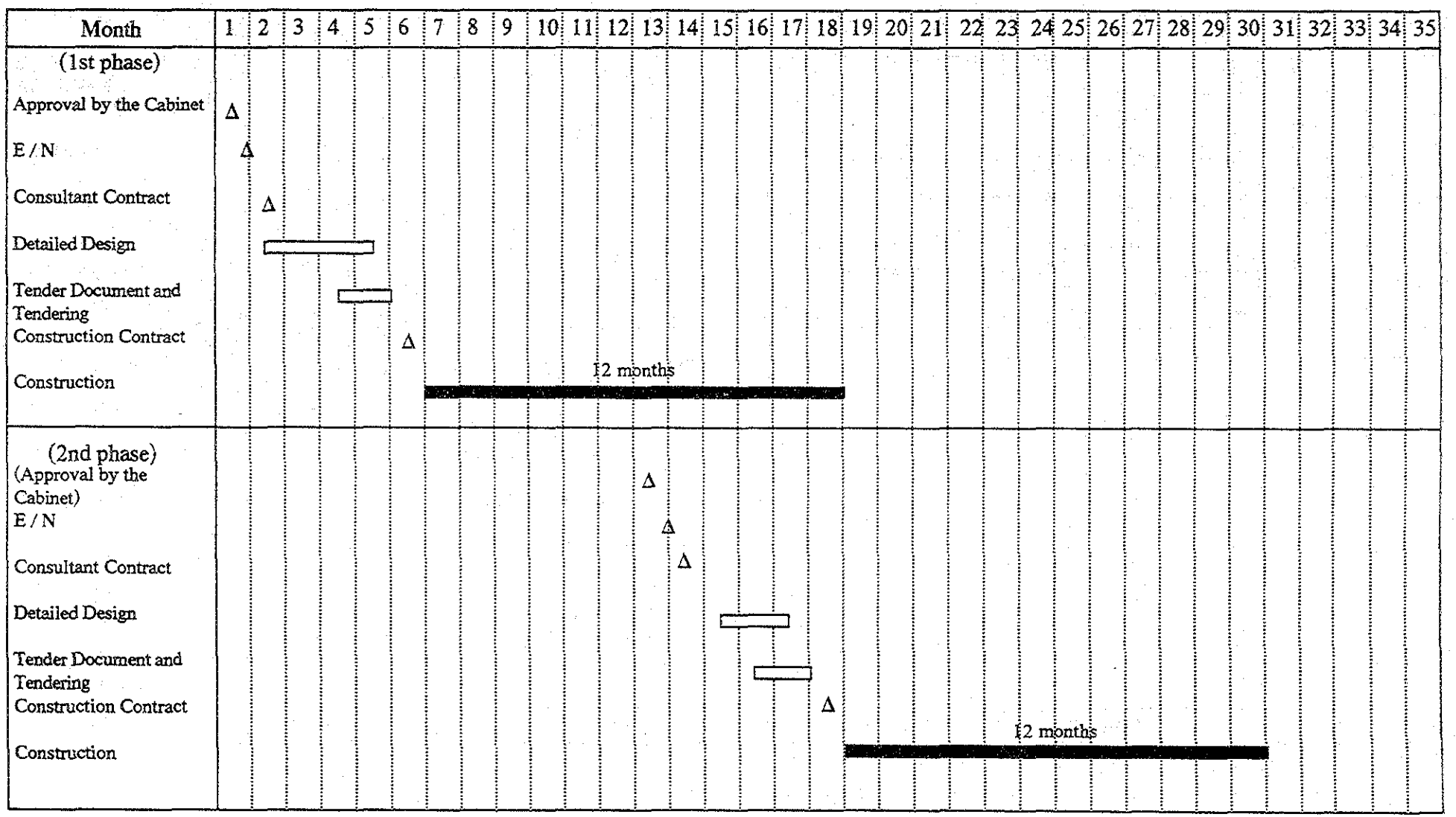
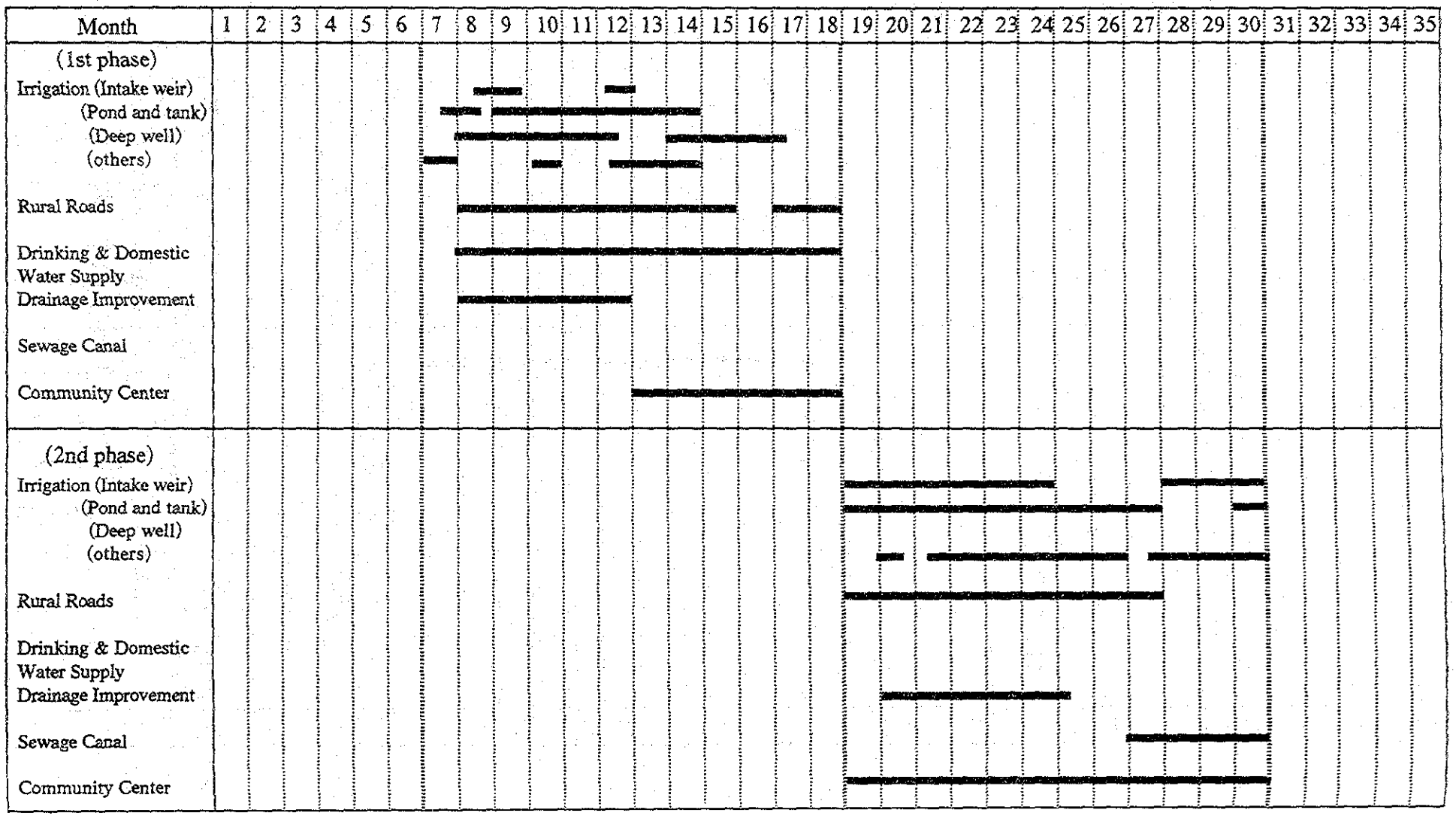


