5-2-3 Interior Finishes

Finishes	Rooms
(Type-A) Floor : Terrazzo tile Base : Cement plaster, painted Wall : Cement plaster, painted Ceiling : Plywood, painted Door & window : Wood	Entrance hall, Office, Manager room. Meeting room, Kitchen, Library, Training room, Seed examination room, Corridor
(Type B) Floor : Cement plaster Base : Cement plaster Wall : Cement plaster Ceiling : Structure exposed Door & window : Wood	Garage, Seed processing room, Crop processing room, Shipment room, Crop packing room
(Type-C) Floor : Terrazzo tile Base : – Wall : Ceramic tile Ceiling : Plywood, painted	Laboratory, Toilet, Clean room
(Type-D) Floor : Cement plaster Base : Cement plaster Wall : Cement plaster Plywood with insulation, painted* Ceiling : Plywood, painted	Store room, Seed store room, Seed fumigation room

*: Seed store rooms

5-3 Structural Design

5-3-1 Structure

Buildings are all single storied, constructed of reinforced concrete frame, hollow concrete block or brick wall and wooden roof in consideration of durability and structural soundness against earthquake and wind. This type of structure is common in contemporary buildings in Bhutan.

5-3-2 Design Criteria

(1) Seismic Force (applicable to building having not less than 4 storeys)

$$F = \alpha \cdot w$$

where, F : Horizontal seismic force
$\alpha = \alpha_0 \cdot I \cdot \beta$
α_0: Regional factor 0.08
I : Building category factor 1.5
β : Ground foundation factor 1.2
w : Weight of portion of building

(2) Wind Force

$$P = c \cdot q$$

where, P : Wind pressure (kg/m2)
c : Coefficient about building configuration
q : Constant 150 kg/m2 (for building not taller than 30 m)

(3) Loads

1) Dead Load

Reinforced concrete	:	2.4 ton/m3
Steels	:	7.85 ton/m3
Hollow concrete block	:	250 kg/m2 (t = 20 cm)
Brick	:	380 kg/m2 (t = 20 cm)

2) Live Load (kg/m2)

Roof	- General	:	50
	- Stone roof tile	:	100
Floor	- Office, Training room, Corridor, etc.	:	300
	- Toilet	:	150
	- Store room	:	500
	- Seed store room	:	2,000 (for use of forklift)

5-3-3 Structural Materials

Reinforcement bar	:	Deformed bar SD30 (JIS) or equivalent
Concrete	:	Fc 180 kg/cm^2 (4 weeks strength)
Cement	:	Portland cement
Structural steel	:	SS41 (JIS) or equivalent

5-3-4 Load Bearing Capacity of Ground

Load bearing capacity of ground at Changdu-Dingka site has been determined based on a cone penetrometer test carried out on the field survey and those at other sites have been assumed empirically on the soils inspected on the field survey as follows:

Project Site	Soil	Load Bearing Capacity (ton/m^2)
1. Chungdu-Dingka	Clay	14
2. Bondey Farm	Clay	14
3. Changyultang	Sandy clay	14
4. Chinary	Clay	14
5. Gaylegphug	Sand with gravel	30

Cone penetrometer test at Chungdu-Dingka Site.

(a) Equation

$$qa = a \times Q/A$$

where, qa : Design load bearing capacity (kg/cm^2) with safety factor 3

Q : Minimum cone penetration resistance (kg)

A : Sectional area of cone (6.45 cm^2)

a : Constant (0.15)

(b) Measurement

Depth below GL (cm)	Point 1		Point 2		Point 3	
	Q	qa (t/m²)	Q	qa (t/m²)	Q	qa (t/m²)
10	52.68	12.25	52.68	12.35	52.68	12.25
20	26.34	6.12	35.12	8.17	52.68	12.25
30	30.73	7.15	32.93	7.66	50.49	11.74
40	50.49	11.74	26.34	6.12	48.29	11.23
50	26.34	6.12	26.34	6.12	35.12	8.17
60	26.34	6.12	21.95	5.10	39.51	9.19
70	70.24	16.33	28.54	6.60	39.51	9.19
80	Hard resist.		52.68	12.25	87.80	20.42
90			61.46	14.29	Hard resist.	
100			Hard resist.			

5-3-5 Structure of Buildings

Buildings	Foundation	Superstructure
1. Changdu-Dingka Headquarters		
Administration Office Tissue Culture House Seed Processing House Garage Seed Store House Crop Processing House	RC independent and continuous foundations	RC frame with hollow concrete block wall and wood roof
Nursery Houses (Mist, Glass & Net House)	Stone masonry	Steel
2. Changyultang Branch		
Seed Processing House	RC independent and continuous foundations	RC frame with hollow CB wall and wood roof
3. Chinary Branch		
Seed Processing House	RC independent and continuous foundations	RC frame with hollow CB wall and wood roof
4. Gaylegphug Branch		
Cardamon Processing House	Stone masonry foundation	Brick structure with wood roof

5-4 Building Service Facilities

5-4-1 Design Principle

Grade of building service facilities has been determined in coordination with those of the existing buildings of AMC, Bondey Farm and NASEPP and based on the requirement of the equipment installed and the activities in the buildings, together with the following criteria.

1) To be economical, especially energy efficient.
2) Easy operation, maintenance and supply of spare parts.
3) Safety.
4) Compatibility with existing system.
5) Easy installation.

5-4-2 Electric System

(1) Power characteristics : ϕ3, 4 wires, 415/230 V, 50 Hz

(2) Power Source

Chungdu-Dingka Headquarters :

Existing power supply station at the Agriculture Mechanization Center having a transformer of 150 kVA capacity located at about 800 m to the east.

Crop Processing House (in the Bondey Farm) :

A diesel engine generator supplied and installed under the Project.

Changyultang Branch : Branched from a power distribution line running along the public road in front of the site, which is scheduled to be constructed by the beginning of 1987.

Chinary Branch : A mini-hydro power station located at about 300 m east of the site.

Gayleyphug : A diesel engine generator supplied and installed under the Project.

(3) Room Illumination Criteria

Illumination (lx)	Rooms
500	: Office room (only Chungdu-Dingka), Library, Laboratory
400	: Manager room, Meeting room, Training room, Seed examination room, Office room
300	: Crop processing room, Seed processing room, Canning & Bottling room, Shipping room, Packing room
250	: Kitchen
100	: Entrance hall, Store room, Seed store room, Seed fumigation room, Machine room
50	: Corridor, Garage, Toilet

(4) Electrical Facilities

	Chungdu-Dingka H.Q.	Crop Process. House (Bondey)	Changyultang Branch	Chinary Branch	Gaylegphug Branch
1. Distribution line	○	○	○	○	○
2. Motor power supply	○	○	○	○	○
3. Lighting	○	○	○	○	○
4 Convenience power outlet	○	○	○	○	○
5. Telephone conduits	○	○	○	○	○
6. Telephone exchanger	○				
7. Clock	○				
8. Lightning protection	○				
9. Outdoor lighting	○	○			
Total power demand (kVA)	130	100	6	30	12

Specifications :

(a)	Distribution line	:	Overhead line
(b)	Indoor lighting	:	Fluorescent and incandescent lamps
(c)	Telephone exchange	:	Desk-top type
(d)	Clock	:	Battery driven
(e)	Lightning protection	:	Air terminal type
(f)	Outdoor lighting	:	Fluorescent lamp

5-4-3 Plumbing System

(1) Chungdu-Dingka Headquarters

(a) Water source	:	A water supply pipe ϕ50 mm running along the pathway in front of the site (south side).
(b) Supply system	:	Gravity supply with an elevated water tank
(c) Water treatment system	:	None
(d) Estimated water demand	:	20 m^3/day
(e) Hot water supply system	:	Electric hot water generator
(f) Water pipe	:	Galvanized steel pipe
(g) Waste drainage system	:	Soil to be treated in a septic tank and disposed of in a subsoil drainage system. Waste water to be conducted into outdoor storm drainage ditches.
(h) Plumbing fixture	:	Vitreous china. Seating or pedestal type water closets to be used as suitable.
(i) Drainage pipe	:	Cast iron and galvanized steel pipes
(j) Gas supply system	:	None
(k) Fire fighting system	:	None

(2) Crop Processing House (in the Bondey Farm)

(a) Water source	:	Branched from the existing water supply pipe running nearby in Bondey Farm
(b) Estimated water demand	:	15 m^3/day
(c) Hot water supply system	:	Electric hot water generator
(d) Water pipe	:	Same as the Headquarters
(e) Waste drainage system	:	Same as the Headquarters
(f) Plumbing fixture	:	Same as the Headquarters
(g) Drainage pipe	:	Same as the Headquarters
(h) Gas supply system	:	Same as the Headquarters
(i) Fire fighting system	:	Same as the Headquarters

(3) Changyultang Branch and Chinary Branch

(a) Water source	:	River water flowing beside the site
(b) Supply system	:	River water to be pumped up directly to an elevated water tank
(c) Water treatment system	:	Portable water filter to be provided for potable water
(d) Estimated water demand	:	2 m^3/day (Changyultang), 3 m^3/day (Chinary)
(e) Hot water supply system	:	Electric hot water generator
(f) Water pipe	:	Galvanized steel pipe
(g) Waste drainage system	:	Same as the Headquarters
(h) Plumbing fixture	:	Same as the Headquarters
(i) Drainage pipe	:	Same as the Headquarters
(j) Gas supply system	:	Same as the Headquarters
(k) Fire fighting system	:	Same as the Headquarters

(4) Gaylegphug Branch

(a) Water source	:	Branched from the existing water supply pipe running nearby in Bhur Farm
(b) Estimated water demand	:	2 m^3/day
(c) Hot water supply system	:	Electric hot water generator
(d) Water pipe	:	Galvanized steel pipe
(e) Waste drainage system	:	Same as the Headquarters
(f) Plumbing fixture	:	Same as the Headquarters
(g) Drainage pipe	:	Same as the Headquarters
(h) Gas supply system	:	Same as the Headquarters
(i) Fire fighting system	:	Same as the Headquarters

5-4-4 Airconditioning and Ventilation Systems

(1) Changdu-Dingka Headquarters

(a) Heating	:	Provided at the following places	
		Administration Office	- Manager room Office room
		Tissue Culture House	- Laboratory Plant growth room Fog room
		Glass House	
		Mist House	
(b) Heating system	:	Individual heating system	
		Tissue Culture House	: Packaged type, oil burning room heater
		Glass & Mist Houses	: Hot water piping with oil burning hot water generator
		Administration Office	: Oil burnt stove
(c) Design room conditions	:	Laboratory	: 20°C
		Clean room	: 20°C~27°C (24 hrs)
		Fog room	: 10°C~30°C (24 hrs)
		Glass & Mist Houses	: 10°C~30°C (24 hrs)
		(Outdoor temperature	: -6°C~29°C)
(d) Cooling	:	Provided for seed store room (long period storage)	
(e) Cooling system	:	Fan coil unit with air cooled condenser	
(f) Design room conditions	:	3°C~5°C (24 hrs)	
(g) Control	:	Automatic control with room thermostat	
(h) Ventilation	:	Provided at the following rooms.	

	Room Air Refreshment
Laboratory	5~7 times/hr
Plant growth room	5~7
Fog room	5~7
Seed store room (normal storage)	5~10
Toilet	8~10

(i) Ventilation system	:	Individual system with wall or ceiling mounted propeller fan

(2) Crop Processing House (in Bondey Farm)

(a) Heating	:	None
(b) Cooling	:	None
(c) Ventilation	:	Provided at the following rooms.

	Room Air Refreshment
Processing room	3~5 times/hr
Packing room	3~5
Toilet	8~10

(d) Ventilation system	:	Individual system with wall or ceiling mounted propeller fan

(3) Changyultang Branch and Chinary Branch

(a) Heating	:	None
(b) Cooling	:	None
(c) Ventilation	:	Provided at the following room.

	Room Air Refreshment
Seed store room	5~10 times/hr
Toilet	8~10

(d) Ventilation system	:	Individual system with wall or ceiling mounted propeller fan

(4) Gaylegphug Branch

(a) Heating	:	None
(b) Cooling	:	None
(c) Ventilation	:	Provided at the following room.

	Room Air Refreshment
Processing room	3~5 times/hr
Toilet	8~10

(d) Ventilation system	:	Individual system with wall or ceiling mounted propeller fan

5-5 Equipment Scheme

5-5-1 Design Principle

Equipment supplied and installed are those for seed/seedling production, seed/seedling processing, pilot cash crop cultivation and crop processing. A list of these equipment had been included in the request form of the Government to the Japanese Government. Upon study and discussions, the most essential and immediately needed equipment have been picked up. In specifying the equipment, consideration has been paid on the following points.

1) Equipment and tools for tissue culture must be of high grade, high precision, contamination-proof and high durability ones.
2) Easy operation maintenance and supply of spare parts.
3) Compatibility with the existing equipment and tools.
4) Low running cost, especially energy efficiency.

5-5-2 Kinds of Equipment and Capacities

Determination of kinds of equipment, their quantity and capacities has been based on the following points.

1) As time goes scope of services rendered at the Project facilities will expand and technical expertise will grow resulting in want of new equipment and tools. At the initial stage of the Project, however, the most essential and immediately needed equipment and materials to enable activities intended during the coming some 10 years based on the current technical capabilities should be supplied.

2) Quantities of equipment and tools have been determined based upon the planned seed/seedling production, processing and storing volumes, and fresh crop processing and canning/bottling volumes. Equipment and materials for pilot cash crop cultivation (at Panbesa village) have been determined according to the planned cultivation area.

3) Capacities of equipment are co-related with the quantities of them. The point is to utilize standard models as far extent as possible.

4) In case a system is made with combination of equipment, full automation has not been considered. Attendance of people between the equipment is required.

At Chungdu-Dingka headquarters, equipment for tissue culture and seedling nursery have been given a particular emphasis to enable production of seeds/seedlings most efficiently in an as small space and by as few manpower as possible. Time-wise efficiency and easiness of operation and spare parts problem have been carefully be planned. Also provided are equipment for seed screening, packing and storing, for cash crop processing such as screening, grading, packing and storing and for canning and bottling.

Chiufu Branch, where the major activity is fruit seedling growing, has been provided with net houses with misting equipment. Attention has been paid to selection of a durable anti-aphid net and to corrosion resistant structual design.

At Panbesa Branch, major equipment and materials supplied are irrigation equipment, counter-animal-intrusion fencing materials and cash crop unloading equipment in compliance with the intended pilot cash crop production in Panbesa village. Durability, safety features and reproducibility at domestic mechanical shops of the equipment and materials should be the main concern.

Changyultang Branch is a sub-center to the Headquarters so to speak in vegetable and wheat seed production. For seed screening service, seed screening machines have been provided. Easy and maintenance-free operation of the equipment are the main point.

Chinary Branch located in the eastern region is equivalent to Bondey Farm in Paro in the western region handling maize, the major crop in the region. At this Branch, maize seed processing is the major service and bean and vegetable seed the auxiliary. Seed drying, seed screening, disinfecting, packing and storing equipment have been provided with the same consideration as that for Changyultang Branch.

Gaylegphug Branch has been provided with cardamon drying equipment. Selection of the drying equipment has been made in consideration of energy-efficiency, preservation of flavor, taste and color of cardamon and handling volume.

Among the equipment in hand of NASEPP, the following will be transferred to the Project:

Place	Equipment	Q'ty
Chungdu-Dingka Headquarters	Spiral seed separator	1 no.
	Seed packing machine	1
	Gravity seed separator	1
	Tissue culture equipment	1 lot
Chinary Branch	Screen seed separator	1 no.
	Seed germinator	1

Description	Chungdu-Dingka Headquarters	Changyultang Branch	Chinary Branch
I. Seed/seedling Production			
1. Forklift	2		
2. Equipment for low temperature seed store	1 lot		
3. Grain seed dryer	1	1	1
4. Vegetable seed dryer	1		
5. Seed pre-cleaner	1		
6. Air screen seed cleaner	1	1	1
7. Indent cylinder seed separator			1
8. De-awner	1		
9. Vegetable seed processing machine	1		
10. Seed sterilizer	1		1
11. Seed packing machine	2		
12. Plastic seed bag sealer	2		
13. Bagging machine	2		1
14. Platform balance	1	1	1
15. Germinator	1		
16. Portable seed moisture meter	2	1	1
17. Grain moisture meter	3		1
18. Transport vehicle	1		
19. Remote dial thermometer	1	1	1
20. Seed store chamber	1		
II. Tissue Culture			
1. Metal rack with illumination	30		
2. Refrigerator	1		
3. Cold storage chamber	1		
4. Cell roller	1		
5. Micro filter with pump	1		
6. Micro filter, manual	2		
7. High pressure autoclave	2		
8. Remote dial thermometer	3		
9. Hot air apparatus sterilizer	2		
10. Ultra-sonic apparatus cleaner	1		
11. Drying oven, vacuum type	1		

Description	Chungdu-Dingka Headquarters	Chiufu Branch	Chinary Branch
12. Laboratory glass utensil washing machine	1		
13. Automatic dispenser	1		
14. Manual dispenser	1		
15. Microscope	1		
16. Electric PH meter	1		
17. Hydrometer	1		
18. Analytical balance	2		
19. Magnetic stirrer	2		
20. Magnetic stirrer with hot plate	5		
21. Distillation apparatus	4		
22. Demineralizer	1		
23. Thermometer, rod type	80		
24. Sanitary thermometer	10		
25. Dissection instrument	4 set		
26. Pressure cooker	4		
27. Laboratory glass ware	1 lot		
28. Acclimatizing fog making machine	2		
29. Mist house for seedling propagation	300 m^2		
30. Net house for virus-free nursery	600 m^2	1,800 m^2	
31. Glass house for seedling propagation	600 m^2		
37. Culture bottle	2,000		
38. Clean bench	4		
39. Chemicals	1 lot		

Description	Chungdu-Dingka Headquarters	Chiufu Branch	Gaylegphug Branch
III. Crop Grading, Packing and Storing			
1. Crop gravity grader	4		
2. Potato cleaner	1		
3. Diesel generator	1		1
4. Vegetable/fruit rinsing machine	1		
5. Root-crop rinsing machine	1		
6. Binder-stem cleaner	1		
7. Label printer	1		
8. Binding machine	3		
9. Strawberry grading machine	1		
10. Storage chamber	1		
IV. Crop Processing Equipment			
1. Cardamon drying chamber			1
2. Vacuum concentrator	1		
3. Boiler	1		
4. Bottle washing machine	1		
5. Bottling machine	1		
6. Centrifugal filter	1		
7. Forklift	1		
8. Heat exchanger	1		
9. Centrifugal sanitary pump	3		
10. Portable refractometer	3		
11. Canning machine	1		
12. Food examination apparatus	1 lot		
13. Retort oven	1		

Description	Chungdu-Dingka Headquarters	Chiufu Branch	Panbesa Branch
V. Cash Crop Cultivation Equipment			
1. Drip irrigation system		1 lot	1 lot
2. Rain gun irrigation system			3 set
3. Crop unloading lift, 3 km			1 set
4. Seedling transport box			20
5. Perforated rubber hose			5 roll
6. Trench excavator			1
7. 4-wheel tractor			4
8. Power tiller			15
9. Counter-animal fence fabricating machine			1
10. Compost/nursery bed making machine			1
11. Solar powered counter-animal fence			10 set
12. Knapsack spayer			30
13. Nursery pot filling machine			1
14. Grafting tool		1	
15. Fog making machine		1	

Description	Chungdu-Dingka Headquarters	Changyultang Branch	Chinary Branch
IV. Others			
1. Vehicle for field supervising staff	4		
2. Extension service kit	5 set		
3. Photostatic copy machine	1		
4. Electric typewriter	4		
5. Radio communication	4 sets		
6. Portable diesel generator	1		

5-6 Design Drawings

Dwg. No.1 Chungdu-Dingka Headquarters, Plot Plan

Dwg. No.2 Chungdu-Dingka Headquarters, Plan (1)

Dwg. No.3 Chungdu-Dingka Headquarters, Plan (2)