Fig. 5.4.2 Construction Schedule



Implementation Schedule of the Project is shown in Fig. 5.4.1.

5.5 Procurement of Equipments and Materials

The construction works are roughly divided into civil works, concrete works, drilling of deep well, pipe works and building works.

Major equipments and materials for each works are presented below.

		Materials	Construction Machineries
(1)	Civil Works	Dynamite and Detonator for rock blasting, Gravel for pavement	Bulldozer, Backhoe shovel, Dump truck, Steak truck, Vibrating roller, Tamping roller, Air compressor, Pump, Generator
(2)	Concrete Works	Cement, Aggregates, Reinforced iron bar, Forms arms scaffold	Batching plant, Portable mixer, Tower crane, Truck mixer, Tank lorry, Generator
(3)	Deepwell Works	Pump, Casing, Cable, Scaffold	Boring machine, Generator, Pump
(4)	Pipe works	Steel pipe, Valve, Coupling for pipe, Paint	Truck, Backhoe shovel, Compactor
(5)	Building Works	Lumber, Wooden fittings, Internal goods, Metal fittings, Paint, Glass, Lump, Consent, Sanitation, Cable, Roofing	
(6)	Equipments to be granted	Equipments for operation and maintenance (Copy machine, Micro-computer)	Vehicles (Jeep, Pick-up, Dump-truck)

Equipments for
meteorological observation
(Rainfall gauge, etc.)
Equipments for water
quality testing (Cl meter, pH
meter, etc.)

For implementation of the Project, construction equipments and materials are basically procured in local.

Principal construction materials can be obtained in La Trinidad or Manila. Coarse and fine aggregates will be transported from the Province of La Union located 30 km west of the Project area. A great part of the construction equipments required will be provided from Manila, because that available equipments in and around the Project site are limited in type and number.

Three routes exist from Manila to the Project site as described below. Every routes are in good condition with maximum traffic capacity at 10 - 12 tons.

It takes 5 - 6 hours (in night) for the transportation in every routes.

- Manila - Naguilian road - Baguio Route
- Manila - Kennon Road - Baguio Route
- Manila - Marcos Highway - Baguio Route

However, construction equipments, i.e. batching plant, tower crane and generator (100 - 300 kVA) etc. are procured from Japan due to difficulties of supply and full occupied in Philippines.

Procurement schedule for construction equipments are presented below.

a. Equipments and materials procured in local

Cement, Aggregates (sand, crushed stone)
Concrete products (RC pipe, concrete block)
Lumber
Pipe, Valve (excluding pipes around pump)

Reinforced iron bar, Steel materials
Roofing
Glass
Paint
Interior goods
Cable
Lamp, Consent, Switch
Heavy equipments (bulldozer, backhoe shovel, dump truck, steak truck, vibrating roller, etc.)
Materials for temporary works (forms, scaffold, drain pump, small generator, etc.)
Equipments to be granted (micro-computer, copy machine)

b. Equipments and materials procured from Japan

Pump, Casing
Pipe, Valve (around pump)
Heavy equipments (batching plant, tower crane, large generator, etc.)
Equipments to be granted (vehicles, equipments for meteorological observation, equipments for water quality testing)

Micro-computer, and copy machine among equipments to be granted will be procured in Philippines considering of maintenance and taking care.

5.6 Scope of Work

The funds for the construction cost of the Project will be offered by the GOJ in the General Grant Aid Program.

No funds for the construction will be fundamentally required to GOP.

However, LT/HIRDP Project Office which is a main function of the Project implementation, should be established and managed by PGB own self.

As for the LT/HIRDP Project Office, it is proposed for the establishment and management to utilize the accommodation, equipments, and staffs of PGB as same manner during B/D study.

Moreover, land acquisition for the construction is expected to complete with the fund of GOP which has been already budgeted in 1989 provincial budget at 1,147,000 pesos.

CHAPTER VI OPERATION AND MAINTENANCE

After construction the LT/HIRDP Project Office will be re-constituted to the LT/HIRDP O&M Office. The function and responsibility of the LT/HIRDP O&M office after construction is the management and monitoring of the operation and maintenance of the facilities, equipments, structures constructed and the institutional barangay level organizations/associations established under the LT/HIRDP.

6.1 Organization for Operation and Maintenance

The LT/HIRDP O&M Office will be under direct control of Governor of Benguet managed with budget of PGB.

The Office will be composed of seven (7) units as shown in Fig. 6.1.1. Each unit will carry out the operation and maintenance in cooperation with each governmental agency concerned.

6.2 Operational and Maintenance Plan

The units within the O & M Office shall function in the manner outlined Fig. 6.2.1, each having its own components that fall within its supervisory domain. This will necessitate a staffing level of 22 (and 15 of these will simultaneously be charged with duties pertaining to other administrative agencies). The Figure also shows the associated equipments investment requirements. (The latter have been dealt with in the relevant section concerning the equipment investment needs to be met.)

Given, however, that the facilities to be made available under the Project will have a direct beneficial effect on the population's productive activities and its living environment, it is felt more desirable and even vitally important to generate a positive involvement by ensuring that those who will benefit from the Project should participate and play an active role in the operation and maintenance tasks, even though, in practice, a system will be established that will enlist the understanding and cooperation of other, third-party beneficiaries.

Based on this philosophy, the LT/HIRDP O &M Office will be called upon to provide guidance and assistance in the form of a back-up function to support the maintenance and supervision activities directly undertaken by the beneficiaries. At the same time, the Office shall act in an executive and organizing capacity to facilitate maintenance and repair tasks as

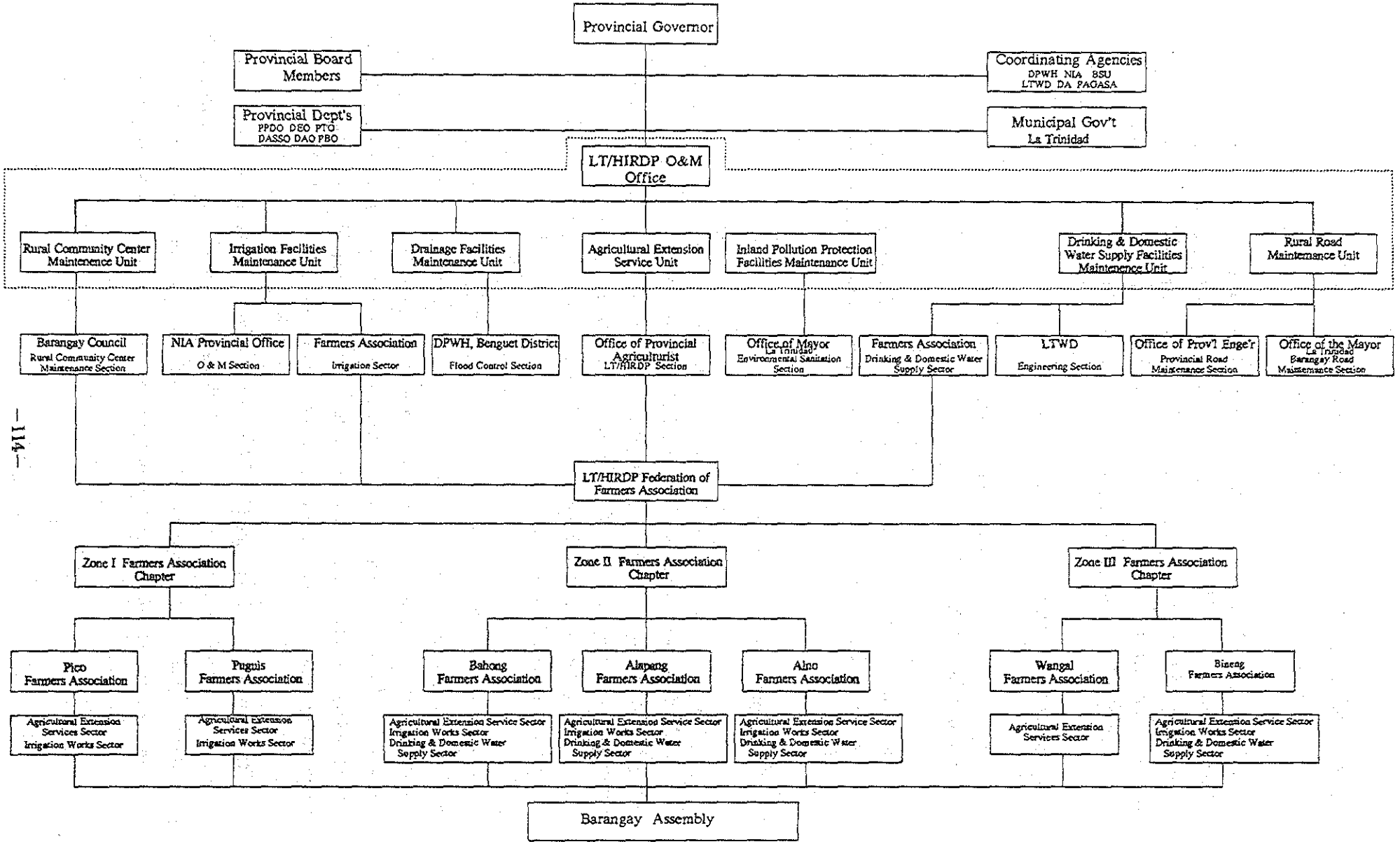
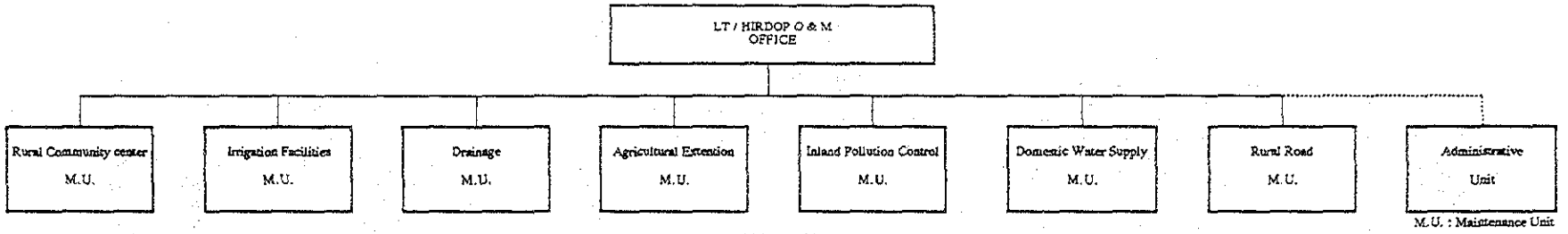