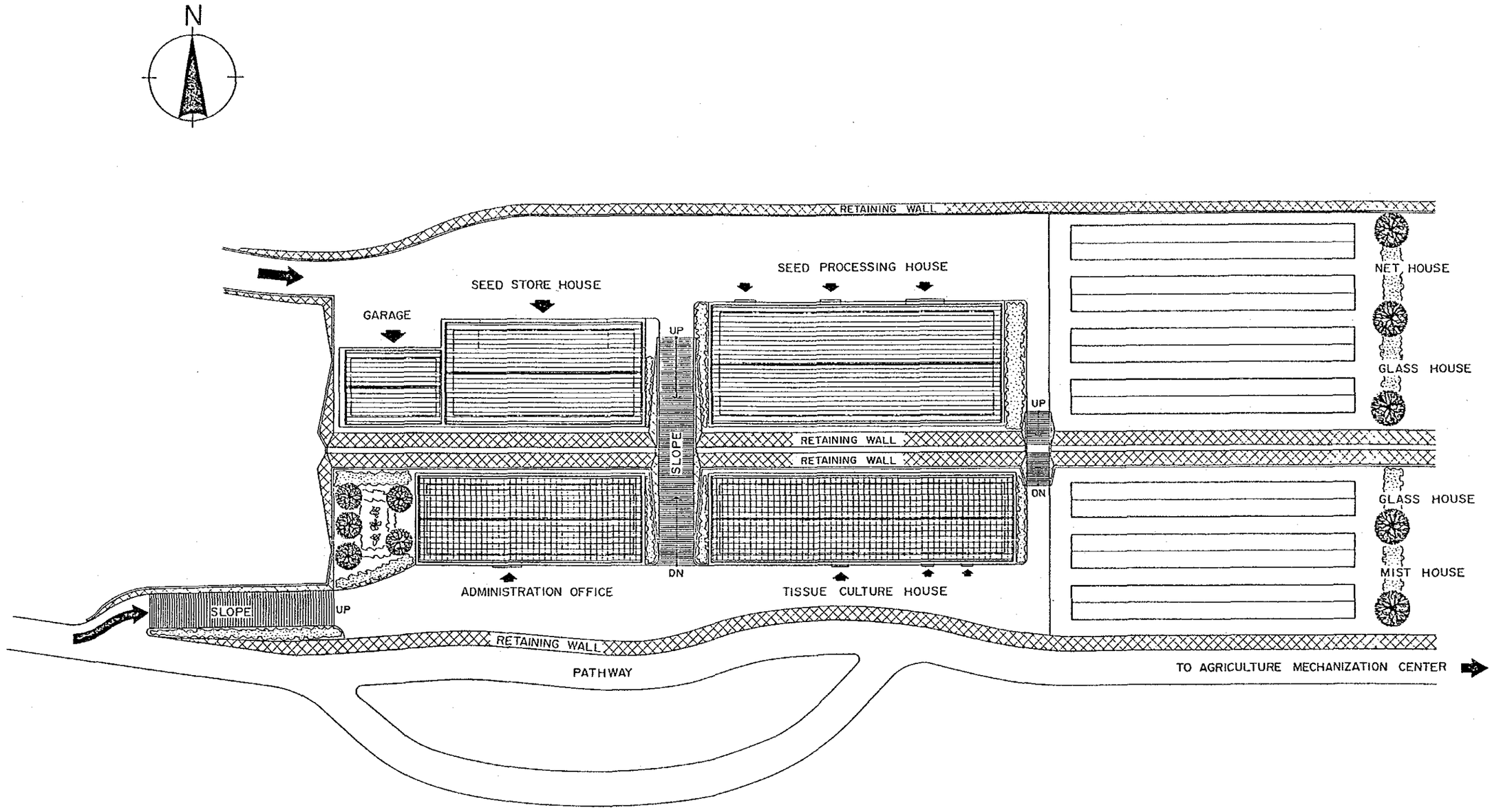
Dwg. No.4 Chungdu-Dingka Headquarters, Elevation 1 Section

Dwg. No.5 Chungdu-Dingka Headquarters, Plan (3)

Dwg. No.6 Changyultang Branch, Plan

Dwg. No.7 Chinary Branch, Plan

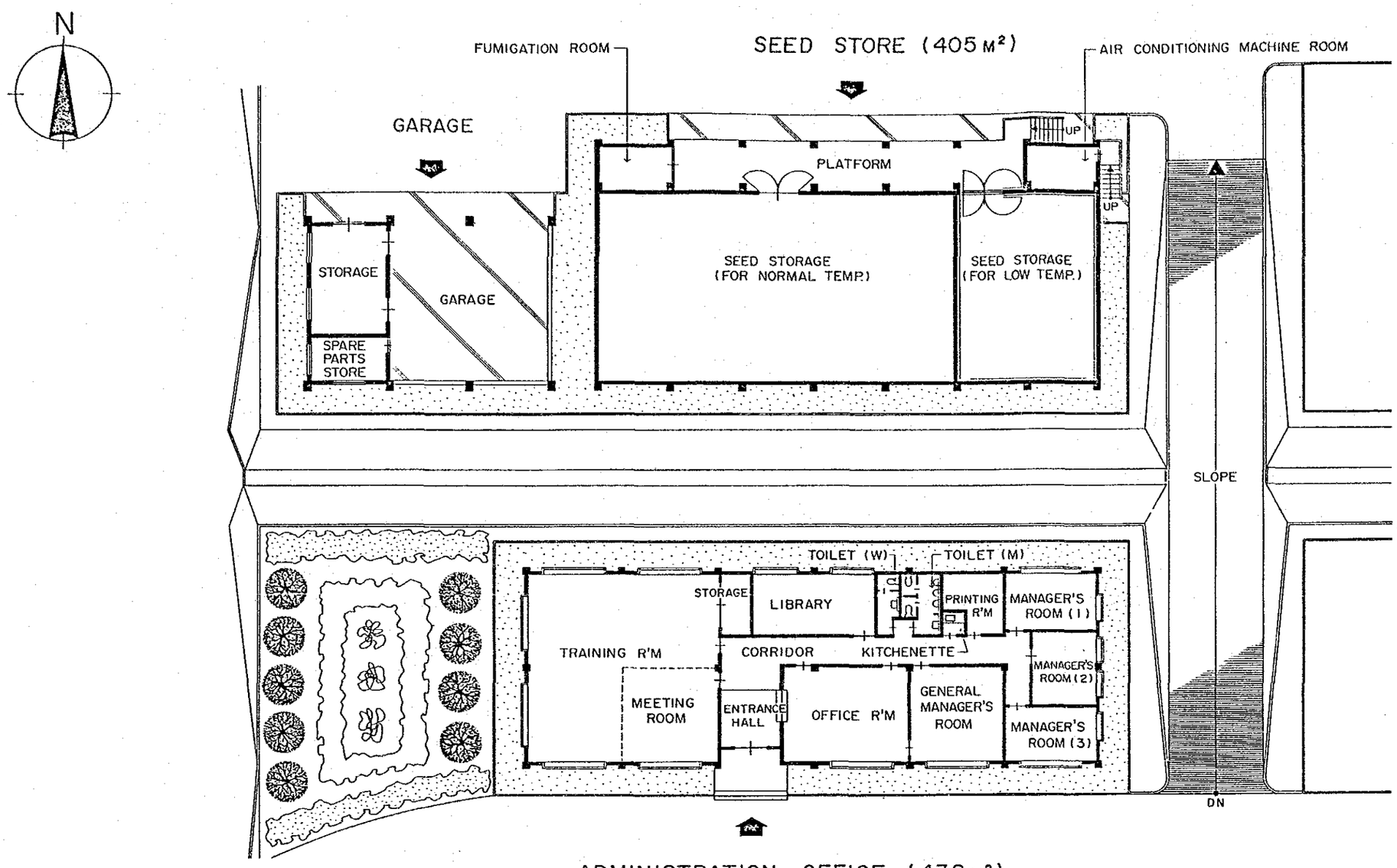
Dwg. No.8 Gaylegphug Branch, Plan



PLOT PLAN

SCALE 0 50M (1/500)

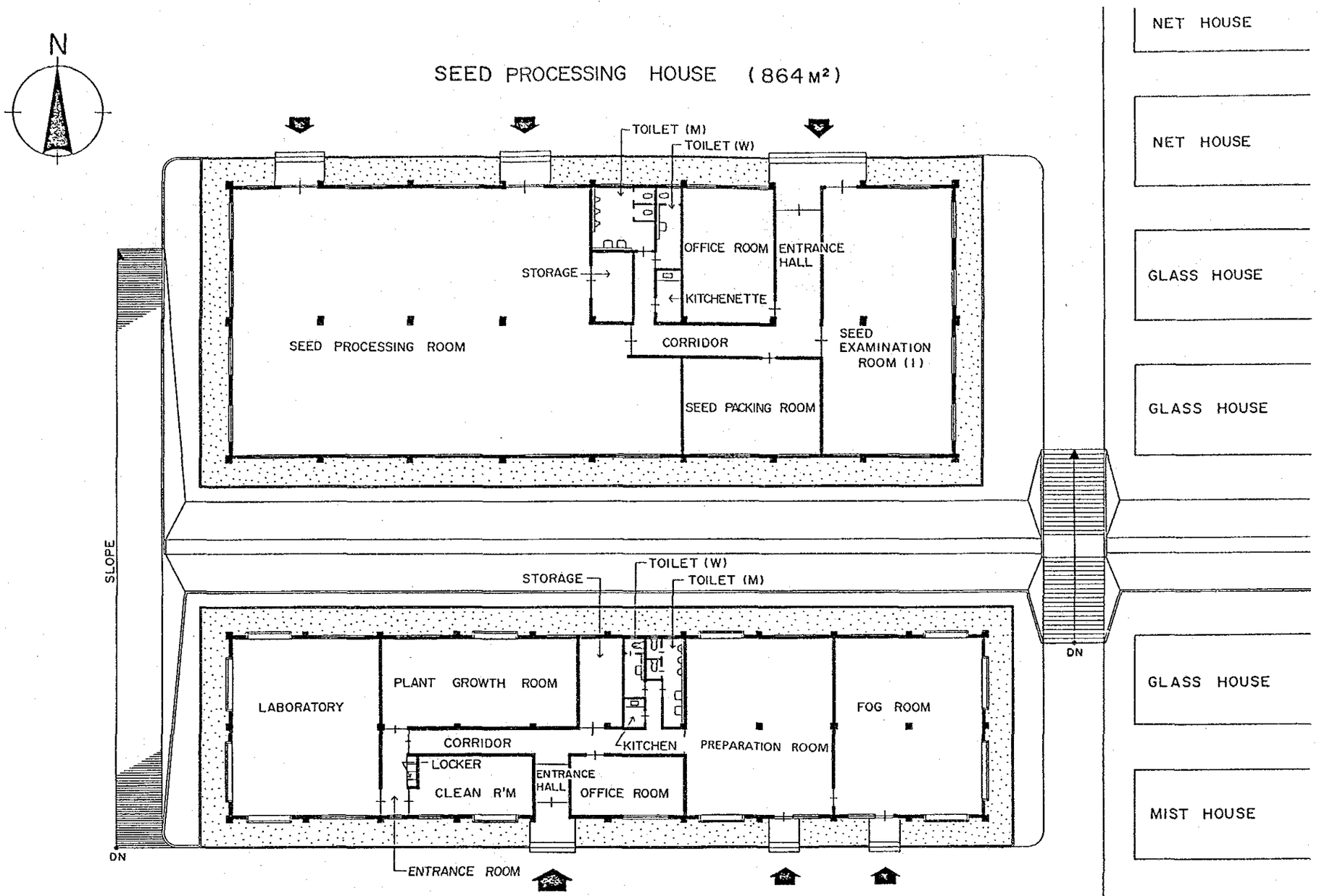
THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHUNGDU-DINGKA HEADQUARTERS PLOT PLAN			
Date		Drawing No.	1
JAPAN INTERNATIONAL COOPERATION AGENCY			



ADMINISTRATION OFFICE (432 M²)

SCALE 0 10 20M (1/200)

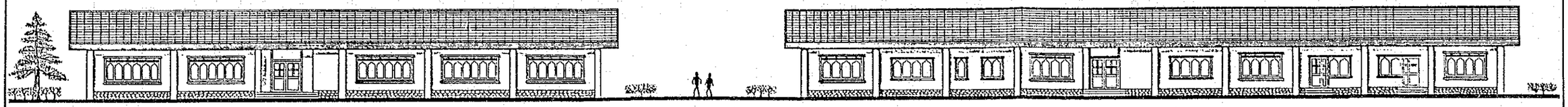
THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHUNGDU-DINGKA HEADQUARTERS P L A N (1)			
Date		Drawing No.	2
JAPAN INTERNATIONAL COOPERATION AGENCY			



TISSUE CULTURE HOUSE (600 M²)

SCALE 0 10 20M (1/200)

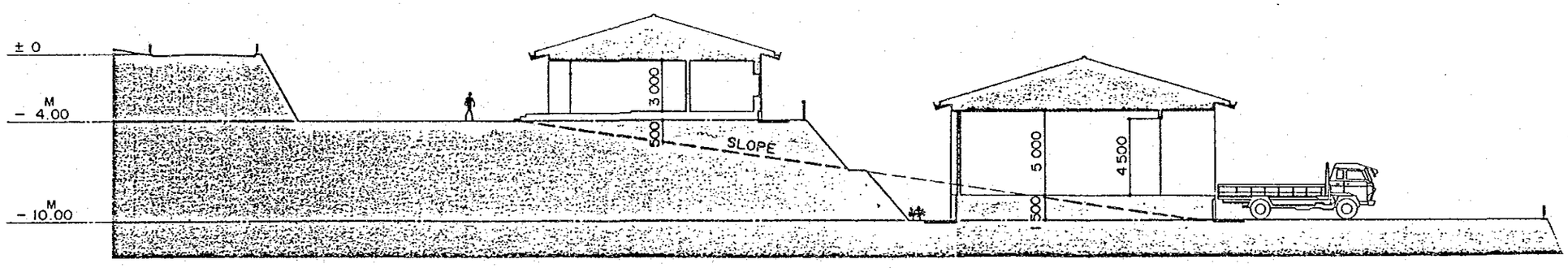
THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHUNGDU-DINGKA HEADQUARTERS P L A N (2)			
Date		Drawing No.	3
JAPAN INTERNATIONAL COOPERATION AGENCY			



ADMINISTRATION OFFICE

TISSUE CULTURE HOUSE

FRONT ELEVATION



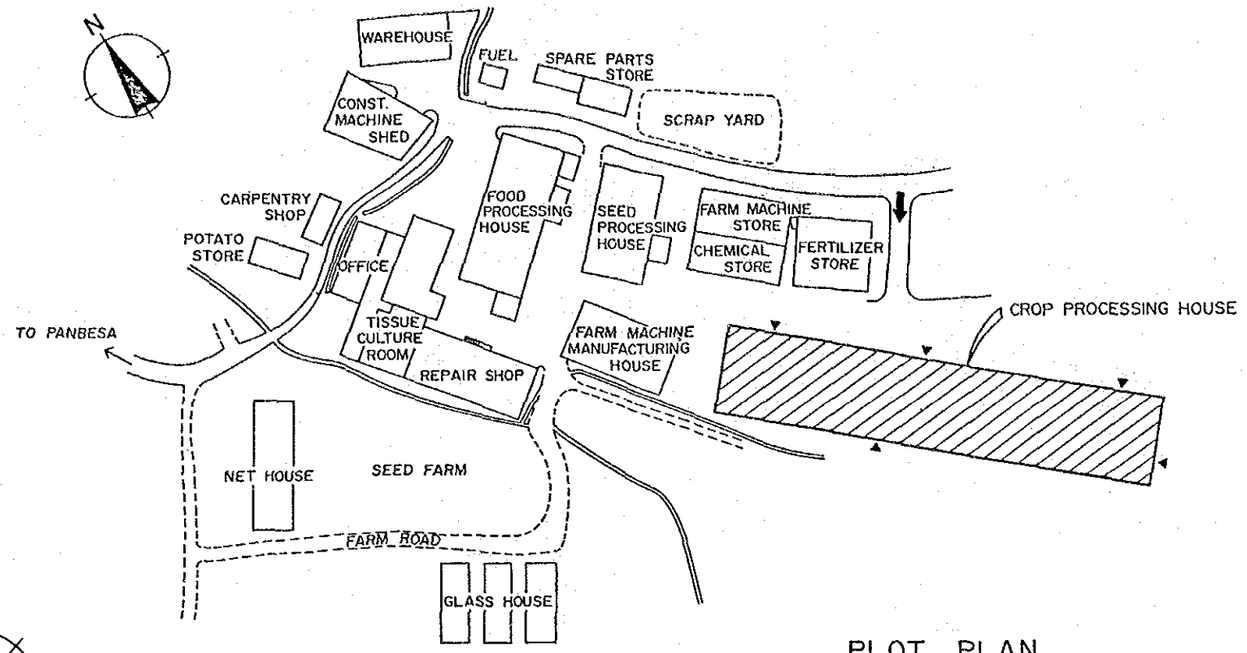
ADMINISTRATION OFFICE

SEED STORE

SECTION

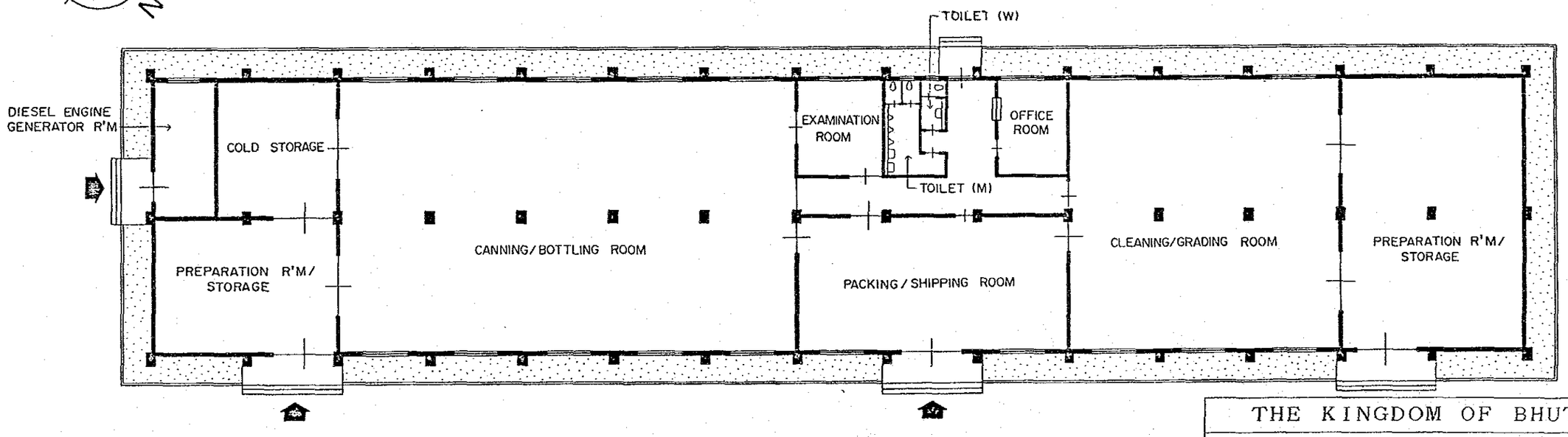
SCALE 0 10 20M
(1/200)

THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHUNGDU-DINGKA HEADQUARTERS ELEVATION/SECTION			
Date		Drawing No.	4
JAPAN INTERNATIONAL COOPERATION AGENCY			



PLOT PLAN

(NOT TO SCALE)

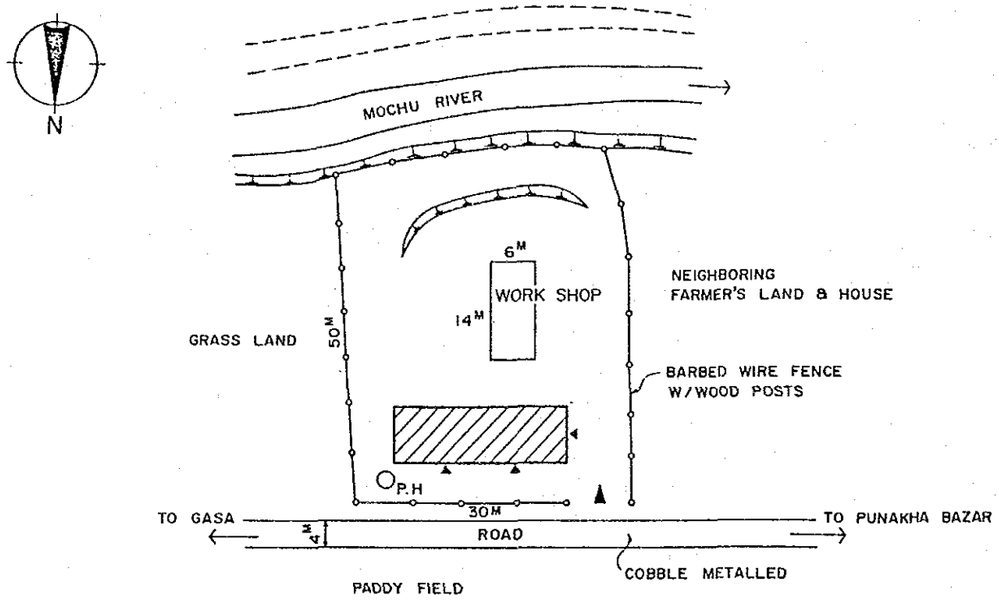


CROP PROCESSING HOUSE (1,620 M²)