Fig.6.1.1 Organization of Operation and Maintenance

Fig. 6.1.2 Major Tasks of LT / HIRDP O & M Office and Assignment Plan



M.U. : Maintenance Unit

Major activities

Rural Community center M.U.

1) Regular patrol
2) Instruction and recommendation to baranagy council for O & M
3) Advice on utilization
4) Instruction and arrangement for maintenance and repair

Irrigation Facilities M.U.

1) Check the operation and maintenance condition, Instruction for utilization
2) Advice for water-use adjustment
3) Advice and instruction for technical problems
4) Superintendence of farmers' association
5) Instruction and arrengement for maintenance and repair
6) Advice for collecting irrigation fee.

Drainage M.U.

1) Check the conditions of facilities
2) Arrangement of weedling etc.
3) Instruction for handling of gate etc.
4) Arrangement for repairing

Agricultural Extention M.U.

1) Excution of demostration
2) Extension of new technology and Consultation
3) Instruction and advice for farm economic management
4) Advice for Crop planning
5) Guidance for strengthening of farmers association

Inland Pollution Control M.U.

1) Educationg activities for garbage disposal
2) Check the condition of sewage canal
3) Instruction and arrangement for maintenance and repair
4) Arrangement for repairing
5) Investigation for further sewage plan

Domestic Water Supply M.U.

1) Guidance for operation and maintenance of facilities
2) Check the condition of facilities
3) Instruction and arrangement for maintenance and repair
4) Construction for water use
5) Advice for collecting fee.
6) Set up of replacement plan

Rural Road M.U.

1) Arrangement for operation and maintenance of roads
2) Check the condition of roads
3) Advice and arrangement for maintenance and repair

Administrative Unit

1) Administrative works
2) Adjustment of each governmental office
3) Control the badjet
4) Operation and maintenance of vehicltues
5) Maintenance of equipments

Staff assignment

Rural Community center M.U.	Irrigation Facilities M.U.	Drainage M.U.	Agricultural Extention M.U.	Inland Pollution Control M.U.	Domestic Water Supply M.U.	Rural Road M.U.	Administrative Unit
(C) Patrolman 1	(C) Irrigation engineer 1 Assistant 1	(C) Drainage engineer 1	(C) Agr. extension officer 1 (Temporary hiring of agriculturist and drivers will be required)	(C) Sanitary engineer 1 (C) Assistant 1	(C) Water supply engineer 1 Assistant 1 (C) Patrolman 1	(C) Road engineer 1 (C) Assistant 1	Officer 1 (C) Information analyst 1 Typist 1 Janiter 1 Driver 1 (C) Driver 1 (C) Mechanic 1 (C) : Concurrently assigned

Equipment disposition

Irrigation Facilities M.U.	Agricultural Extention M.U.	Administrative Unit
Equipments for meteological observation L.S. Equipments for water quality testing L.S. (Utilized by NIA) 4t dump truck 1 no. 2t dump truck 1 no. (Utilized by the Office of Municipality)	4 weel-drive pick-up 2 nos. (Commonly utilized with the Office of Agriculturist in Province)	4 weel-drive jeep 2 nos. Copy machine 1 no. Micro-computer 1 no.

and when required. The staffing and equipment plans for the above O & M Office shall therefore be broadly defined with these basic ideas in mind.