SCALE 0 10 20M

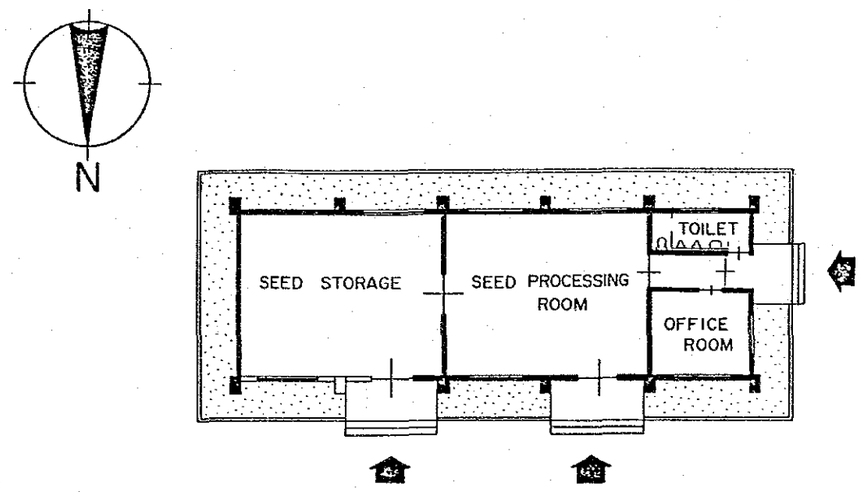
(1/200)

THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHUNGDU-DINGKA HEADQUARTERS P L A N (3)			
Date		Drawing No.	5
JAPAN INTERNATIONAL COOPERATION AGENCY			



PLOT PLAN

(NOT TO SCALE)

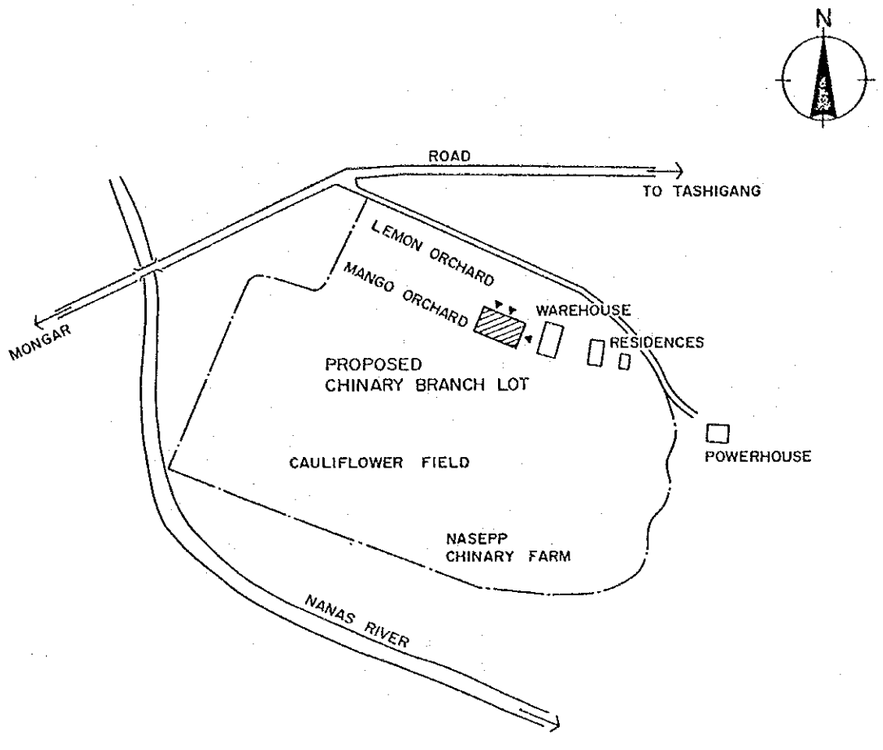


SEED PROCESSING HOUSE

SCALE 0 10 20M

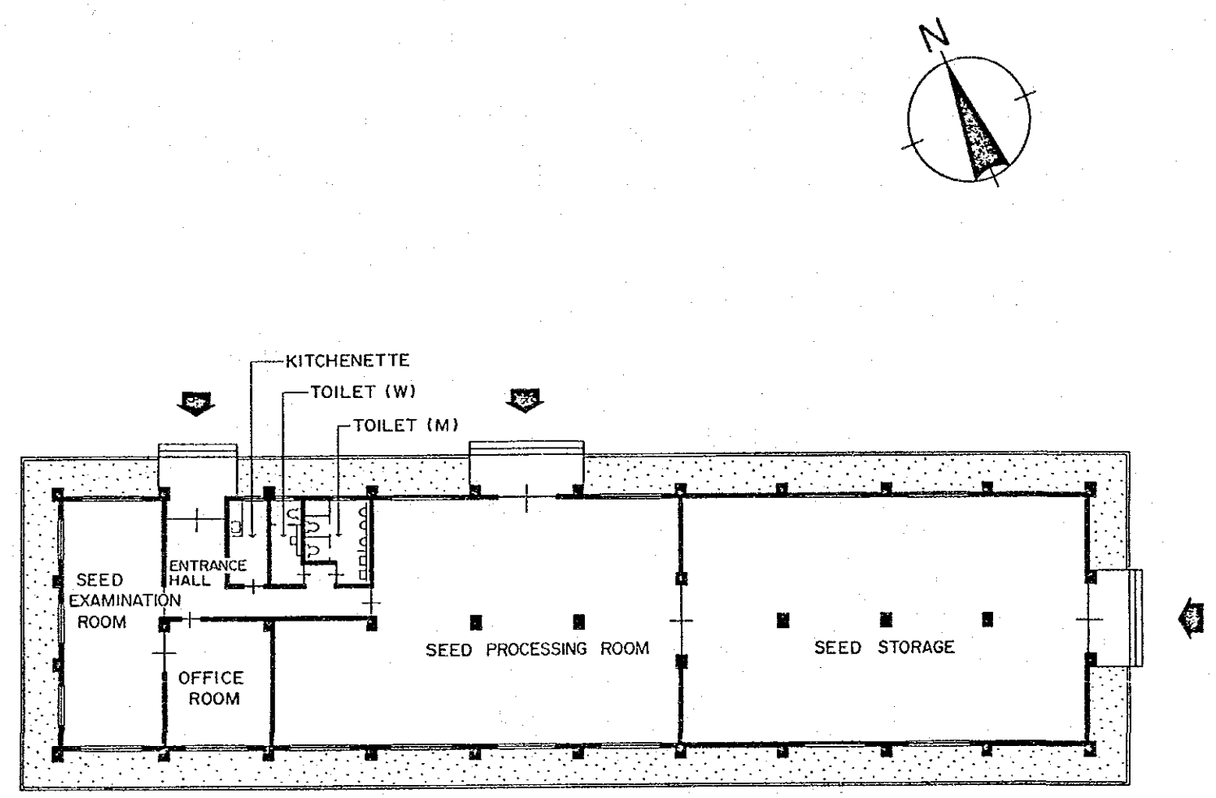
(1/200)

THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHANGYULTANGU BRANCH P L A N			
Date		Drawing No.	6
JAPAN INTERNATIONAL COOPERATION AGENCY			



PLOT PLAN

(NOT TO SCALE)



SEED PROCESSING HOUSE

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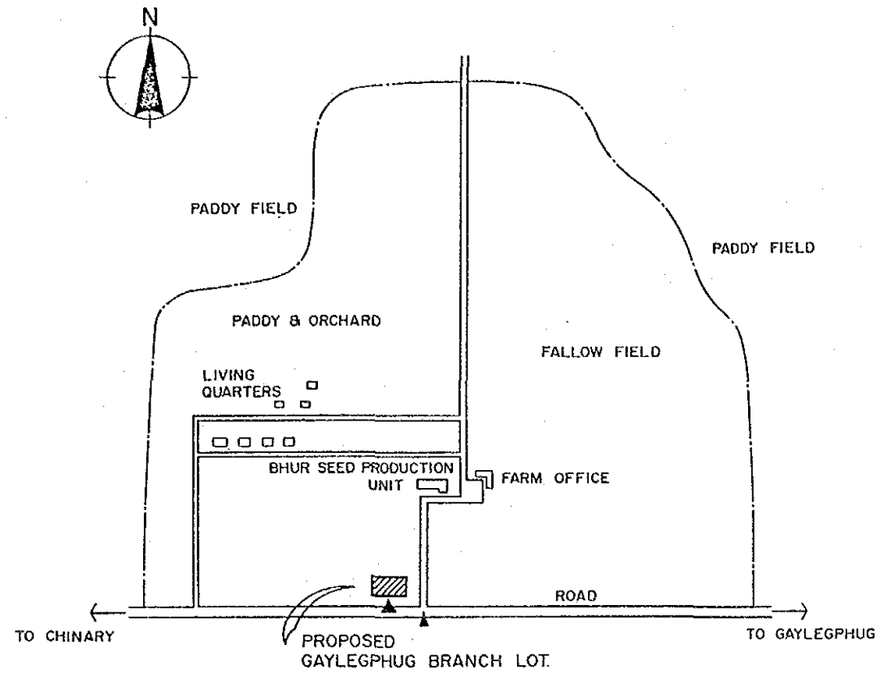
(1/200)

THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING CHINARY BRANCH P L A N			
Date		Drawing No.	7
JAPAN INTERNATIONAL COOPERATION AGENCY			



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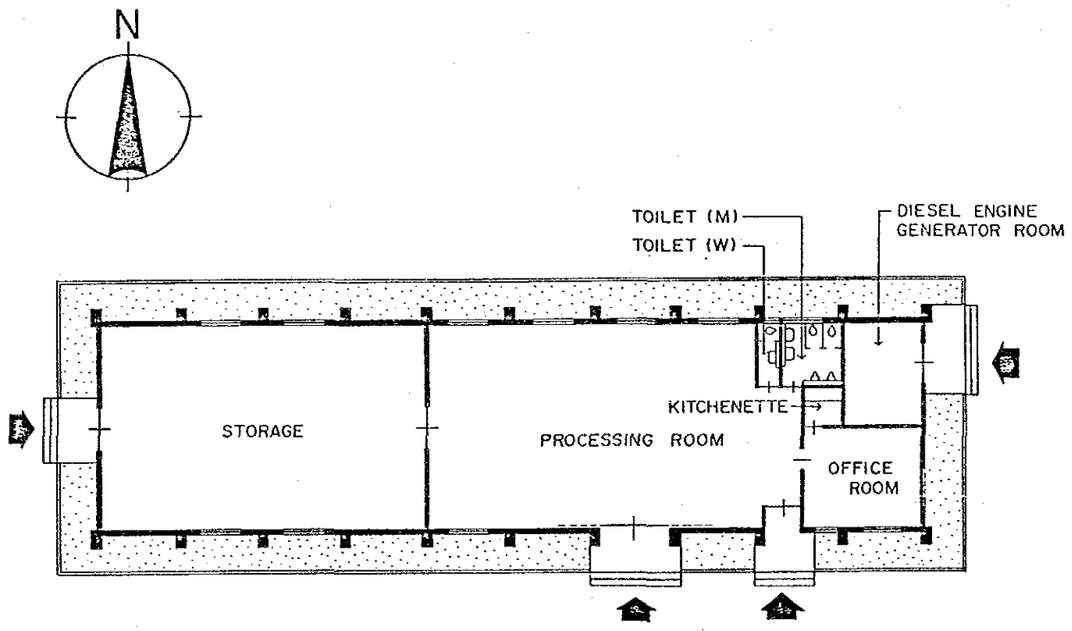

CARDAMOM PROCESSING HOUSE

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THE KINGDOM OF BHUTAN			
CASH CROP DEVELOPMENT PROJECT			
TITLE OF DRAWING GAYLEGPHUG BRANCH P L A N			
Date		Drawing No.	8
JAPAN INTERNATIONAL COOPERATION AGENCY			

SECTION - 6 PROJECT IMPLEMENTATION PROGRAM

SECTION - 6 PROJECT IMPLEMENTATION PROGRAM

6-1 Execution System

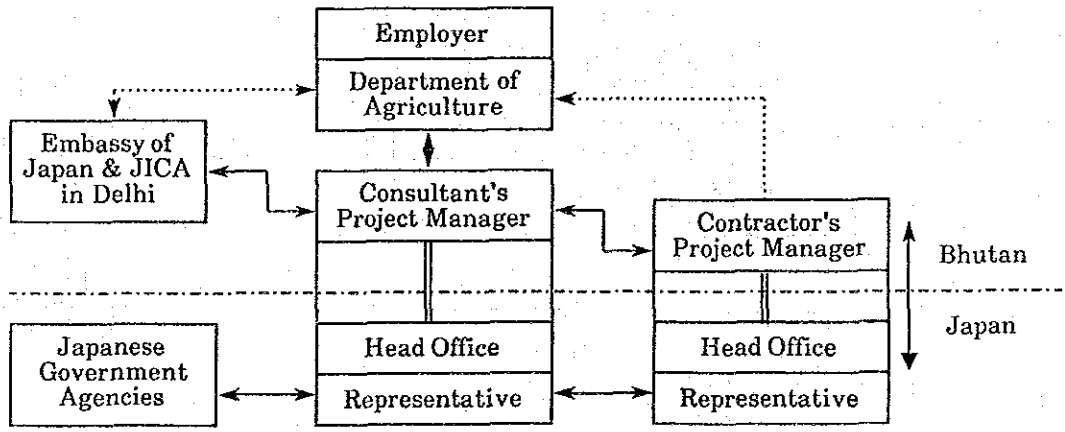
The execution agency of the Project on the side of Bhutan is the Department of Agriculture, Ministry of Agriculture and Forestry. After completion of construction, the Project will be operated by NASEPP under supervision of the Department of Agriculture.

The Department of Agriculture will be authorized to execute the following items for construction of the Project;

(1) Execution of all construction
(2) Execution of contracts for consultancy service and for construction
(3) Approval of designs
(4) Tendering and evaluation of tenders
(5) Approval of all payments
(6) Administration of all contracts
(7) Acceptance of completed works
(8) Liaison and coordination with other government agencies
(9) Banking arrangements

The representative of the Government will be the Director of Department of Agriculture. Construction will be managed by the project manager appointed as the Employer's Representative by the Director. The project manager will be the primary person whom the consultant and the contractor contact for execution of the construction.

The execution system is as illustrated below:



6-2 Scope of Execution

Extent of the works carried out with the assistance of the Japanese Government and the works and services carried out by the Government are summarized as follows:

	Description	Bhutan Government	Japanese Government
(1)	Land and Utilities		
	Land	: To secure lands, Land reclamation, Removal of obstacles	: –
	Water supply	: Delivery of water up to the sites	: All works in the sites
	Drainage	: Discharging out of the sites	: All works in the sites
	Power	: Supply line to the sites	: All works in the sites
	Telephone	: Public line up to private telephone exchanger	: All works from private telephone exchange
(2)	Buildings	: To obtain building permit	: Construction of buildings specified in Section-5 including service facilities
(3)	Outdoor	: Access roads	: Compound road
	Constructions	: Fences and gates, Gardening	: Pavement for parking lot
(4)	Equipment	: –	: Supply and installation of equipment specified in Section-5
(5)	Furnitures & Utensils	: All furniture and utensils as required	: –
(6)	Transportation	: To ensure prompt unloading, tax exemption and custom clearance for imported goods	: Marine and land transportation of imported goods
(7)	Others	: To bear expenses for banking services based on banking arrangement To accord Japanese nationals facilities to enter and stay in Bhutan	: –

The budgetary provisions for the works to be carried out by the Royal Government will be prepared by the Department of Agriculture as follows:

Works	Project Site	Estimated Cost (Nu. million)
1. Land preparation	Changdu-Dingka Headquarters	0.600
	Chiufu Branch	0.085
	Changyultang Branch	0.020
	Gaylegphug Branch	0.045
	Chinary Branch	0.030
		0.780
2. Buildings	Chifu Branch	0.29
		0.29
3. Fencing	Chungdu-Dingka Headquarters	0.29
	Changyultang Branch	0.055
	Gaylegphug Branch	0.045
		0.390
4. Power supply	Chungdu-Dingka Headquarters	0.395
	Chiufu Branch	0.230
	Changyultang Branch	0.205
	Gaylegphug Branch	0.255
	Chinary Branch	0.015
		1.100
5. Water supply	Chungdu-Dingka Headquarters	0.055
	Chiufu Branch	0.020
	Changyultang Branch	0.030
	Gaylegphug Branch	0.020
	Chinary Branch	0.020
		0.145
6. Furniture	Chungdu-Dingka Headquarters	0.065
	Chifu Branch	0.050
	Changyultang Branch	0.010
	Gaylegphug Branch	0.010
	Chinary Branch	0.010
		0.145
7. Gardening		0.150
		0.150
8. Others		1.780
	Total	4.780

6-3 Construction Plan

Construction will be executed in two stages as follows:

First phase	:	Chungdu-Dingka Headquarters and Panbesa Branch
Second phase	:	Chiufu, Changyultang, Gaylegphug and Chinary Branch

6-4 Procurement Plan

Procurement of the Project facilities will be based on the following principles:

(1) All materials for building construction will be procured in domestic market or imported from India and construction will be executed by Bhutan contractor(s) under a subcontract with the prime contractor.

(2) Equipment for seed/seedling production, pilot cash crop production and cash crop processing will all be imported from Japan.

Construction materials produced in the country are cement, sand and gravel, masonry stone, stone and wood roof tiles, and all other materials and equipment necessary for building construction come from outside, mainly from India. To import materials or equipment from Japan will not be necessary as design of buildings will incorporate local materials and construction method as much as possible as discussed in Section-5.

Some of the equipment and materials for seed/seedling production, cash crop production and cash crop processing can be procured in India. However, all of these equipment and materials will be imported from Japan to ensure better quality, compatibility with the existing equipment and supply of spare parts.

6-5 Detailed Design and Construction Supervision

6-5-1 Detailed Design and Tender & Contracting

The consultant will conclude a consultancy service contract with the Department of Agriculture immediately after the exchange of notes between the two Governments and start detailed design following an execution plan agreed between the Department and the consultant. The Department on its side will execute land reclamation works, among other works to be carried out by the

Government as discussed in 6-2, to be in time for the start of construction. All detailed design works will be carried out at the consultant's head office in Japan and approved by the Department of Agriculture before the tendering.

Advertising of tenders will be run in major papers in Japan in the name of the Government and tender documents will be distributed at the consultant's head office. Tenders will also be received at the consultant's head office where they are publicly opened by a representative of the Government. The consultant will thereafter assist the Government in evaluating tenders and drafting the contract. Contract signing will be performed in Bhutan.

6-5-2 Construction Supervision

After signing of the construction contract, the consultant's representative and the project manager will go to the country to organize the start of construction.

The consultant's project manager will be posted at the construction site during the whole period of construction and will supervise constructions at all sites, concurrently he will regularly report construction progress and related matters to the concerned agencies of the Government as well as to the Embassy of Japan and JICA in Delhi and liaise with the concerned officials of the Project and coordinate all construction-related matters. In addition, the consultant will dispatch to the country a mechanical engineer for a short time to supervise the equipment installation and testing.

The consultant, on supervision services, will pay particular attention to Bhutan's natural surroundings, customs, traditions and capability of the workers to effect a smooth construction and completion of the works within the given period.

The construction program will be carefully scheduled taking into account the capability of the local workers and coordinated with delivery and installation of the equipment imported from Japan.

Given below are the major activities of the consultant's project manager:

(1) Assistance services in tendering and contracting

Assist in prequalification of tenderers, tendering, evaluation of tenders and drafting contract.

(2) Examination and approval of shop drawings

Inspect and examine and approve shop drawings, samples, catalogues, etc. and inspect equipment at manufacturer's plant.

(3) Inspection of construction works

See to it that construction complies with the contract in terms of schedule, construction method and quality. Inspect and approve field works.

(4) Approval of payments

Approve payment claims based on the progress of work.

(5) Reporting

Prepare regular progress reports on all the matters concerning the construction for information of the concerned agencies of the Government and Japanese Government.