The practical feasibility of these plans will rest on the vital assumption that adequate and effective training and instructions should be made available to the beneficiaries so that they will be in a position to perform the daily operation and maintenance tasks. This will also entail the provision of appropriate instruction manuals.

It is essential that the training program for the agricultural population under the Project should commence not after the completion of the construction work but that the training should be an on-going process starting even prior to the construction and continued through the construction process. This will ensure early training or preparation in readiness for the necessary tasks and will require the previous recruitment of the appropriate technical experts and staff members that are to be employed in the O & M Office after the completion of the construction work.

6.3 Cost Estimate for Operation and Maintenance

After construction, costs for operation, maintenance and necessary activities for agricultural extension should be offered by Philippines side.

Annual O&M cost is estimated at 1,132,400 pesos. Among the cost, 284,000 pesos and 848,400 pesos are responsible for the PGB and beneficiaries themselves respectively.

Annual cost for each component and the responsible agencies to bear are presented below.

1) O&M cost for O&M office ..... PGB

Personnel expenses (salary etc.)	186,000
Expense of utilities	11,500
Expense for maintenance	
Wear and tear expense	73,000
Fuel and oil etc.	
Others	13,500
Sub-total	284,000 pesos

2) O&M cost for irrigation facilities ..... Farmers association (Beneficiaries)

Expense of pump operation	132,700
Irrigation fee	67,800
Sub-total	200,500 pesos

3) O&M cost for rural roads ..... DPWH

* compensate within the budget for existing roads at present

4) O&M cost for drinking and domestic water supply facilities ..... Farmers association <Beneficiaries>

Water charge (inc. expense of pump operation)	631,000 pesos

5) O&M cost for drinking facilities ..... DPWH

* compensate within the budget for maintenance of rivers at present

6) O&M cost for sewage canal ..... Municipality office of La Trinidad

* compensate within the budget for pollution protection in present

7) O&M cost for rural community center ..... Barangay council <Beneficiaries>

Expense of utilities	16,100
Others	800
Sub-total	16,900 pesos

8) Expense for agricultural extension ..... Office of provincial agriculturalist

* compensate within the budget for agricultural extension services

9) O&M cost for equipments to be granted ..... PGB and official agencies concern

* offer the O&M cost by each official agencies concern with their own budget.

CHAPTER VII PROJECT EVALUATION

1) Socio-economic evaluation

In general, there are five distinct agricultural development objectives: growth of agricultural production, self-perpetuation, stability, fairness, and efficiency. The lack or non-fulfillment of any one of these five objectives is felt to result in a general standstill of agriculture. Given, however, that it is the agricultural population in whom the agricultural pursuits are ultimately vested, it follows that the rural area must be the locus of all agricultural activities. This being so, it is clear how important and decisive a role the general climate of the rural activities plays and how intimately it is interwoven with the aspects of agricultural production efficiency.

It is fair to assume that the target area under the Project has suffered from the ill-effects of the extremely harsh natural environmental conditions, the lack of an agricultural base, and the poor living conditions in the rural areas is many ways. The effects have struck in a non-uniform manner and thus impeded agricultural production in a rather diverse pattern. A field survey has been conducted to highlight the detrimental factors that have hampered agriculture and affected agricultural production in a particularly adverse manner. The overall objective is to raise the conditions of agricultural production "from the bottom up" through such extension measures with a view to improving the socio-economic standards of the target area and the adjoining areas in which the spin-off effect of these improvements will be felt.

As has already been pointed out in Section 3.2 Contents of the Project, the Project is designed to achieve overall development through the implementation of a multi-component improvement effort, and as the individual components of this development effort will interact, they are likely to reinforce each other.

The advantages consequent upon the improvement of the area's irrigation facilities will become manifest in many ways. First the provision of stable irrigation water supplies will, naturally, generate a higher level of efficiency and a larger output of agricultural crops. But this will not be the only effect. At present, the dry season poses a serious problem. Despite the mobilization of the greatest human efforts, the fruit of this labor is only marginally rewarded with a minimal amount of irrigation water. The irrigation water supplies to be made available under this Project will

therefore permit substantial savings in human labor to obtain better results. While it must be realized that some negative factors have arisen in connection with the escalation of operating costs as compared with the cost level allowed for at the time when the Development Plan was established in F / S, it is estimated that the economic effect of these improvement measures will be practically identical, or very close to, the economic results anticipated in the Development Plan of F / S. The above cost escalation is due to a variety of factors, including a reduction in the capacity of the planned reservoir, a change in the level of availability of terminal facilities (the terminal facilities cover an average area of 5 ha), and the natural cost movements in the course of time. In addition, there has also been some modification in terms of such aspects as the close selection of the water intake locations and the review of the maintenance and supervision system to provide greater efficiency (revision of water charge).