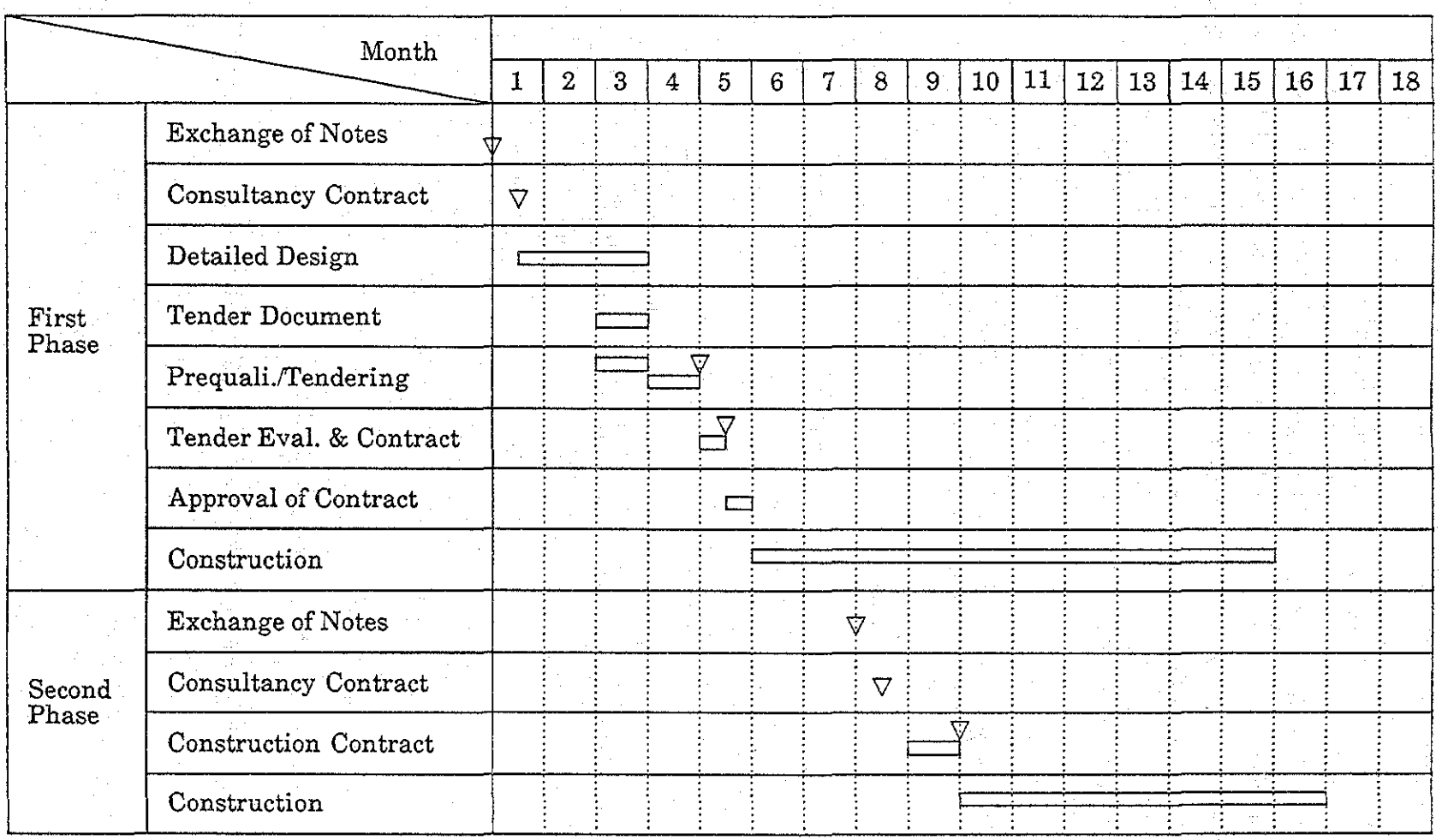
(6) Handing over of completed work

Hand over to the Government the completed works on examination of the works and on confirmation of fulfillment of all contractual obligations. Upon acceptance of the work by the Government, the consultant's project manager will be discharged.

6-6 Implementation Time Schedule

A tentative implementation time schedule including all those activities discussed above is illustrated as below:

Fig.-6.1 TENTATIVE IMPLEMENTATION TIME SCHEDULE

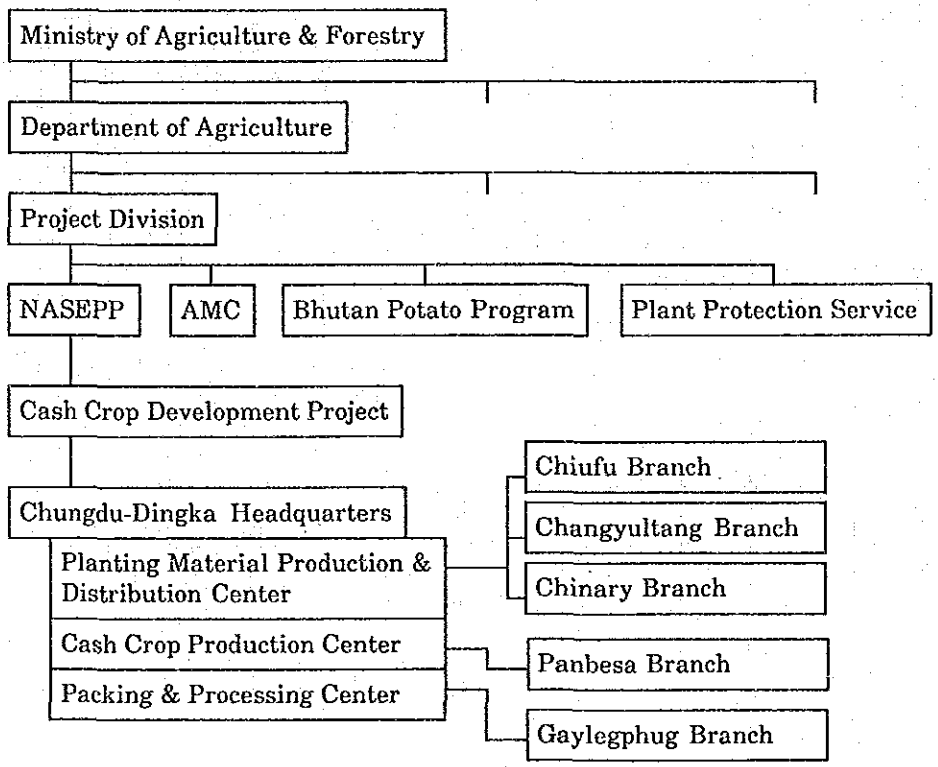


6-7 Project Operation and Maintenance

6-7-1 Administrative Organization and Staffing

The entire cash crop development project will be programed and administered by NASEPP. The Project under NASEPP will be controlled and supervised by Chungdu-Dingka Headquarters. As the activities expand, the structure will be re-organized to a full-fledged shape.

(1) Organization Chart at Start of the Project



(3) Organization at Full-fledged Stage

Refer to the organization chart Fig.-VII.1 attached to Appendix VII.

(3) Staffing Plan

Table-6.1 STAFFING OF PROJECT SITES

	Chungdu-Dingka				Chiufu Branch	Panbesa Branch	Changyultant Branch	Gaylegphug Branch	Chinary Branch	Total
	Tissue Culture	Seed Production	Seed Processing	Crop Processing	Seed Production	Crop Production	Seed Processing	Cardamon Drying	Seed Processing	
1) General ProgramManager	-	1	-	-	-	-	-	-	-	1
2) Program Manager	1	1	-	1	-	-	-	-	-	3
3) Production Officer	-	-	1	-	1	-	1	1	1	5
4) Assistant ProductionOfficer	-	1	1	1	1	-	-	1	-	5
5) Distribution Officer	-	1	1	1	-	-	-	-	-	3
6) Senior Field Inspector	1	-	-	-	1	1	1	-	1	5
7) Field Inspector	-	1	-	-	-	-	-	-	-	1
8) Laboratory Assistant	3	1	-	-	-	-	-	-	1	5
9) Distribution Inspector	-	-	1	1	-	-	-	-	-	2
10) Accountant	-	1	-	1	-	-	-	1	-	3
11) Factory Foreman	-	1		-	-	-	1	-	1	3
12) Senior Field Supervisor	1	1	-	-	1	1	1	-	-	5
13) Processing MachineOperator	-	2	1	1	-	-	-	1	1	6
14) Field Supervisor	2	1	-	1	2	2	1	-	-	9
15) Store Officer	-	1	1	1	-	-	-	1	1	5
16) Factory Assistant	-	1	2	-	-	-	-	2	-	5
17) Field Assistant	2	1	-	-	2	1	2	-	2	10
18) Store Assistant	-	2	-	1	-	-	1	-	1	5
19) U.D.C.	-	1	1	-	-	-	1	-	1	4
20) L.D.C.	-	1	-	1	-	-	-	1	1	4
21) Driver	-	3	1	1	-	-	-	-	-	5
22) Guardman	-	1	-	1	1	-	1	1	-	5
23) Tractor Driver	-	1	-	-	1	1	1	-	-	4
Total	10	24	10	12	10	6	11	9	11	103

These staff will be secured from the following sources:

From NASEPP staff	55
From existing extension staff	12
New diplomates	5
New B. Sc graduates	5
Class XII students	10
Technical school leavers	10
Bondey Farm research staff	6
Total	103

6-7-2 Operation Fund

The following are the budgetary arrangements of the Government for construction, operation and maintenance of the Project:

(1)	NASEPP budget allocation in Sixth Plan (1987~1991)	: Nu. million	23.163
(2)	NASEPP fiscal year budget	: Nu. million	7.785
(3)	The Department of Agriculture budget for the Project construction (ref. 6-2)	: Nu. million	4.780
(4)	Project budget (first fiscal year)	: Nu. million	3.005
	Personnel expense	1.368	
	Power, water & fuel	0.120	
	Furniture & office supply	0.201	
	Maintenance expense	0.110	
	Others	1.206	

Margin of profit accrued from sale of seeds/seedlings and processed crops is estimated as shown in the following table which will be used as revolving fund for operation of the Project apart from the above (4) Project budget.

REVOLVING FUND EARNING PLAN

Unit: Nu. million

	Chungdu-Dingka Headquarters	Gaylegphug Branch
Expenditure		
1. Purchase of seed/seedlings from farmers	11.208	
2. Import of seed/seedlings	1.050	
3. Purchase of vegetables and fruits for processing	2.000	3.500
4. Purchase of cans, bottles and packing matereials	0.400	0.350
	14.658	3.850
Revenue		
1. Sale of seeds/seedlings	12.500	
2. Sale of imported seeds/seedlings	1.050	
3. Sale of processed crops	3.000	
	16.550	5.600
Margin	1.892	5.600

SECTION - 7 EVALUATION OF PROJECT

SECTION - 7 EVALUATION OF PROJECT

7-1 Direct Benefits

The Project odes not engage itself in cultivation of cash crops but renders services directly to farmers to promote their cash crop cultivation. Activities at the Project facilities would produce indirectly the following benefits to the agriculture and economy of the country.

(1) Increase cash crop production.

(2) Raise land use intensity, thereby affording farmers' work opportuinity in slack season.

(3) Raise productivity by supply of quality seeds/seedlings.

(4) Expand cash crop cultivation in high altitude chilly climate villages through the pilot activities at Panbesa Branch.

(5) Give incentive to crop processing undertaking through pilot crop processing activities at Chungdu-Dingka Headquarters.

(6) Contribute to foreign currency earnings and fore conservation through cardamon processing at Gaylegphug Branch.

(7) Give impact on exercising grading and packing of fresh vegetables and fruits and scheduled shipment through the pilot activities at Chungdu-Dingka Heaqdquaqrters.

7-2 Increase of Cash Income

To estimate the increase in cash income of farmers quantitatively is very difficult because of many factors such as regional and climatic conditions, time factor, development of related undertakings, farmers responsiveness, etc. Any estimate is therefore bound to be theoretical and founded on many assumptions.

Estimating cash income increase of this kind has been made about the farmers in Paro, Punakha and Tashigang districts. It turns out that the scale of the farm economy would expand over two-fold and cash income would increase two to ten-fold (estimate sheets are attached to Appendix VII). The estimates are based on the data obtained on the typical farm survey including regional farming

practice, assuming a good supply of seeds/seedlings, improved farming techniques, proper application of fertilizers and insecticides, a good supply of rural crecit and establishment of farmer's cooperative and increase of land use intensity up to 2.2. Although theoretical and conditional, the large scale up shown here would in one way support the viability of the Project.'

7-3 Social Benefits

Increase of cash income of the farmers would indirectly contribute to the following social beneifts:

(1) Help balanced regional development.

(2) Curb excessive urbanization.

(3) Expand internal and external trade and strengthen public finance.

(4) Increase foreign currency earning through export to India.

(5) Modernize the self-contained economy to a monet economy.

(6) Complement of strengthen other agricultural development projects.

SECTION - 8 CONCLUSION

SECTION - 8 CONCLUSION

8-1 Conclusion

The merit of the Project lies in the fact that the activities of the Project are directly linked with farmers. Quality seed/seedling supply to farmers would increase their output of cash crops, to demonstrate cash crop cultivation on a highland village would encourage cultivation on similar areas and the pilot crop processing activities would enlighten the farmers on value-adding and advanced marketing method, all to the interest of farmers; increase of cash income to enable better life.

The cash crop development project as a whole is a national project having a wide and far-reaching view, in there the Project is to form a core of the total plan and act as pilot schemes.

Farmers account for 90% of the population and there are no other industries developed yet. Therefore, development of agriculture is crucial for modernization of the country. The importance of the Project taking a major part of the agricultural development efforts should not be underestimated. The Project, founded on proved technical capability, being extension and reinforcement of the ongoing activities, and well backed up by administrative organization could reasonably be operated and maintained to fulfill the intended services.

8-2 Recommendations

The cash crop development project would not be completed without accomplishing (1) a good seed/seedling supply, (2) production of quality crops and (3) a good marketing system. In other words, any imbalance between them would form a bottleneck hindering the total progress. In order for the Project facilities to fully function and achieve the intended objective, the following measures should be taken.

(1) Establishment of a Good Marketing System

Without a good marketing system, flow of cash crops to the market is blocked, prices fluctuate and in the end discourage farmers from expanding cultivation. This is where the Food Corporation of Bhutan could come in.

As described in Section-2, trade between Bhutan and India is free and only the imports of basic cereals and basic materials are handled by the Government. Currently, trade in cash crops is in the hands of middlemen as is the case with cardamon to the disadvantage of the farmers. Some of the cash crops are bought before harvest or subjected to speculation. Intervention of the Government to break the linkage though establishment of a good marketing system and some subvention to support the prices is deemed indispensable.

The FCB set up for the purpose of importing, storing and distributing staple food has warehouses with a total capacity of as much as 5,000 tons throughout the country, some of which are not effectively used though. The FCB has had its own problems during its history and is about to be re-organized. With ample storage facilities and experience in handling crops, the FCB could be a vehicle for the Government's intervention and subvention in cash crop marketing.

The Government is planning to set up a cardamon corporation to the same effect. However, a unified corporation would be better from the view point of an effective use of the existing facilities and manpower.

(2) Improvement of Seed/Seedling Distribution System

Seeds/seedlings produced at Bondey Farm are being distributed through the district extension service centers. As the distance goes far from Paro, farmers' understanding of the importance of quality seeds/seedlings drops drawing on traditional house seed raising. Reinforcement of the seed/seedling distribution system is very important along with dissemination of knowledge and demonstrative cultivation.

(3) Establishment of Farmer's Cooperative

Cultivation and marketing of surplus crops are individually done by the farmers. Planned cultivation and collective marketing have yet to be exercised. As cultivation of cash crops expands, an organization to administer planned cultivation and shipment, raise farming techniques, promote farm mechanization and common use of machine and mutual farm work will become necessary. Reinforcement of related administrative organization is also recommended.

APPENDIX

I. MINUTES OF DISCUSSIONS (BASIC DESIGN STUDY)

MINUTES OF DISCUSSIONS

ON

THE BASIC DESIGN STUDY OF

THE CASH CROP DEVELOPMENT PROJECT

IN

THE KINGDOM OF BHUTAN

In response to the request of the Royal Government of Bhutan, the Government of Japan decided to conduct a basic design study on the Cash Crop Development Project to be covered by the Japanese Grant Aid Program (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical and economic cooperation of the Government of Japan. JICA sent to Bhutan the JICA Basic Design Study Team (hereinafter referred to as "the B/D Team") headed by Mr. Hideo Yasuki, Special Adviser to the Director of the Grant Aid Project Management Department, from August 4th through 26th, 1986.

The B/D Team was dispatched by the Government of Japan based on his examination of the Minutes of Discussions concluded at the Preliminary Study (hereinafter referred to as "the M/D" and "the P/S" respectively) which had been conducted by JICA from April 8th through 20th, 1986.

The B/D Team had a series of discussions on the Project with the officials concerned of the Royal Government of Bhutan headed by Mr. Khandu Wangchuk, Director of Agriculture, and conducted a field survey.

As a result of the study, both parties agreed to recommend to their respective Government that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

August 22th, 1986, Thimphu, the Kingdom of Bhutan

Hideo Yasuki
Leader of the JICA Basic
Design Study Team

Khandu Wangchuk
Director, Department of
Agriculture, Ministry of
Agriculture & Forestry

ATTACHMENT

1. The objective of the Project is to provide necessary buildings, facilities and equipment for the establishment of the Cash Crop Development Headquarter and Branches (hereinafter respectively referred to as "the Headquarter" and "the Branch").

2. Proposed sites of the Project are located at Chungdu-Dingka for the Headquarter and Changyultang, Panbesa, Chiufu, Gaylegphug and Chinary for the Branches as shown in Annex-I.

3. The Royal Government of Bhutan agreed that the Project will be defined within the scope of works set out by the P/S. Among the formulated Optional Plans for the Project in the M/D of the P/S, Option-A, B, C and D which are outlined in Annex-II, priorities will be given in the alphabetical order of the Plans.

4. The Royal Government of Bhutan agreed that the basic design will be worked out on one of the said Optional Plans within the budgetary limitations of the Government of Japan under the condition that the Project is judged feasible by the Government of Japan.

5. The Royal Government of Bhutan confirmed that necessary financial arrangement will be made on his side for the operation and maintenance of the Project.

6. The Royal Government of Bhutan confirmed that the necessary personnel to operate the Project will be secured shifting the personnel of the National Seed and Plant Program, the Bondey Farm and new recruitment from the Technical Schools.

7. The executing agency for the Project in the Kingdom of Bhutan is the Department of Agriculture, Ministry of Agriculture and Forestry.

8. The basic concept of the Project is as follows:
The Project will play a key role in the Bhutan National Cash Crop Development Project which together with the Agriculture Machinery Center Program and the National Seed & Plant Program constitutes the Integrated Agricultural Plan, the main frame work fo the Bhutan's national agricultural policy. The Project is aimed at promoting the cash crop production of the country through (1) seed propagation and distribution, (2) assistance in seed and seedling farm construction and (3) cash crop processing performed at the Headquarter and the Branches.

The Royal Government expressed its intention to narrow down the gap remained between the Bhutan National Cash Development Project and the Project as much as possible by self-reliance efforts.

The basic concept has been worked out with an assistance of the technical cooperation program of the Government of Japan and similar cooperation could further be expected during the operation of the Project to jointly attain the objectives.

The Project facilities will be designed to match the Bhutan soil incorporating local materials and construction methods to the maximum extent possible.

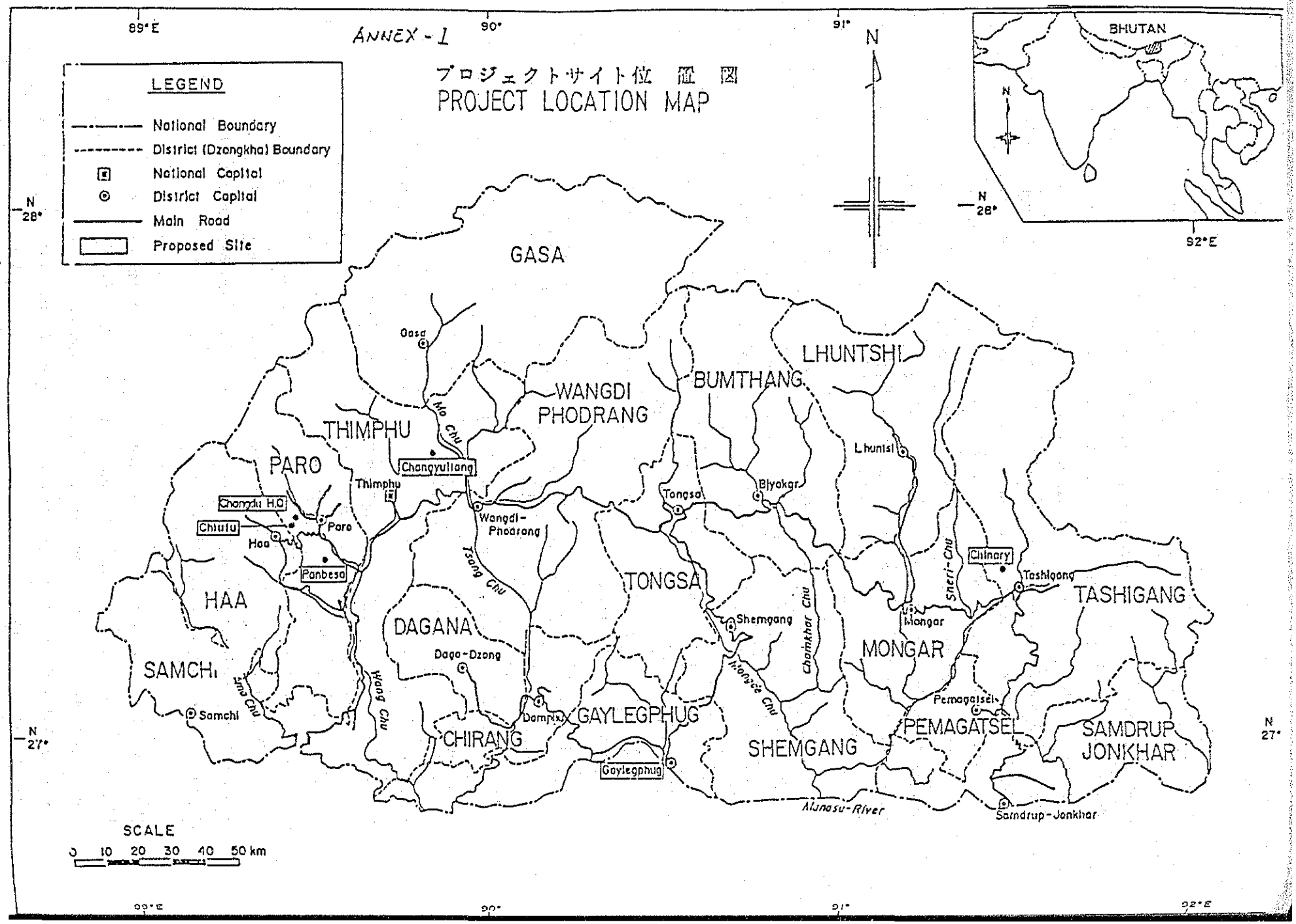
9. The B/D Team will convey to the Government of Japan the desire of the Royal Government of Bhutan that the Government of Japan takes necessary measures to cooperate in implementing the Project and provide the buildings and other items listed in Annex-III within the scope of the Japanese economic cooperation program in grant form.