In connection with the provision of the rural road system, the area due for new road construction has been reduced. Yet, this quantitative curtailment will be offset qualitatively by a plan under which all qualifying roads will be surfaced with concrete, thus providing greater safety and convenience in road maintenance and supervision.

The same applies to other components also. The socio-economic effects that had been expected from the Development Plan of F /S will be achieved practically as scheduled by a detailed implementation program based on the Development Plan of F /S. This will ensure high efficiency in respect of each individual project component and also lead to a compounded effect ("synergistic reinforcement") through the interaction of various components.

Thus, the implementation of the Project is viewed as being capable of raising agricultural production and improving the level and quality of village life by making the fullest use of the keen desire of the local agricultural population to be more productive.

In this connection, the general socio-economic effect benefitted by the project is summarized in Table 7.1.

Table 7.1 Socio - Economic Effects of Each Component

component	Zone	Contents of the Project	Effects
Irrigation	I, II III	Construction of water source, distribution and terminal facilities in 13 irrigation blocks.	Stabilized cropping in dry season will realize in 534 ha farmland. Net product value will increase 191 % of the present value including agricultural extension effects. (for drought less than 2 - 5 year return period)
Rural Road	II, III	Road implement of 23.4 km length, and new construction of 2.7 km length.	About 1,400 families, 7,700 peoples will be directly benefited. Agricultural activities for more than 600 ha will be encouraged.
Drinking and Domestic water Supply	II, III	Deepwells and water supplying system of 7 districts.	About 6,100 peoples (11,000 peoples in 10 years future) will be supplied water, and 500 ha farmland can be utilized water for multi - purpose.
Drainage Improvement	I	River improvement of 2,500 m length in 3 rivers etc.	88 ha land will free from inundation, and cropping area will increase 217 ha in flooding on a scale of 5 year return period.
Sewage canal,	I	New construction of sewage canal 1 line at 2,450 m length.	About 1,000 families, 16,000 peoples in 2 barangays will be benefited for improving of pollution.
Public Building	I, II III	Construction of 7 community centers	About 2,700 families (1,100 farm families), more than 15,000 people can utilize the community centers.

2) Financial evaluation

As the contents of the Project were contrived taking real condition of the Project area into consideration, operation and maintenance of the facilities settled upon can be conducted without difficulties.

Annual O&M cost to be offered by PGB is estimated as 284,000 pesos. This expense is considered not to overload the PGB's budget (the annual budget in 1989 is 16,781,300 pesos, and 6,170,000 pesos of infrastructure fund).

As for the O&M cost to be responsible for the beneficiaries, for the irrigation facilities, drinking and domestic water supply facilities and rural community center are 200,500 pesos, 631,000 pesos and 16,900 pesos, respectively. These expenses are also considered not to pressure the farm household economy.

Estimated annual expense per farm household for the irrigation facilities and drinking and domestic water supply facilities is 400 pesos in Zone I and 630 pesos, respectively. (Annual income of farmers in the Project area is 37,000 pesos, 27,400 pesos and 19,200 pesos in Zone I, II and III, respectively.)

3) Evaluation for O&M

The O&M of the Project is mainly conducted by farmers as beneficiaries under the superintendence of the LT/HIRDP O&M office in cooperation with governmental agencies.

Organization of the office is composed of units for each component in which technical staffs of the governmental agencies will be jointly assigned in order to smoothly understand each other. O&M can be expected to be effectively carried out through the system. Moreover, the O&M office will function well owing to equipment to be granted.

Farmers' organizations as actual factors in the O&M are barangays and CISs, which will be revised from existing CIS so as to be more systemized. Barangays can be also expected to positively cooperate for O&M because they have made efforts to secure land for construction so far.

Even in ferms of expenses, no difficulties are recognized as mentioned above.

CHAPTER VIII CONCLUSION AND RECOMMENDATION

(1) Conclusion

As mentioned previously, implementation of this Project is above all significant for the Government of the Philippines which has principally directed itself towards the goals of alleviation of poverty, generation of more productive employment, and development of agriculture especially in rural areas.

That will realize not only increased agricultural production and activation of rural life through improvement of living circumstances in the Project area, but will also lay the foundation for stable vegetable products for establishment of a model for highland rural areas and for memorable success of a project executed by local government in ferms of the national level.

In conclusion, to assist in the construction of the Project and the procurement of necessary equipment will be remarkably effective in all senses.

It is therefore recommended to implement this Project under a Grant Aid Program.

(2) Recommendation

In order to ensure implementation as planned, it is recommended that the following items will be undertaken.

1) The land for the construction, for access roads, and for the stockyard should be secured.

2) The purpose of the plan should be explained to the affected farmers, whose present water use will be modified. The farmer's should consent to the fact that they will be benefitted by the Project. It should be explained to all farmers that the irrigation aspects of the Project will greatly improve water availability downstream of the Project Area.

After construction, realization of effective operation will depend considerably upon the self-help efforts of farmers as well as the efforts of Philippine officials.

It is recommended that the concerned Philippine personnel conducting necessary activities such as those presented below.

1) Assign the counterpart personnel of the B / D study to the Project office , so that they can organize the executor systems, and educate farmers concerning the Project.

2) Utilize careful and thoughtful explanation in order to obtain the consent of beneficiaries to bear the charges for supplies of irrigation water and, drinking and domestic water.

3) Continue to pursue realization of rural development by means of drastic planning for sewage problems in Zone I, and establishment of city planning corresponding to urbanization, etc.
The exercise of PGB's own initiative following Project implementation will significantly enhance the value of the Project.