10. The Royal Government of Bhutan will take necessary measures listed in Annex-IV on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

11. The Royal Government of Bhutan has understood the system of the Grant Aid program of the Government of Japan explained by the B/D Team, including a provision that the consultant who participated in the Basic Design Study is desired to be engaged for the detailed design and construction supervision of the Project.

ANNEX - 1

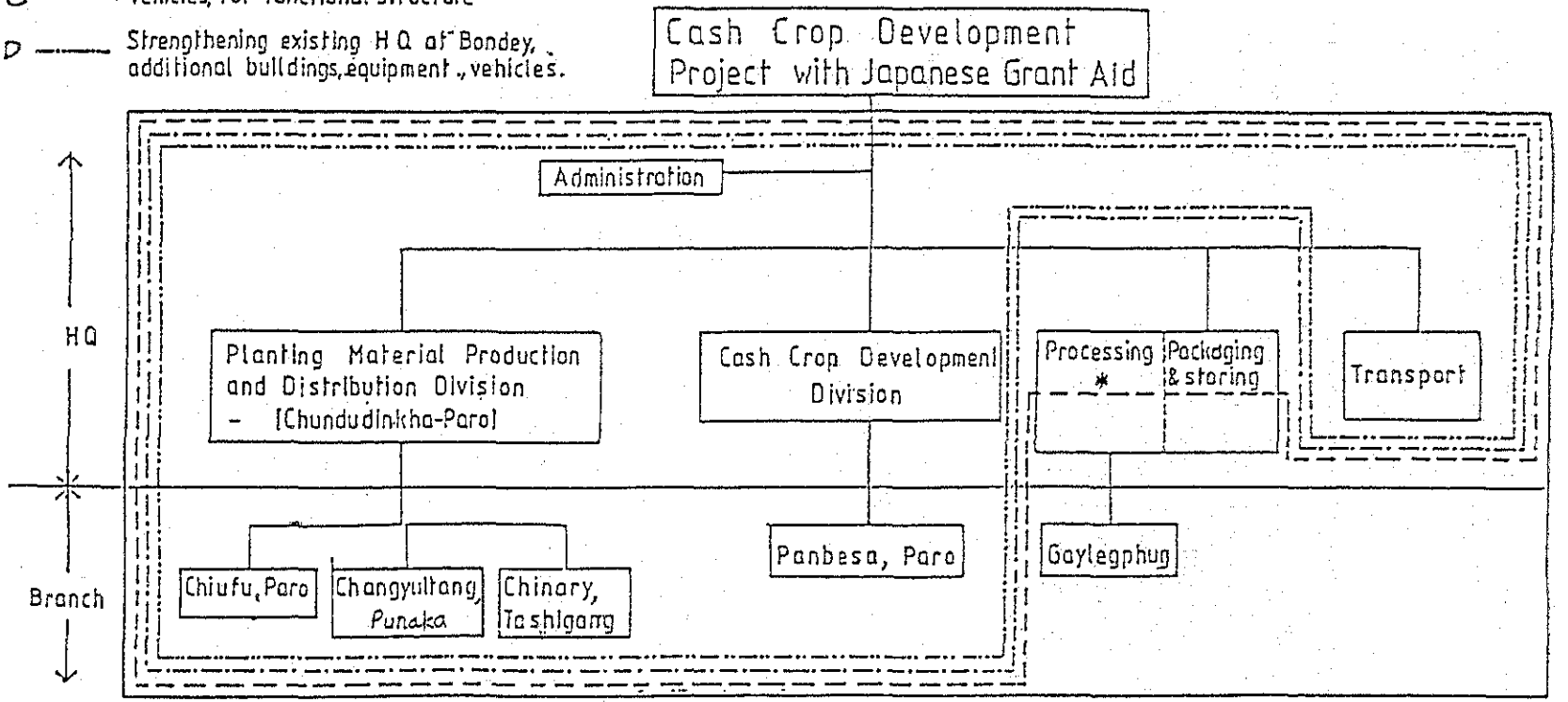
プロジェクトサイト位置図
PROJECT LOCATION MAP



ANNEX - II THE OPTIONAL PLANS

OPTION A ——— } Establishing new HQ by providing
OPTION B - - - - } sufficient buildings, equipments,
OPTION C ——— } vehicles, for functional structure

OPTION D ——— Strengthening existing HQ at Bondey, additional buildings, equipment, vehicles.



* Processing Headquarters ; at Bondey, PAR.
Packaging & Storing Headquarters ; at Bhumta-Tshe

ANNEX - III Main Items Requested by the Royal Government of Bhutan to be Provided by the Government of Japan

1. Buildings

(1) Chungdu-Dingka Headquarter

(a) Administration Office
(b) Seed Processing Room
(c) Seed Storage Room
(d) Tissue Culture Room
(e) Crop Processing Room
(f) Crop Packing Room
(g) Machinery Room

(2) Changyultang Branch

(a) Seed Sorting and Storage House

(3) Chinary Branch

(a) Seed Processing and Storage House

(4) Gaylegphug Branch

(a) Crop Processing House

2. Equipment

(a) Seed propagation and processing equipment
(b) Tissue culture equipment
(c) Seed and seedling farm machineries
(d) Crop processing, packing and storing equipment

ANNEX - IV Arrangement to be Undertaken by the Royal Government of Bhutan and the Government of Japan

	Description	Bhutan Government	Japanese Government
(1)	To secure the lands for the proposed sites	o	
(2)	To clear and reclaim the lands as required before start of the construction	o	
(3)	To construct access roads to the sites for transportation of materials and equipment	o	
(4)	To construct buildings listed in Annex-III		o
(5)	To supply and install the equipment listed in ANNEX-III		o
(6)	To construct gate and fence around the sites and gardens as required	o	
(7)	To construct pavement and parking lots inside the sites		o
(8)	To bear the following commissions to a Japanese foreign exchange bank for the banking services related to the grant aid program based on the banking arrangement: i) Advising commission of the authorization to pay ii) Payment commission	o	

	Description	Bhutan Government	Japanese Government
(9)	To ensure prompt unloading, tax exemption, custom clearance at ports of disembarkation in the Republic of India and the Kingdom of Bhutan, and prompt internal transportation therein of the products purchased under the grant aid	o	
(10)	To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into the Kingdom of Bhutan and stay therein for the performance of their work	o	
(11)	To maintain and use properly and effectively the facilities constructed and equipment purchased under the grant aid	o	
(12)	To provide facilities for distribution of electricity, water, drainage, telephone and other incidental facilities leading and up to the proposed sites	o	
(13)	To provide furniture, office supply and other incidentals required for operation of the Project	o	
(14)	To bear all expenses other than those to be born by the grant aid necessary for construction of the facilities as well as for transportation and installation of the equipment	o	

ANNEX-V Officials of the Royal Government of Bhutan

1. Planning Commission

(1) Dasho C. Dorji	Secretary	
(2) Mr. Ugen Tshering	Director	
(3) Mr. Dawa Tenzing		

Ministry of Finance

(1) Dasho Dorji Tseling Deputy Minister

(2) Mr. Sharma - Dept. of Budget

2. Ministry of Agriculture and Forestry

(1) Dasho Leki Dorji	Secretary
(2) Mr. Pema Wongdi	Director
(3) Mr. Kinley Dorji	Planning Officer

3. Department of Agriculture

(1) Mr. Khandu Wangchuk	Director
(2) Mr. Thubten Novbu	Joint Director
(3) Mr. Pem L. Dorji	Project Coordinator
(4) Mr. Rajini Chavda	Planning Officer
(5) Mr. Jampey Dorji	Officer-in-Charge, NASEPP
(6) Mr. Tseten Rabgay	NASEPP
(7) Mr. Tshering Wongdhi	NASEPP
(8) Mr. Dorji Drukpa	NASEPP
(9) Mr. Sherub Gyaltshen	Officer-in-Charge, AMC
(10) Mr. Chime Dorji	AMC

4. Public Works Department

(1) Mr. Somba Tamang	Director

5. Gaylegphug Dzongkhag

(1) Dasho Tshering Dorji	Deputy Dzongdag
(2) Mr. T.R Gurung	District Agriculture Officer

6. Tashigang Dzongkhag

(1) Mr. Rinchen Dorji	Agriculture Extension Officer
(2) Mr. I.C. Parajul	District Agricultural Officer

7. Punaka Dzongkhag

(1) Mr. Sangye Thinley.	District Agriculture Officer

8. Japan International Cooperation Agency

(1)	Dasho Keiji Nishioka	JICA Expert

9. Volunteers

(1)	Deborha Keith (U.K)	NASEPP
(2)	Tina-Mari Maritimo (Finland)	NASEPP
(3)	Christen Renton (U.K)	NASEPP

ANNEX-VI Member of the JICA B/D Team

Mr. Hideo Yasuki	Team Leader	Special Adviser to the Director of the Grant Aid Project Management Dept., JICA
Mr. Jiro Montani	Agricultural Development Planner	Examiner, Seed and Seedlings Div., Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries, Japanese Government
Mr. Shinya Osumi	Architect	Nippon Koei Co., Ltd.
Mr. Shintaro Sugiyama	Agricultural Engineer	-do-
Mr. Ikuo Koshino	-do-	-do-
Mr. Yoshiji Ishii	Asst. Architect	-do-

II. MINUTES OF DISCUSSIONS (DRAFT REPORT EXPLANATION)

MINUTES OF DISCUSSIONS
ON
THE DRAFT FINAL REPORT OF THE BASIC DESIGN STUDY
ON
THE CASH CROP DEVELOPMENT PROJECT
IN
THE KINGDOM OF BHUTAN

The Government of Japan has sent, through the Japan International Cooperation Agency (JICA), a Basic Design Study Team to the Kingdom of Bhutan from 11 to 23 November 1986 for the purpose of presenting and explaining the Draft Final Report of the Basic Design Study on the Cash Crop Development Project.

After a series of discussions between the Basic Design Study Team and the authorities concerned of the Royal Government of Bhutan, both sides confirmed the following results attached herewith (ATTACHMENT).

Signed in THIMPHU, in duplicate, this 19th day of November 1986.

Mr. Masahiko METOKI Leader Basic Design Study Team Japan International Cooperation Agency	Dasho Leki Dorji Secretary Ministry of Agriculture Royal Government of Bhutan

ATTACHMENT

1. Both sides agreed to reconfirm the Minutes of Discussions which was mutually signed on August 22, 1986.

2. The Bhutan side has agreed in principle to the basic design proposed in the Draft Final Report and appropriate alterations agreed by both sides in the course of discussions will be incorporated in the Final Report.

3. The Bhutan side has understood Japan's grant aid system and the arrangement to be taken by the Bhutan side for realization of the Project, such as the land preparation by the end of February 1987.

4. The Final Report (10 copies in English) will be submitted to the Bhutan side before the end of March 1987.

5. The Bhutan side agreed to provide assistance for the importation of labour required for construction of the Project.

III. MEMBERS OF MISSIONS

III-1 Basic Design Study Team

Mr. Hideo Yasuki	Team Leader Special Adviser to the Director of the Grant Aid Project Management Dept., JICA
Mr. Jiro Hontani	Agricultural Development Planner Examiner, Seed and Seedlings Div., Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries, Japanese Government
Mr. Shinya Osumi	Architect Nippon Koei Co., Ltd.
Mr. Shintaro Sugiyama	Agricultural Engineer Nippon Koei Co., Ltd.
Mr. Ikuo Koshino	Agricultural Engineer Nippon Koei Co., Ltd.
Mr. Yoshiji Ishii	Asst. Architect Nippon Koei Co., Ltd.

III-2 Draft Report Explanation Team

Mr. Masahiko Metoki	Officer, Research and Programming Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, Japanese Governmen
Mr. Shinya Osumi	Architect Nippon Koei Co., Ltd.
Mr. Ikuo Koshino	Agricultural Engineer Nippon Koei Co., Ltd.

IV. ININERARY OF MISSIONS

IV-1 Basic Design Study (August 4 ~ August 26, 1986)

	Date	AM/PM	Place	Activities
1.	Aug. 4 (Mon)			Tokyo $\xrightarrow{JL491}$ Bangkok
2.	Aug. 5 (Tue)			Bangkok $\xrightarrow{JL491}$ Delhi $\xrightarrow{IL401}$ Calcutta
3.	Aug. 6 (Wed)	AM	Paro	Calcutta $\xrightarrow{GQ102}$ Paro Discussion with Dasho Nishioka and DOA officials on itinerary
		PM		Survey on Bondey Farm
4.	Aug. 7 (Thu)	All day	Paro	Topographical & soil survey at Chungdu-Dingka site
		AM		Survey of Chiufu site
		PM		Farm survey around Chiufu
5.	Aug. 8 (Fri)			Survey on Panbesa site Farm survey in Panbesa village
6.	Aug. 9 (Sat)	AM		Moved to Thimphu
		PM	Tongsa	Left for Tongsa
			Thimphu	Courtesy call to DOA. Request of answer to questionnaire
7.	Aug. 10 (Sun)	AM	Thimphu	Survey on buildings in Thimphu
		PM		Data filing
		All day	Gaylegphug	Trip to Gaylegphug
			Tashigang	Trip to Tashigang
8.	Aug. 11 (Mon)	AM	Thimphu	Courtesy call to Director of DOA Data collection at PWD & NUDC
		PM		Data collection from contractor
		AM	Gaylegphug	Survey on Gaylegphug site
		PM		Farm survey in Gaylegphug area Survey on construction in Gaylegphug area
		AM	Tashigang	Survey on Chinary site
		PM		Survey on Tashiyanatsi Farm Farm survey on Tashigang area
9.	Aug. 12 (Tue)	All day	Thimphu	Explanation of questionnaire at DOA
			Tongsa	Return trip to Tongsa
		AM		Survey on Kanglung Farm
		PM	Mongar	Return trip to Mongar (Team leader & Agricult. develop. planner left Tokyo)

Date	AM/PM	Place	Activities
10. Aug. 13 (Wed)	AM	Thimphu	Discussion on questionnaire at DOA
	PM		Data collection from contractor
	All day	Thimphu	Return trip to Thimphu
	AM		Survey on Bumthang Farm
	PM	Tongsa	Return trip to Tongsa (Team leader & Agricult. develop. planner; discussion at Japanese Consulate in Calcutta)
11. Aug. 14 (Thu)	AM	Paro	Moved to Paro Team leader & Agricult. develop. planner arrived at Paro Team meeting. Survey on Bondey Farm. Discussion with Dasho Nishioka and DOA officials
	AM		Farm survey on Tangalung village Survey on Wangdiphodrang Experimental Farm
	PM	Thimphu	Returned to Thimphu
12. Aug. 15 (Fri)	AM	Paro	Survey on Chungdu-Dingka & Chiufu sites
	All day		Survey on equipment in Bondey Farm
	AM		Moved to Paro
	PM		Data filing
	PM		Team meeting
13. Aug. 16 (Sat)	AM	Paro	(Messrs. Sugiyama & Ishii left Paro (GQ101) arriving at Tokyo on 18th)
	All day		Preparation of Field Report
			Discussion on equipment supply plan with DOA
		Thimphu	Moved to Thimphu
14. Aug. 17 (Sun)	AM	Thimphu	Survey on Sunday market
	All day		Survey on Changyultang site
			Farm survey on Changyultang village
15. Aug. 18 (Mon)	AM	Thimphu	Discussion with DOA, PC and MOA
	PM		Receipt of answers to questionnaire and study of them
16. Aug. 19 (Tue)	AM	Thimphu	Discussion with DOA on answers to questionnaire Discussion with DOA on equipment supply
	PM	Phuntsholing	Left for Phuntsholing

	Date	AM/PM	Place	Activities
17.	Aug. 20 (Wed)	All day	Thimphu	Discussion on equipment supply plan with DOA
		AM	Phuntsholing	Data collection from contractor
		PM	Thimphu	Return trip to Thimphu
18.	Aug. 21 (Thu)	AM	Thimphu	Round-up meeting with MOA, MOF & PC Signing of Minutes of Discussion
		PM		Preparation of Field Report
19.	Aug. 22 (Fri)	AM	Thimphu	Preparation of Field Report Data filing
		PM	Paro	Moved to Paro
20.	Aug. 23 (Sat)	All day	Paro	Discussion with Dasho Nishioka & DOA officials Preparation of summary survey report
21.	Aug. 24 (Sun)	AM		Paro —GQ101→ Calcutta Survey on a vegetable & fruit market Reporting to Japanese Consul in Calcutta
		PM	Delhi	Calcutta —IC402→ Delhi
22.	Aug. 25 (Mon)	AM		Reporting to Embassy of Japan and JICA Indian Office in Delhi
23.	Aug. 26 (Tue)	AM		Delhi —JL492→ Tokyo

IV-2 Draft Report Explanation Mission (November 11 ~ November 23, 1986)

	Date	AM/PM	Place	Activities
1.	Nov. 11 (Tue)			Tokyo —SQ005→ Singapore —SQ048→ Delhi
2.	Nov. 12 (Wed)		Delhi	Discussion at Embassy of Japan in Delhi Delhi —IC264→ Calcutta
3.	Nov. 13 (Thu)		Calcutta	Reporting to Japanese Consultate in Calcutta
4.	Nov. 14 (Fri)	AM		Calcutta —GQ102→ Paro
		PM	Paro	Discussion with DOA officials and Dasho Nishioka
5.	Nov. 15 (Sat)	All day	Paro	Discussion with DOA officials and Dosho Nishioka on buildings and equipment scheme
6.	Nov. 16 (Sun)	All day	Paro	Discussion with DOA officials and Dasho Nishioka on equipment scheme

	Date	AM/PM	Place	Activities
7.	Nov. 17 (Mon)	AM	Paro	Discussion with DOA officials on Tissue culture house
		PM		Equipment scheme data compilation
8.	Nov. 18 (Tue)	AM	Thimphu	Moved to Thimphu Courtesy call to Director of DOA
		PM		Equipment scheme data compilation
9.	Nov. 19 (Wed)	AM	Thimphu	Courtesy call to Secretary of MOA Round-up meeting with DOA, MOF, MOFA, PC and MOHA Signing of Minutes of Discussion
		PM	Paro	Moved to Paro
10.	Nov. 20 (Thu)	AM	Paro	Preparation of instruction on land reclamation work at Chungdu-Dingka Headquarters
		PM		Field session on land reclamation work at Chungdu-Dingka Headquarters
11.	Nov. 21 (Fri)	AM	Calcutta	Paro $\xrightarrow{GQ101}$ Calcutta Reporting to Japanese Consulate in Calcutta
12.	Nov. 22 (Sat)			Calcutta $\xrightarrow{TG314}$ Bangkok
13.	Nov. 23 (Sun)			Bangkok $\xrightarrow{TG740}$ Tokyo

Remarks:

DOA	:	Department of Agriculture
MOA	:	Ministry of Agriculture and Forestry
MOF	:	Ministry of Finance
PC	:	Planning Commission
MOHA	:	Ministry of Home Affairs
PWD	:	Public Works Department
NUDC	:	National Urban Development Corporation
MOFA	:	Ministry of Foreign Affairs

V. LIST OF CONCERNED OFFICIALS

V-1 The Royal Government of Bhutan

1) Planning Commission

Dasho C. Dorji	Secretary
Mr. Ugen Tshering	Director
Mr. Dawa Tenzin	Planning Officer