Appendix

CONTENTS OF APPENDIX

1. Members of the Team

1-1 Basic Design Study

Team Leader	Mr. Itsuro Tsuruki	Director Okinawa Development Office, Japan Agricultural Land Development Agency
Agricultural & Rural Infrastructure	Mr. Kosho Daigo	Overseas Cooperation Office, Design Division, Agricultural structure Improvement Bureau, Ministry of Agriculture, Forestry & Fisheries
Project Coordinator	Mr. Tetsufumi Mikami	Officer, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs
Irrigation and Drainage Facilities	Mr. Yoshimitsu Yukawa	Nippon Giken Inc.
Impounding Reservoir for Irrigation	Mr. Shuichi Matsushima	Nippon Giken Inc.
Structures Designing	Mr. Hiroki Hayashi	Nippon Giken Inc.
Rural Road Designing	Mr. Takahiro Kato	Nippon Giken Inc.
Cost Estimate (Home office works)	Mr. Shoji Irita	Nippon Giken Inc.

1-2 Explanation for Draft Final Report

Team Leader	Mr. Mitsuhiko Yoshida	Director, Land Improvement Technical Service Center, Kyushu Regional Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries
Agricultural and Rural Infrastructure	Mr. Kosho Daigo	Overseas Cooperation Office, Design Division, Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry and Fisheries
Irrigation and Drainage Facilities Planning	Mr. Yoshimitsu Yukawa	Nippon Giken Inc.
Rural Road Designing	Mr. Takahiro Kato	Nippon Giken Inc.

2. Survey Schedule

2-1 Basic Design Study

Date	Activities
20 th of December 1988	Arriving Manila from Tokyo (4 members)
21st	Discussion in JICA Philippines Office, Embassy of Japan and NIA
22 nd	Moving to Baguio from Manila Setting up of B / D study office
23 rd	Meeting within team, Courtesy call to Governor, and Mayor
24 th	Reconnaissance
25 th	Collecting data
26 th	Meeting with PGB's officers
27 th	Reconnaissance
28 th	- do -
29 th	Reconnaissance, topo-survey
30 th	Reconnaissance, topo-survey Arriving Manila from Tokyo (1 member)
31 th	Reconnaissance, topo-survey Moving to Baguio from Manila (1 member)

Date	Activities
1 st of January 1989	Arrengement of the data
2 nd	Discussion with PGB, topo-survey
3 rd	Reconnaissance, topo-survey
4 th	Collecting data, topo-survey
5 th	Reconnaissance, topo-survey
6 th	Progress meeting with PGB
7 th	Collecting data, arrengement of the data
8 th	Arrengement of the data
9 th	Meeting with PGB for land acquisition
10 th	Pre-basic designing of facilities
11 th	- do -
12 th	Arriving Manila from Tokyo (governmental members) Pre-basic designing of facilities (other members)
13 th	Meeting with JICA, Embassy (governmental members) Reconnaissance (other members)
14 th	Moving to Baguio (governmental members) Arrengement of data (other members)
15 th	Reconnaissance (governmental members) Arrengement of data (other members)

Date	Activities
16 th	Meeting with PGB (all members)
17 th	Reconnaissance, meeting within team (all members)
18 th	- do - (all members)
19 th	Signing of Minutes of Discussions, moving to Manila (governmental members) Pre-basic designing (other members)
20 th	Pre-basic designing
21 st	Data analysis
22 nd	- do -
23 rd	- do -
24 th	- do -
25 th	Final meeting with PGB
26 th	Moving to Manila from Baguio
27 th	Reporting the result of survey to JICA Philippines Office, and Embassy
28 th	Leaving Manila to Tokyo

2-2 Explanation for Draft Final Report

Date	Activities
3 rd of April 1989	Arriving Manila from Tokyo Courtesy call to JICA Philippines Office, and Embassy of Japan
4 th	Courtesy call to NIA Collecting data in Manila
5 th	Moving to Baguio from Manila Courtesy call to Governor, and Mayor Reconnaissance in Zone I
6 th	Reconnaissance in Zone II Discussion with PGB, Explanation of Draft Final Report
7 th	Reconnaissance in Zone III, Explanation of Draft Final Report
8 th	Reconnaissance in Zone I
9 th	Preparation of Minutes of Discussions Reconnaissance in Zone II
10 th	Signing of Minutes of Discussions Final Discussion with PGB
11 th	Moving to Manila, Reporting to JICA Philippines Office, and Embassy of Japan
12 th	Leaving Manila to Tokyo

3. Member List of Persons Concerned

Japanese persons concerned

- Embassy of Japan in Philippines

Mr. Naoki Hayashida	First Secretary

- JICA Philippines Office

Mr. Moriya Miyamoto	Resident Representative
Mr. Noriaki Niwa	Assistant Resident Representative

- Mr. Yasuhiro Mishima — JICA expert (NIA)
- Mr. Yukinori Ouchi — JICA expert (NIA)

Philippines Persons concerned

- Provincial Office of Benguet

Hon. Dr. Andres R. Bugnosen	Governor
Hon. Robert R. Tinda-an	Vice Governor
Hon. Cipriano Abalos, Jr.	Board Member
Hon. Raul Molintas	- do -
Hon. Jaime Paul B. Panganiban	- do -
Hon. Walter Carantes	- do -
Hon. Manuel C. Cuilan	- do -
Hon. John Haight	- do -
Atty. Gabriel Pawid Keith	Provincial Administrator
Mr. Teresita A. Finaza	Administrative Officer IV
Mr. Alejandro M. Tello	PEO
Mr. Bial A. Palaez	PPDO
Mr. Tuho Chapdian	- do -
Mr. Albert Carte	PASSO
Engr. Romeo Gomez	- do -

Mr. Jose de la Cruz, Jr.	PAO
Dr. Cresencia Beltrau	PAO
Miss. Marilyn D. Cosalan	PAO
Mrs. Victoria B. Akia	PAO
Mrs. Lolita Sabo	PAO

- Municipality of La Trinidad

Mrs. Edna C. Tadanda	Mayor
Mr. Gibson Bahod	Councilor
Mr. Richard C. Pacalso	DPD
Mr. Avelino Bahod	DA

- Benguet State University

Dr. Lucio Victor	President
Mr. Octavio Duna	

- La Trinidad Water District

Engr. Benedicto Abastilla

- National Irrigation Administration

Engr. Barromeo Melchor	Provincial Irrigation Engineer
Mr. Patrick Conception	
Mr. Wiston Abobo	

- Department of Public Works & Highways

Engr. Thomas Batac
Engr. Arcadio V. Regacho

- Other Agency

Mr. Quintin Rullan	Department of Local Government

Col. Romeo Acop	Provincial Commander
Atty. Felix Cabading	Provincial Fiscal
Fr. Brigido Galasgas	San Jose Parish Church
Mr. Marie C. Arranz	DTI

4. Minutes of Discussions

4-1 Basic Design Study

Minutes of Discussions
on
The Highland Integrated Rural Development Project
in
La Trinidad
Province of Benguet, Republic of the Philippines

In response to the request of the Government of the Republic of the Philippines (GOP), the Government of Japan decided to conduct a Basic Design Study on the Highland Integrated Rural Development Project (HIRDP) in La Trinidad, Province of Benguet (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA). Relative hereto JICA sent to the Republic of the Philippines the study team headed by Mr. Itsuro Tsuruki, Japan Agricultural Land Development Agency, from December 20, 1988 to January 28, 1989.

The team carried out a field survey in the relevant areas of the Project and conducted series of discussions on the Project with the Provincial Government of Benguet and concerned authorities of the Government of the Republic of the Philippines.

As a result of the survey and discussions, both parties have agreed to recommend to their respective Governments and authorities concerned for examination attached major points of understanding reached between them for the realization of the Project.

January 19, 1989
Province of Benguet

鶴木逸郎

ITSURO TSURUKI
Leader
JICA B/D Study Team

ANDRES R. BUGNOSEN
Provincial Governor
Province of Benguet

Attachment

1. The objective of the Project is to formulate the Highland Integrated Rural Development Plan to promote highland agriculture and improve the living standards of the inhabitants in the rural areas in and around the Municipality of La Trinidad.

2. The proposed site of the Project is in the Municipality of La Trinidad, Province of Benguet with a total area of 1,420 hectares.

3. The B/D Study Team will convey the desires of the Government of the Republic of the Philippines to the Government of Japan that the latter will realize the Project as listed in Annex I within the scope of the grant aid program.

4. The B/D Study Team stressed that the land necessary for the construction should be secured.

5. The Government of the Republic of the Philippines will take the necessary measures listed in Annex II on condition that the grant assistance by the Government of Japan is extended to the Project.

6. Both sides confirm that the B/D Team explained Japan's Grant Aid Programme and that the Philippines side understood it.

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Annex I

Proposed facilities are as follows:

(1) Drainage improvement works
- Improvement of the Balili River, the Bolo Creek and the Bayabas Creek
- Consolidation dam and inflow protection screen in front of Dinog Cave

(2) Irrigation facilities works
- Construction of ponds
- Construction of intake facilities
- Irrigation canals, conduit pipes and on-farm facilities
- Construction of deepwells and conduit pipes for irrigation

(3) Rural roads
- Improvement of rural road
- Construction of farm-to-market road

(4) Drinking and domestic water supply works
- Deepwells, pumps, conduit pipes and appurtenant structures

(5) Inland pollution protection works

(6) Rural community center works

(7) Equipment
- Operation and maintenance equipment
- Agricultural extension equipment

Annex II

Required Arrangements to be undertaken by the Government of the Republic of the Philippines

1. To secure land necessary for the construction and to clear the site as needed before the commencement of the construction.

2. To give necessary approval and assistance for the items of investigation that the Consultant may require during detailed design stage.

3. To ensure prompt unloading, tax exemption and customs clearance in the Philippines and prompt internal transportation therein of the products purchased under the grant.

4. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in the Philippines with respect to the supply of the products and services under the verified contracts.

5. To accord without delay to Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into the Philippines and their stay therein for the performance of their works.

6. To maintain and use properly and effectively the facilities constructed under the grant.

7. To bear all the expenses, other than those borne by the grant, necessary for the construction of the facilities as well as for the internal transportation of the products and services under the grant.

8. To provide the space necessary for such construction as temporary offices, working areas, stock yards and others.

9. To provide adequate funds, staff and equipment to assure the effectiveness of implementation, operation and maintenance of the Project.