2) Ministry of Finance

Dasho Dorji Tshering	Deputy Minister
Mr. M..P. Sharma	Deputy Director of Budget & Accounts Division

3) Ministry of Agriculture and Forestry

Dasho Leki Dorji	Secretary
Mr. Pema Wongdi	Director
Mr. Kinley Dorji	Officiating Deputy Secretary

4) Ministry of Home Affairs

Mr. Lhakpa Dorji	Deputy Secretary

5) Ministry of Foreign Affairs

Mr. Leki Dorji	Director of Economic Division

6) Department of Agriculture

Mr. Khandu Wangchuk	Director
Mr. Thubten Novbu	Joint Director
Mr. Pem L. Dorji	Project Coordinator
Mr. Rajini Chavda	Planning Officer
Mr. Jampey Dorji	Officer-in-Charge, NASEPP
Mr. Tseten Rabgay	NASEPP
Mr. Tshering Wongdhi	NASEPP
Mr. Dorji Drukpa	NASEPP
Mr. Sherub Gyaltshen	Officer-in-Charge, AMC
Mr. Chine Dorji	AMC

7) Public Works Department

Mr. Somba Tamang	Director

8) Gaylegphug Dzongkhag

Dasho Tshering Dorji	Deputy Dzongdag
Mr. T. R. Gurung	District Agriculture Officer

9) Tashigang Dzongkhag

Mr. Rinchen Dorji	Agriculture Extension Officer
Mr. I.C. Parejul	District Agriculture Officer

10) Punakha Dzongkhag

Mr. Sangye Thinley	District Agriculture Officer

11) Japan International Cooperation Agency

Dasho Keiji Nishioka	JICA Expert

12) Volunteers

Deborha Keith (U.K)	NASEPP
Tina-Mari Maritimo (Finland)	NASEPP
Christen Renton (U.K)	NASEPP

V-2 The Government of Japan

1) Empassy of Japan in Delhi

Mr. Shinsuke Horiuchi	Minister
Mr. Yukio Sugano	Councillor
Mr. Toyoshi Miyanaga	First Secretary
Mr. Jun Sugie	First Secretary

2) Japanese Consulate in Calcutta

Mr. Kunio Kamoshida	Consul General
Mr. Chihiro Nakamura	Consul

3) JICA Indian Office

Mr. Tokukiyo Hirai	Representative

VI. PROJECT SITE MAPS

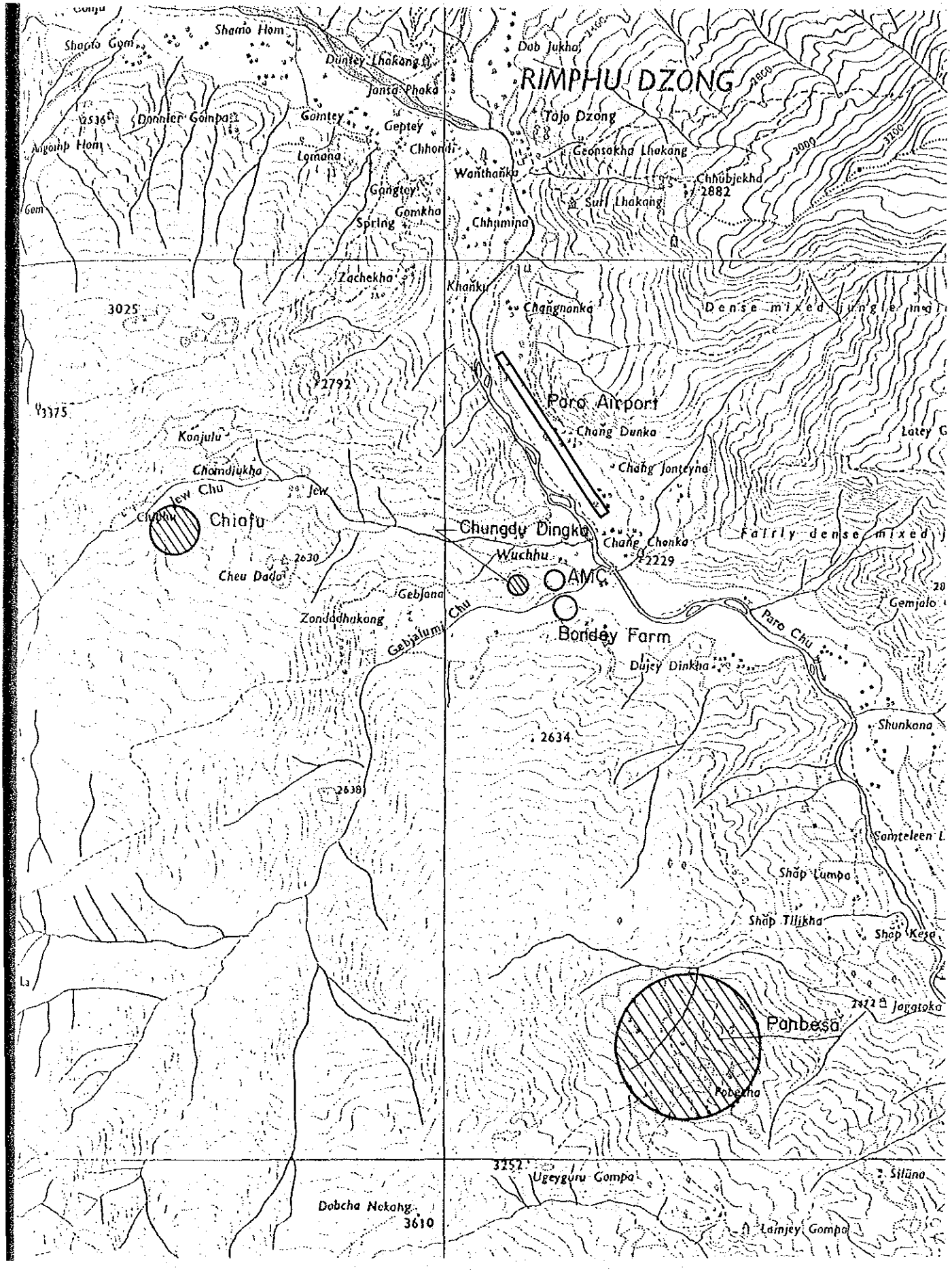


Fig – VI.1 PARO DZONG Scale : 1/50.000

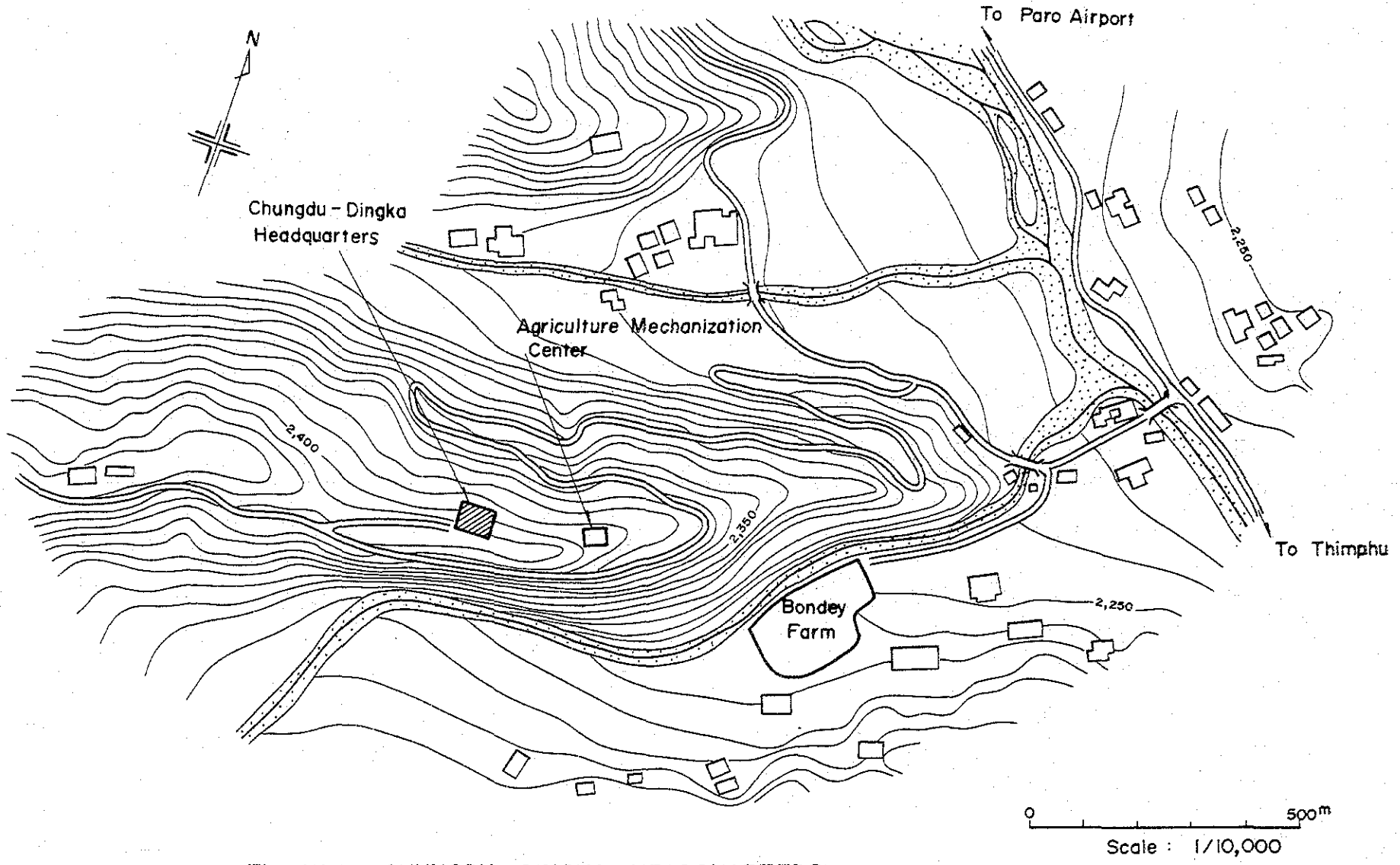


Fig -VI.2 CHUNGDU - DINGKA HEADQUARTERS
VICINITY MAP

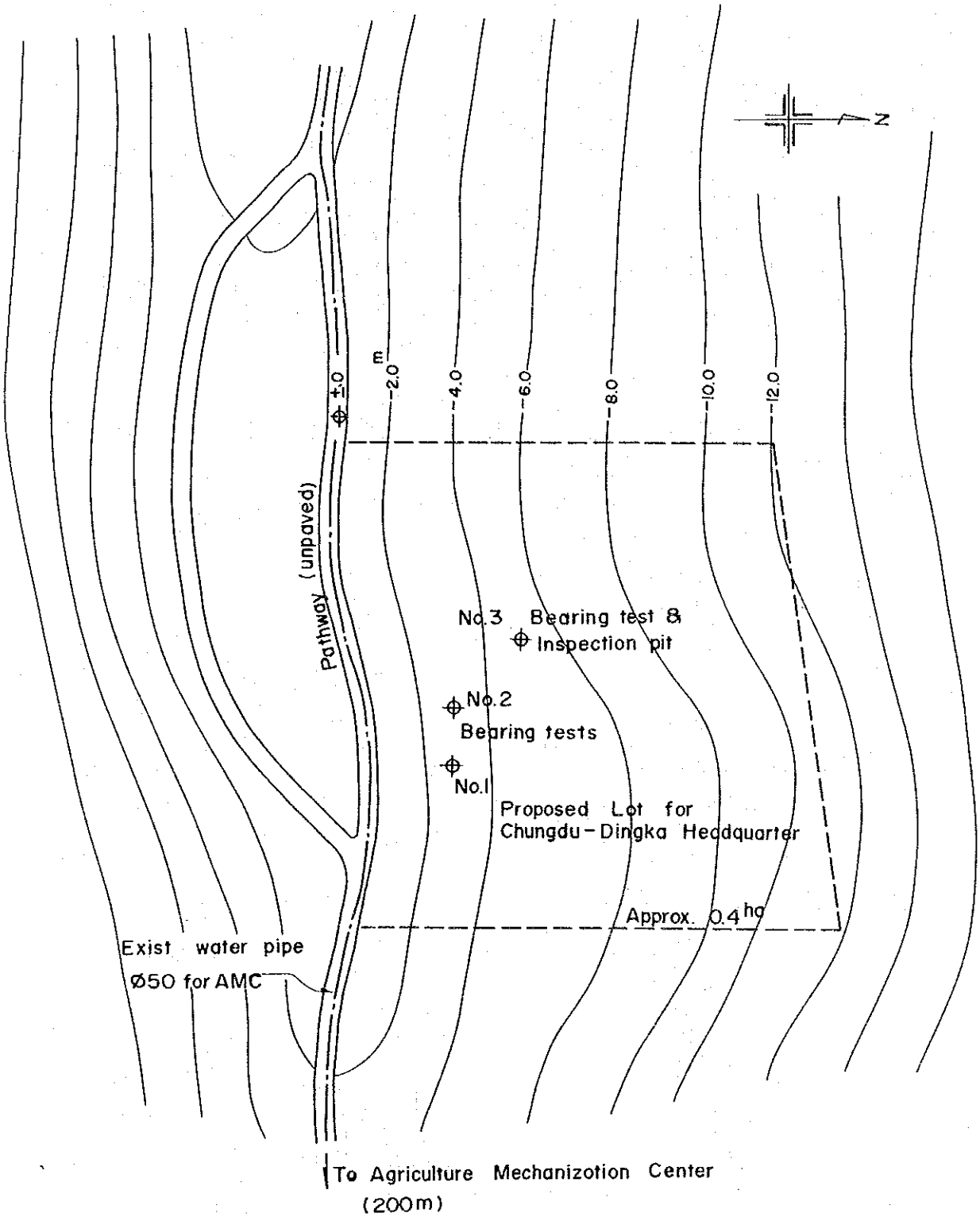


Fig-VI.3 CHUNGDU-DINKA HEADQUARTERS
SITE MAP

SCALE : 1/800

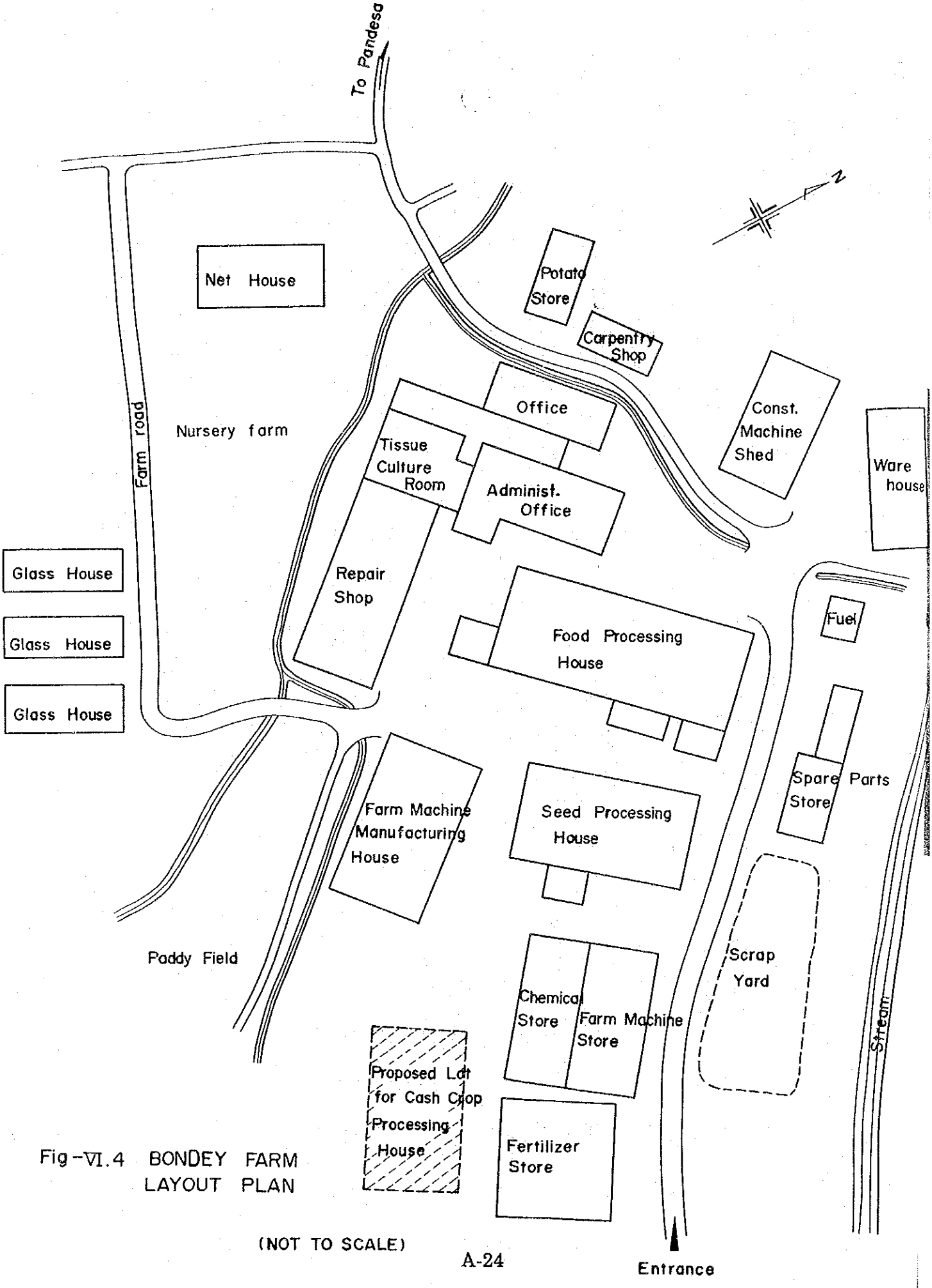


Fig-VI.4 BONDEY FARM LAYOUT PLAN

(NOT TO SCALE)

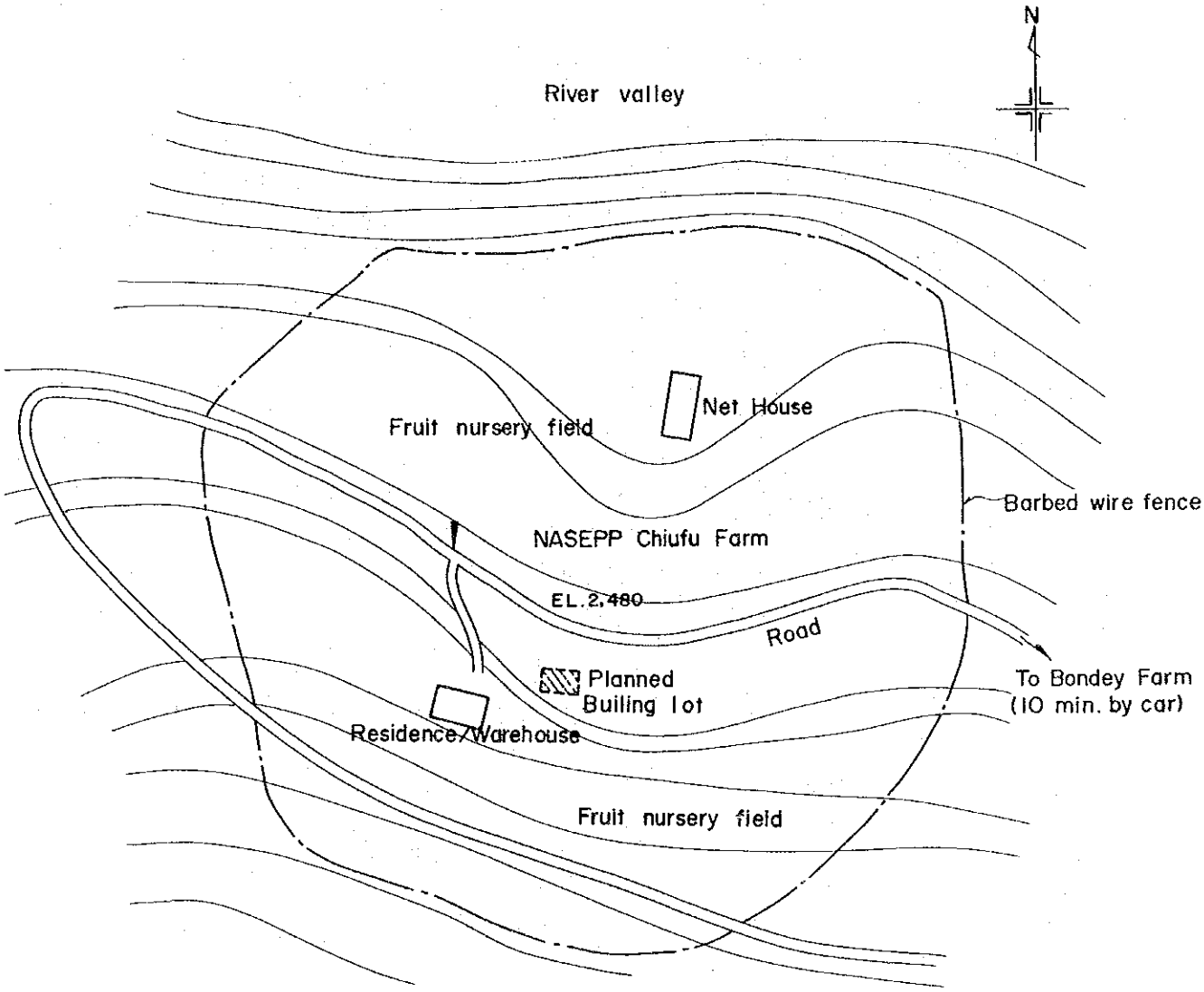


Fig - VI.5 CHIUFU BRANCH
SITE MAP

(NOT TO SCALE)

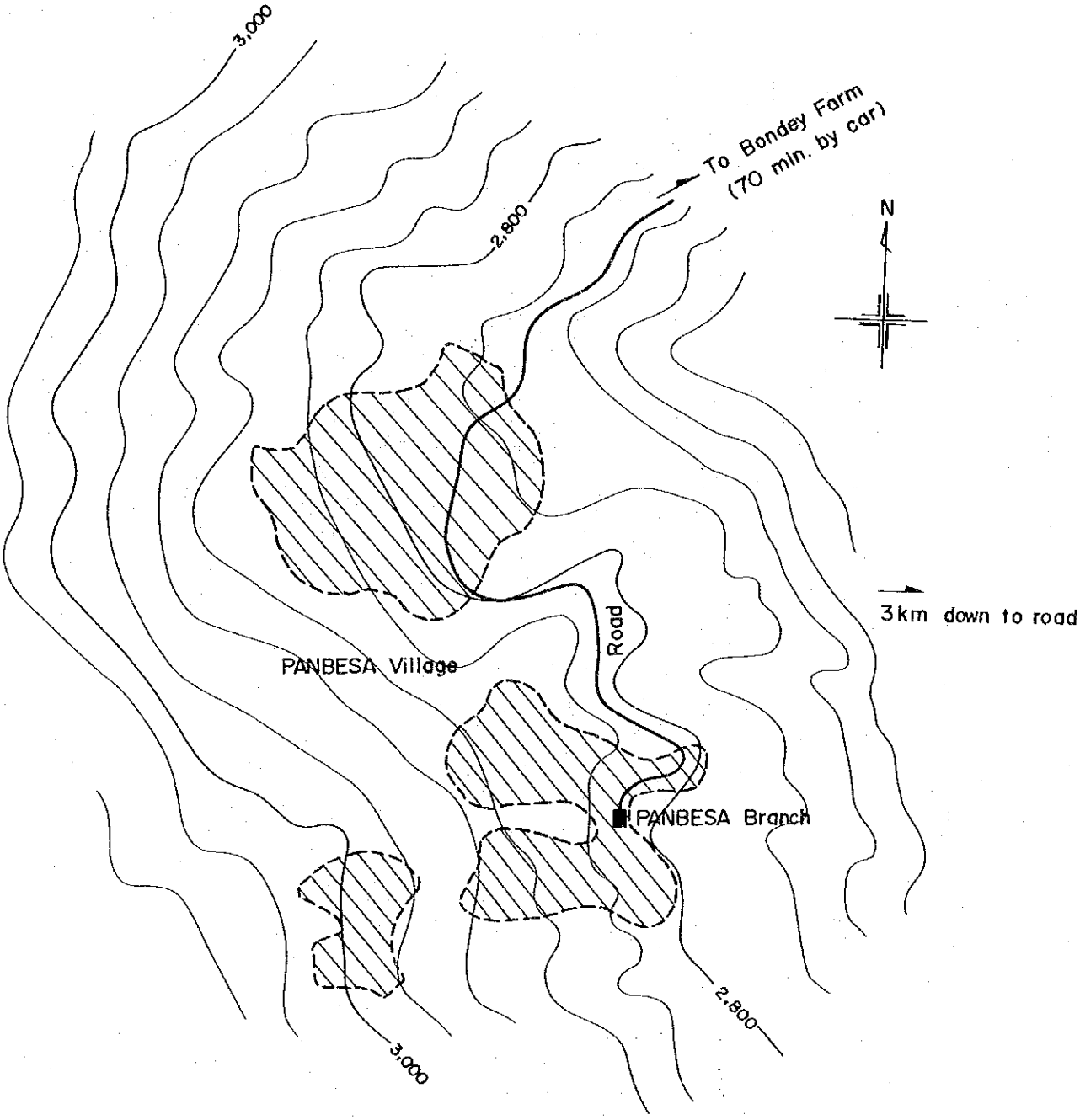


Fig-VI.6 PANBESA BRANCH
SITE MAP

(NOT TO SCALE)

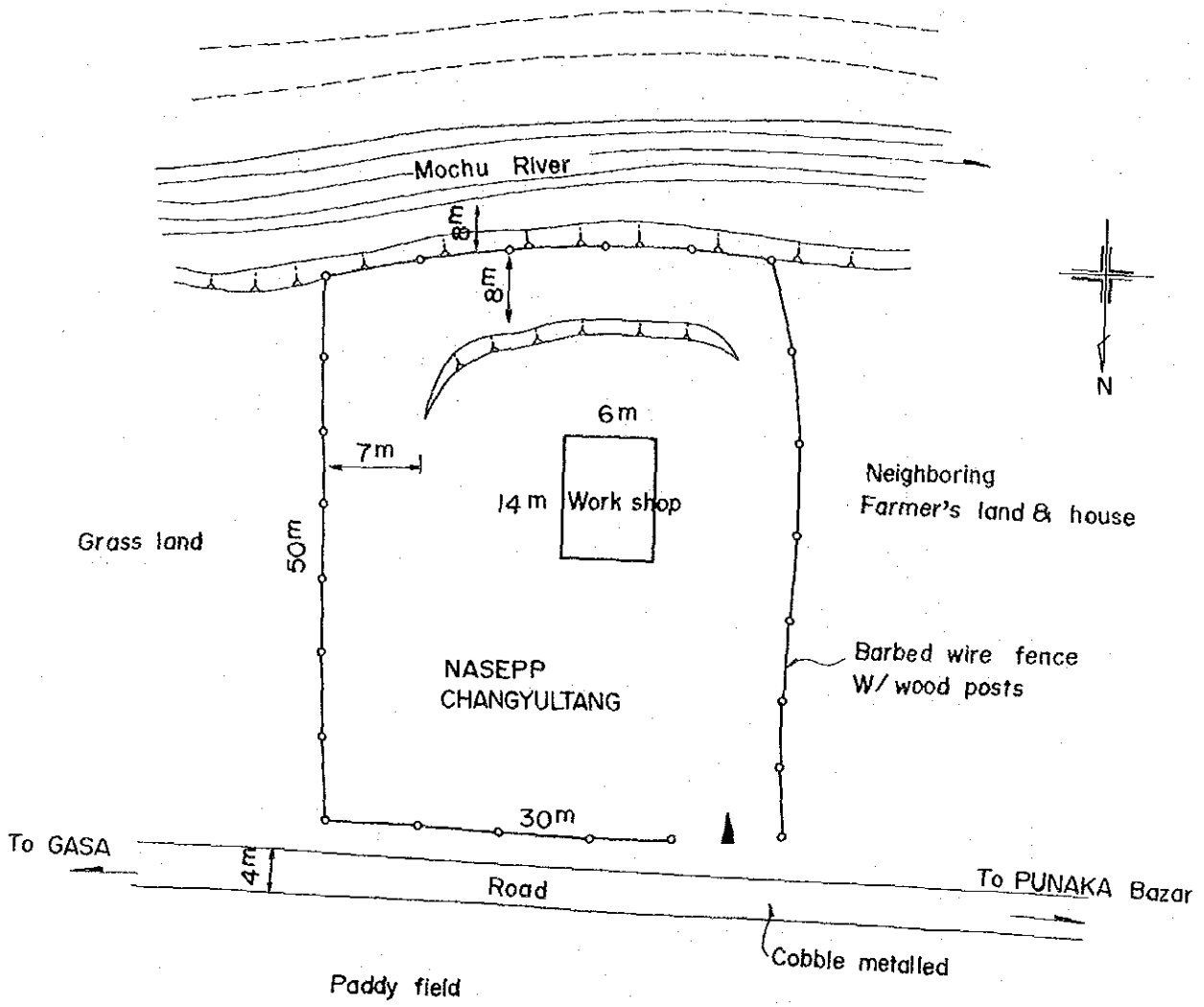


Fig-VI.7 CHANGYULTANG BRANCH SITE MAP

(NOT TO SCALE)

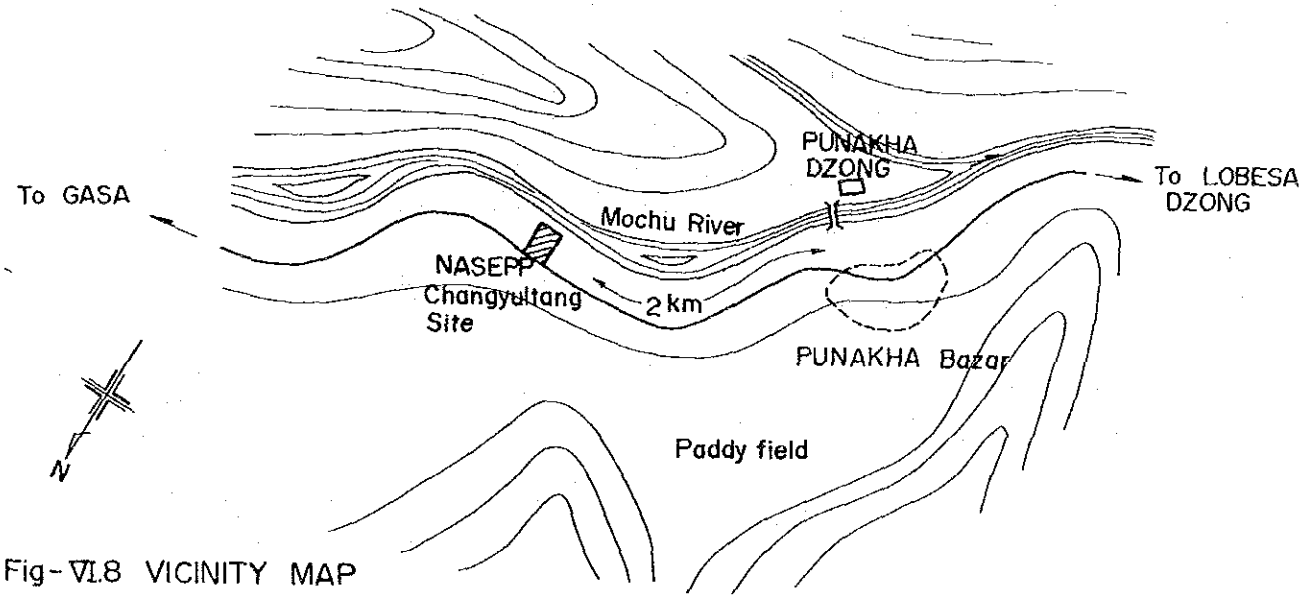


Fig-VI.8 VICINITY MAP

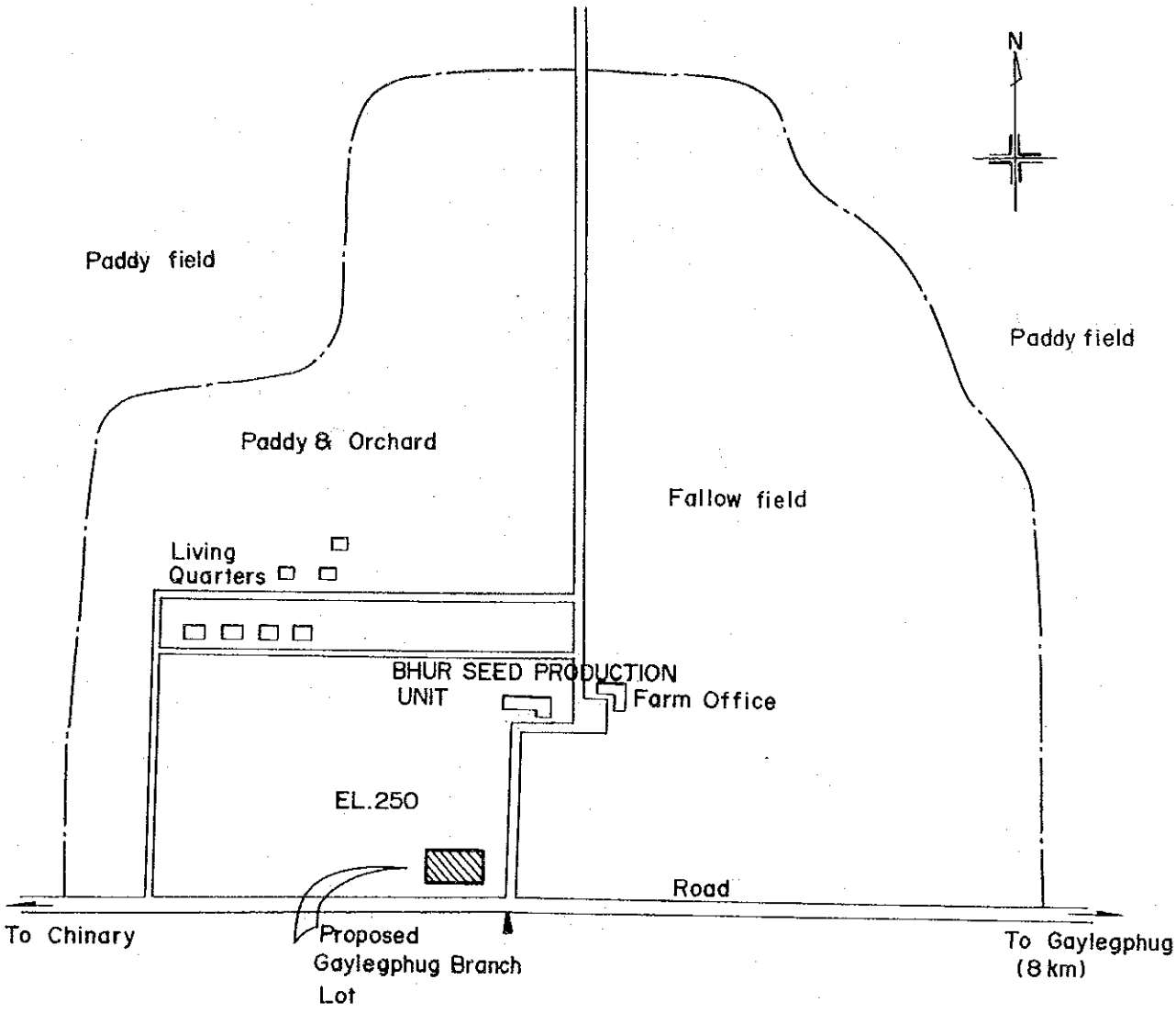


Fig-VI.9 GAYLEGPHUG BRANCH
SITE MAP

(NOT TO SCALE)

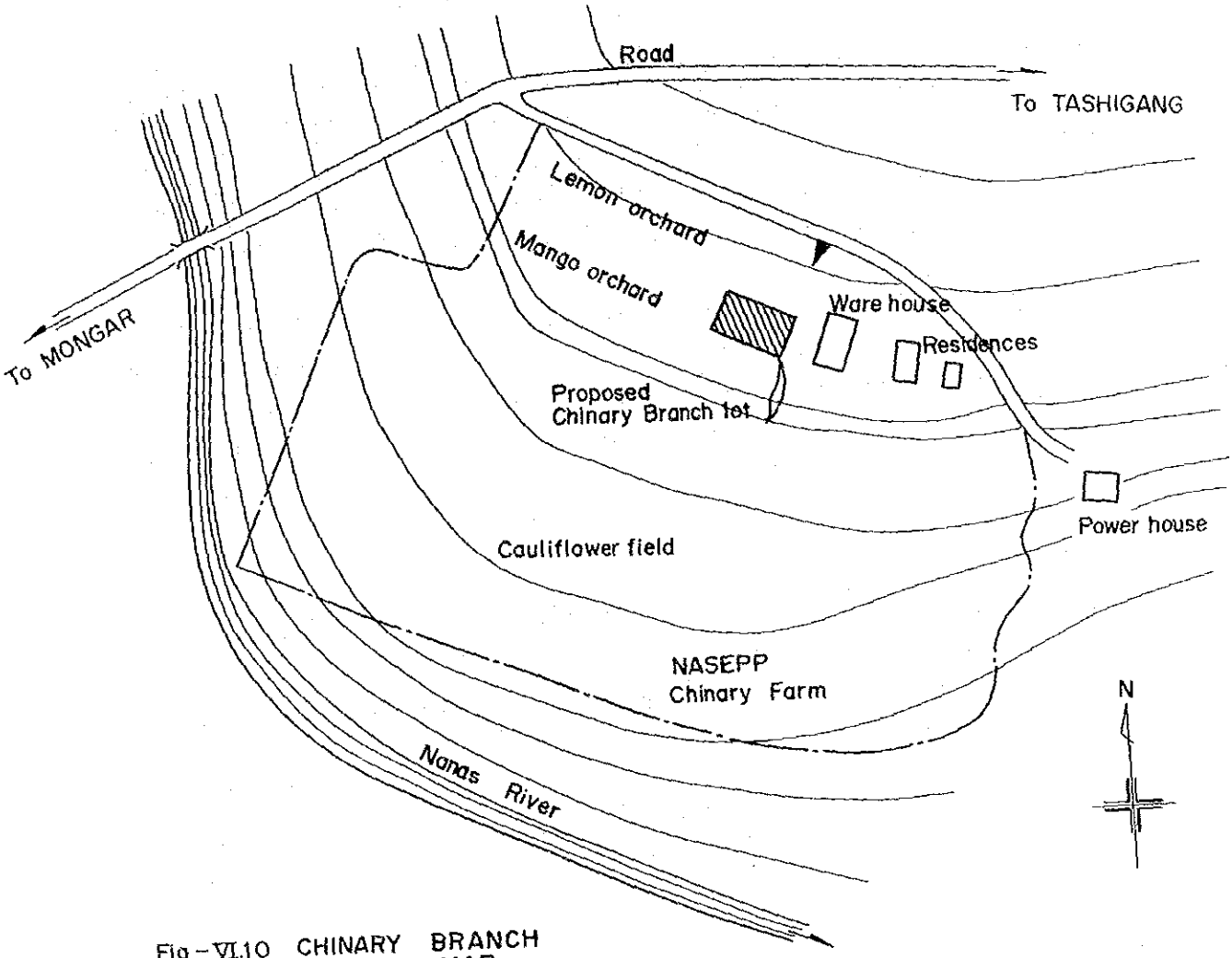


Fig – VI.10 CHINARY BRANCH SITE MAP

(NOT TO SCALE)

VII. RELEVANT DATA

VII-1 Agricultural Matters

1. Current Crop Cultivation

Farming practice in Bhutan is primarily based on traditional methods settled in during the history under the natural surroundings, except in Paro district where modernization of the farming practice has been attempted and achieved a successful result. Farming is mainly done by manpower with simple hand tools such as hoe, sickle, shovel, rake and crop basket, with some help of cow for plowing.

Cultivation is broadly divided into two seasons, summer and winter. In summer, rice and maize are grown and in winter wheat and barley. Vegetables, beans, oil seeds and flowers are planted before or after these major crops. On top of these, fruits are grown in orchard. Hereunder described are cultivation methods of the major crops.

(1) Rice

Rice is one of the staple food in Bhutan. It is mainly grown in paddy field with a very few dry field. Majority of rice are local breed with some high yielding varieties. Following are the representative rice varieties in the country.

	Breed	Growing Period (days after planting)
Local breed	Marb	125~130
	Karp	120~125
	Kochum	125~130
High yielding variety	IR-8	110
	Jaya	115
	IET 1-444	115
	Pusa-33	95

Takanenishiki known as No. 11 has been spreading in Paro and Thimphu districts and has proved to be higher yielding and more resistant to falling than the local breeds. Paro district has cultivated area of about 1,000 ha of this variety which has shown a yield of about 5 ton/ha of unhulled rice in 1985.

Nursery field is plowed in February to March by cows abreast and further hoed by farmers. Nursery fields are prepared mostly in dry field but irrigated nursery field came to be introduced in recent years. Most of the nursery fields are made in part of the paddy field with an average sowing quantity of 50~100 kg/ha. Nursery period is a relatively long 1~3 months during which weeding is done by hand.

Plowing of the paddy fields is done primarily by cows in May to June. Watering is done after this primary plowing and successive clod breaking by hand, , followed by balk making, tilling and levelling. Immediately after the preparation, seedlings are extracted and transplanted in the fields.

Planting is done in late May to early June varying region by region. Planting is rather dense and random, about 90 stocks/m^2 with 1~2 pieces of seedlings per stock. In some area, particularly Paro district, grid planting has come to be exercised using planting guide ropes. In this system, planting density averages in around 27 stocks/m^2 with a stock consisting of 2~3 seedlings. All planting are done by hand..

Chemical fertilizers are not widely used yet. Basic fertilizer is compost applied at a rate of 5~10 tons per ha. Some advanced farmers have come to use a composite chemical fertilizer known as Suphala which contains N(15%), P(15%) and K(15%). The Suphala is applied after the first weeding in an amount of 15~20 kg/ha.

Weeding are made 3~4 times by hand. In the area where grid planting is employed a rotating weeding tool with a long handle has come to be used. To get rid of hard weeding work, chemical herbicides are being promoted in some area with promising result. In Tongsa region, 30~40% of farmers are said to use the chemical herbicides.

Irrigation water is generally not abundant in Bhutan. In almost all area, irrigation water is renewed in a cycle of 5~10 days. Therefore, water is carefully taken care of by the farmers to prevent dry-up of their fields. Irrigation of the fields are continued until 10~15 days before harvesting. Reaping is done by hand sickles demanding intensive labor. After reaping, paddy is dried in shocks in the field for 3~5 days and then threshed. Foot pedaled threshing tools are becoming popular in recent years.

Farming techniques of paddy are relatively low resulting in a low yield. Immediate target of yield per unit area of land would be 4~5 tons/ha. In order to raise the yield the following measures would have to be taken.

a) Promotion of high yielding varieties
b) Proper application of fertilizers
c) Proper application of plant protection chemicals
d) Good control of irrigation water
e) Timely reaping and improved threshing and hulling

(2) Wheat and Barleys

Among wheat and barleys, wheat is outstanding followed by naked barley. Major breeds of wheat are Karyansona and Sonalika having the origin in Mexico. On the other hand those of naked barley are mostly local breed such as Na (Ne), Nap and Kap. Cultivation of wheat and barleys are much the same. Following are about wheat cultivation.

Sowing is done in November after preparation of fields by cow-plowing and clod breaking by hand using rake or chopping hoe. Sowing methods are spreading or stringing out in an average quantity of 100 kg/ha. As plants sown later than November would not ripen, planting timing is very important.

Weeding and plant protection are generally not exercised.

Because of rarity of rainfalls during the growing season, 2 to 3 times of artificial irrigation of the field is necessary, although currently it is not widely practiced.

Fertilizer used is mainly compost applied at a rate of 5~10 tons/ha. Use of chemical fertilizers is not popular yet. In some areas, some farmers are said to use 20 ~35 kg/ha of composit fertilizer.

Wheat is reaped in May to June. Reaping, drying and threshing are much the same as those of rice.

Yield per unit area of land is low due partly to lack of proper irrigation systems and shortage of fertilizers. Introduction of high yielding varieties, proper use of fertilizers along with providing good irrigation systems would be the key factors to raise the productivity.

(3) Maize

Major breed of maize is a local breed known as Vijay. An improved variety called Gang-5 has been introduced recently and produced a good result.

Maize are grown both in paddy fields and dry fields. In paddy field, cow-plowing is done in cold January to February in good advance of maize planting to effect drying of field soil, a piece of empirical wisdom in farming. Sowing is not done until rain comes, often until April. Sowing season differs from region to region, early sowing in February to April while late sowing in June to July. Sowing methods are spreading or stringing out, among these stringing out is more wide-spread. Sowing density in the latter method is about 6 stocks/m^2 after culling where ridges are at an interval of 50 cm and stocks at 30 cm.

Cultivation is generally carefree, weeding is not exercised and fertilizers not applied.

Yield per unit land area is a relatively low 1.5 ton/ha. Introduction of high yielding varieties, use of fertilizers and plant protection chemicals, setting up of irrigation systems would have to be promoted.

(4) Mustard

Major breeds are of local breeds. High yielding varieties such as T-9 and M-27 imported from India in recent years are producing a good result.

Mustard is grown in dry field where sowing is done in September to October. Late sowing in November would not produce full seeds resulting in poor harvest.

Cultivation is generally carefree, weeding is not exercised and fertilizers not applied.

Reaping is done by hand using sickles. After drying plants are threshed and seeds hulled by hand.

Yield per unit land area averages 0.7 ton/ha. Introduction of high yielding varieties, proper application of fertilizers and plant protection chemicals would have to be promoted.

(5) Potatoes

Potatoes have been an important cash crop in Bhutan. The majority are of local breeds with some new varieties such as white, red and Swiss-red species. Sowing is done in February to March at a rate of about 1.5 ton/ha, where ridges are at an interval of 45 cm and seeds in 20~25 cm. Fertilizers are compost or composite fertilizer applied at about 20~30 kg/ha.

Weeding is done 1~2 times by hand tools. Yield per unit land area is in the vicinity of 8 tons/ha. Introduction of quality seeds and upgrading farming techniques would have to be promoted.

(6) Cardamon

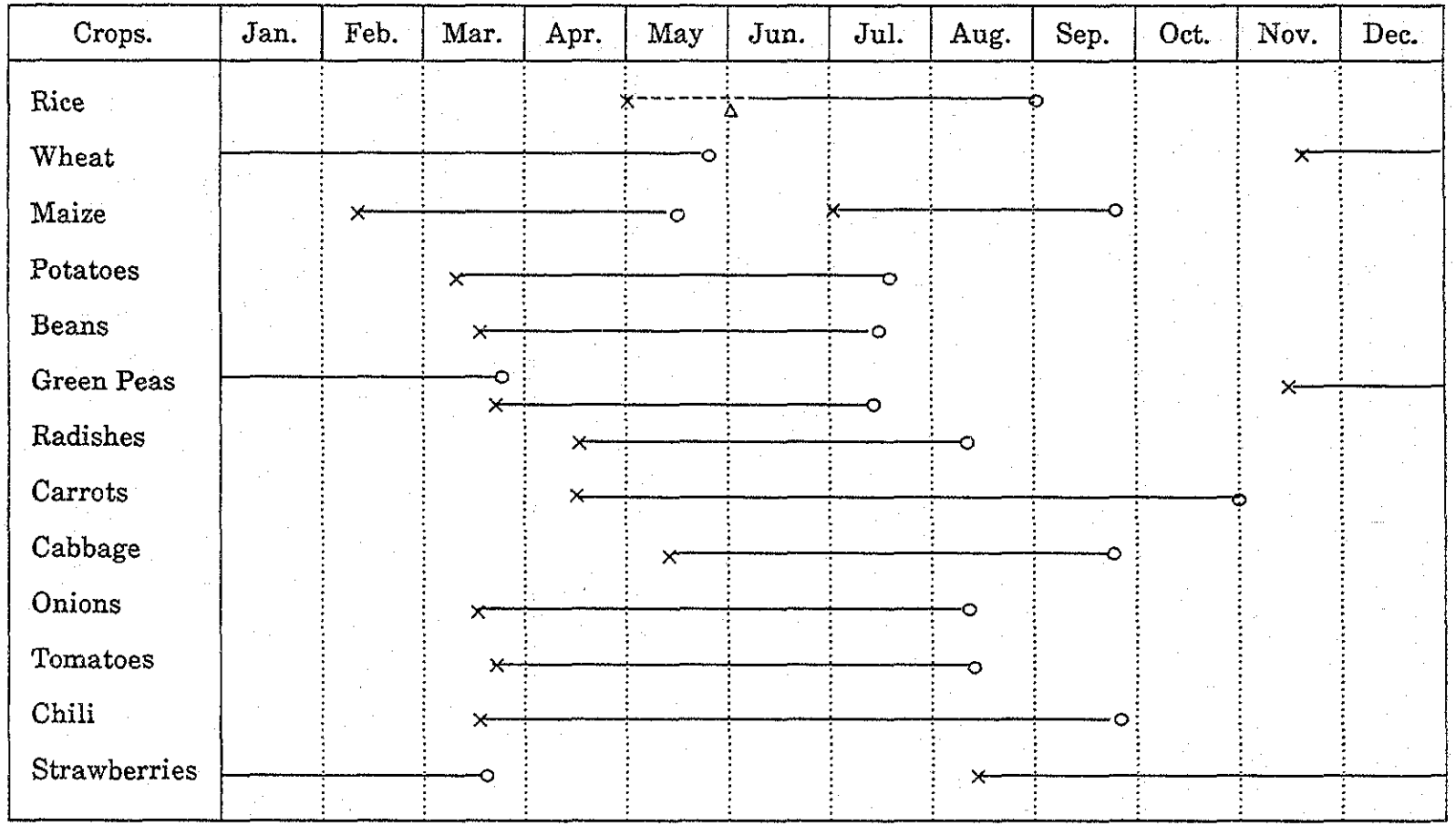
Cardamon is a perennial spice plant peculiar to southern border area particularly to Gaylegphug region. Cultivated area in Gaylegphug region is about 3,300 ha in there about 1,000 tons/year of cardamon is produced. This production accounts for about 60% of the total production in Bhutan. Cardamon is not only a major crop in Gaylegphug region but an important cash crop of the country.

Cardamon is grown on north slope of hills under the shade of trees. Planting of seedlings are done in May to June in a grid of 1.5 m x 1.5 m. Cultivation is rather carefree with occasional weeding but without fertilizer or plant protection chemical.

Reaping is done in September to November after an elapse of 4 years time using knives. After reaping seeds are dried by the farmers burning fire woods; a pit is dug in the ground, fire wood placed at the bottom, bamboo mat over the pit and cardamon seeds spread over the bamboo mat, taking 6 days and nights. After drying seeds are hulled by foot trampling, bagged and shipped.

Yield per unit land area is about 300~400 kg/ha. Trade of cardamon is dominated by Indian middlemen often to the disadvantage of farmers, a major issue in cardamon cultivation along with illegal use of forest trees for firewood.

Table-VII.1 Cropping Calendar in Paro District



Notes : × Sowing
△ Transplanting
○ Harvesting

Table-VII.2 CASH CROP PRODUCTION

(Paro District: 1984)

Crops	Cultivated Area (ha)	Production (t)	Market Value (Nu.x10³)
Rice	2,045	6,158	31,283
Wheat/Barley	2,189	2,508	6,546
Maize	399	484	1,234
Potatoes	592	5,524	14,086
Soy/Kidney beans	161	144	432
Mustard	173	133	599
Oranges	34	164	667
Apples	181	895	3,133
Cardamon	33	15	675
Buckwheat/Millet	610	496	1,364
Other vegetables	42	109	581
Other fruits	3	7	-

Table-VII.3 CASH CROP PRODUCTION

(Punakha District: 1984)

Crops	Cultivated Area (ha)	Production (t)	Market Value (Nu.x10³)
Rice	1,435	4,152	21,092
Wheat/Barley	627	662	1,728
Maize	103	136	347
Potatoes	26	138	352
Soy/Kidney beans	18	18	54
Ginger	1	5	33
Mustard	168	124	558
Chilies	55	168	1,164
Sugarcane	1	15	-
Oranges	39	215	875
Apples	6	18	63
Cardamon	26	17	765
Buckwheat/Millet	62	55	151
Radish/Turnip	23	116	229
Other fruits	1	4	-

Table-VII.4 CASH CROP PRODUCTION

(Gaylegphug District: 1984)

Crops	Cultivated Area (ha)	Production (t)	Market Value (Nu.x10^3)
Rice	4,145	8,341	42,372
Wheat/Barley	430	441	1,151
Maize	10,478	12,206	31,125
Potatoes	57	432	1,101
Soy/Kidney beans	498	305	915
Ginger	75	756	4,952
Mustard	822	144	648
Chilies	33	144	998
Sugracane	354	10,425	-
Oranges	2,078	6,968	28,360
Cardamon	3,267	1,031	46,395
Buckwheat/Millet	3,981	3,401	9,353
Radish/Turnip	28	142	280
Other vegetables	54	109	581
Areca nut	12	93	-

Table-VII.5 CASH CROP PRODUCTION

(Tashigang District: 1984)

Crops	Cultivated Area (ha)	Production (t)	Market Value (Nu.x10^3)
Rice	3,248	7,357	37,374
Wheat/Barley	2,616	2,803	7,316
Maize	9,185	20,774	52,974
Potatoes	997	7,082	18,059
Soy/Kidney beans	2,223	1,474	4,422
Ginger	7	39	255
Mustard	396	221	995
Chilies	217	716	4,962
Sugarcane	7	134	-
Oranges	87	51	208
Apples	2	2	7
Cardamon	6	1	45
Buckwheat/Millet	2,244	2,296	6,314
Radish/Turnip	62	338	666
Other vegetables	127	284	1,514
Other fruits	9	27	-

2. Farm Economy Analysis

(1) Paro District

Table-VII.6 (Family Member 6, Farm Land 1.3 ha)

Crops	Cultiv. Area (ha)	Out-put (t)	Gross Income (Nu.)	%	Input Cost (Nu.)	Net Income (Nu.)	%	Other Income	Total	Living Expense	Surplus
Present											
Rice	0.54	1.625	5,119	35.7	502	4,617	34.8	-	-	-	-
Wheat/Barley	0.57	1.656	4,322	30.2	314	4,008	30.2	-	-	-	-
Maize	0.10	0.121	309	2.2	15	294	2.2	-	-	-	-
Potatoes	0.15	1.400	3,570	24.9	84	3,486	26.3	-	-	-	-
Mustard	0.05	0.039	176	1.2	28	148	1.1	-	-	-	-
Soybeans	0.04	0.036	108	0.8	5	103	0.8	-	-	-	-
Budkwheat/Millet	0.16	0.130	350	2.4	24	326	2.5	-	-	-	-
Apples	0.05	0.023	81	0.6	53	28	0.2		-	-	-
Other vegetables	0.02	0.052	288	2.0	33	255	1.9		-	-	-
Total	1.68	-	14,323	100.0	1,058	13,270	10	4,440	17,710	17,160	550
Land use intensity	1.29										(US445)
Future											
Rice	1.04	5.200	16,380	30.1	2,200	14,180	31.0	-	-	-	-
Wheat	0.85	2.580	6,730	12.4	1,140	5,590	12.2	-	-	-	-
Maize	0.17	0.425	1,080	2.0	250	830	1.8	-	-	-	-
Potatoes	0.26	3.900	9,940	18.3	990	8,950	19.6	-	-	-	-
Mustard	0.08	0.096	430	0.8	90	340	0.7	-	-	-	-
Soybeans	0.07	0.105	320	0.6	40	280	0.6	-	-	-	-
Buckwheat/Millet	0.08	0.120	320	0.6	50	270	0.6	-	-	-	-
Other vegetables	0.27	2.700	14,950	27.5	2,990	11,960	26.1	-	-	-	-
Apples	0.06	1.200	4,200	7.7	840	3,360	7.4	-	-	-	-
Total	2.88	-	54,350	100.0	8,590	45,760	100.0	-	45,760	34,510	11,250
Land use intensity	2.22										(US$915)

(2) Punakha District

Table-VII.7 (Family Member 7, Farm Land 1.1 ha)

Crops	Cultiv. Area (ha)	Out-put (t)	Gross Income (Nu.)	%	Input Cost (Nu.)	Net Income (Nu.)	%	Other Income	Total	Living Expense	Surplus
Present											
Rice	0.92	2.659	8,380	67.5	860	7,520	68.6	-	-	-	-
Wheat	0.40	0.424	1,110	9.0	220	890	8.1	-	-	-	-
Maize	0.07	0.092	240	1.9	10	230	2.1	-	-	-	-
Potatoes	0.02	0.106	270	2.2	10	260	2.4	-	-	-	-
Mustard	0.11	0.081	370	3.0	60	310	2.8	-	-	-	-
Chilies	0.04	0.122	850	6.9	10	840	7.7	-	-	-	-
Radishes	0.03	0.151	300	2.4	10	290	2.6	-	-	-	-
Cardamon	0.02	0.013	590	4.8	230	360	3.3	-	-	-	-
Oranges	0.01	0.055	220	1.8	10	210	1.9	-	-	-	-
Buckwheat/Millet	0.03	0.027	70	0.5	10	60	0.5	-	-	-	-
Total	1.65	-	12,400	100.0	1,430	10,970	100.0	4,880	15,850	15,600	250
Land use intensity	1.50										(US$20)
Future											
Rice	1.10	5.50	17,330	37.0	2,330	15,000	37.4	-	-	-	-
Wheat	0.65	1.95	5,090	10.9	860	4,230	10.5	-	-	-	-
Maize	0.15	0.375	960	2.0	70	890	2.2	-	-	-	-
Potatoes	0.14	2.10	5,360	11.4	150	5,210	13.0	-	-	-	-
Mustard	0.16	0.192	860	1.8	90	770	1.9	-	-	-	-
Cardamon	0.02	0.02	900	1.9	350	550	1.4	-	-	-	-
Oranges	0.05	1.25	5,090	10.9	690	4,400	11.0	-	-	-	-
Buckwheat/Millet	0.06	0.09	240	0.5	30	210	0.5	-	-	-	-
Other vegetables	0.20	2.00	11,070	23.6	2,210	8,860	22.1	-	-	-	-
Total	2.53	-	46,900	100.0	6,780	40,120	100.0	-	40,120	31,380	8,740
Land use intensity	2.30										(US$710)

(3) Tashigang District

Table-VII.8 (Family Member 7, Farm Land 0.8 ha)

Crops	Cultiv. Area (ha)	Out-put (t)	Gross Income (Nu.)	%	Input Cost (Nu.)	Net Income (Nu.)	%	Other Income	Total	Living Expense	Surplus
Present											
Rice	0.16	0.482	1,520	27.6	150	1,370	26.8	-	-	-	-
Wheat	0.14	0.161	420	7.6	80	340	6.7	-	-	-	-
Maize	0.46	0.557	1,420	25.8	70	1,350	2.6	-	-	-	-
Potatoes	0.05	0.467	1,190	21.6	30	1,160	2.3	-	-	-	-
Soybeans	0.11	0.098	290	5.3	10	280	5.5	-	-	-	-
Mustard	0.02	0.015	70	1.3	10	60	1.2	-	-	-	-
Oranges	0.01	0.055	220	4.0	10	210	4.1	-	-	-	-
Buckwheat/Millet	0.11	0.089	240	4.4	20	220	4.3	-	-	-	-
Other vegetables	0.01	0.026	140	2.5	20	120	2.3	-	-	-	-
Total	1.07	-	5,510	100.0	400	5,110	100.0	9,980	15,090	14,560	530
Land use intensity	1.30										(US$43)
Future											
Rice	0.82	4.10	12,920	47.5	1,140	11,780	48.1	-	-	-	-
Wheat	0.20	0.60	1,570	5.8	260	1,310	5.3	-	-	-	-
Maize	0.45	1.125	2,870	10.6	140	2,730	11.1	-	-	-	-
Potatoes	0.07	1.05	2,680	9.9	100	2,580	10.5	-	-	-	-
Soybeans	0.10	0.15	450	1.7	50	400	1.6	-	-	-	-
Mustard	0.04	0.048	220	0.8	30	190	0.8	-	-	-	-
Oranges	0.04	1.00	4,070	15.0	550	3,520	14.4	-	-	-	-
Buckwheat/Millet	0.05	0.075	200	0.7	10	190	0.8	-	-	-	-
Other vegetables	0.04	0.40	2,220	8.0	410	1,810	7.4	-	-	-	-
Total	1.81	-	27,200	100	2,690	24,510	100.0	9,980	34,490	29,290	5,200
Land use intensity	2.21										(US$423)

As seen in the above tables, increase of income is expected to come largely from rice, vegetables and fruits. Although rice is not categorized as the cash crop, promotion of its production would also contribute to the increase of cash income. As other vegetables and fruits are cultivated as back crops or grown separately in orchard, promotion of rice cultivation would not trade off these crops.

Comparing the income at present and in the future, it would increase 3.4 fold, 3.7 fold and 4.8 fold in Paro district, Punakha district and Tashigang district respectively. The large increase of income from farming in Tashigang district is attributed to the lower income at present. In Tashigang area, the "other income" would maintain the present level because the farmland here is smaller and therefore there would still be surplus labor to gain income from outside contrary to the other areas where the house labor has to be wholly devoted to house farming.

The living expenses at present are based on the field farm survey and those in the future are assumed including price inflation and some enrichment of life. What is significant is the increase of the "surplus" which would enable the farmers to enjoy better cultural life.

3. Food Corporation of Bhutan

(1) Establishment : 1974

(2) Objective of establishment

: a) Importing, storing and distributing basic cereals
b) Trading horticultural and agricultural produce

(3) Motive of establishment

: Food crisis due to drought in early 1970s

(4) Import quota : Food Corporation of India

(5) Warehouse : 38 nos. (1968)

(6) Storage capacity : Nominal 8,000 tons (incl. rented warehouses)

(7) Finance : Trading margin from basic cereals is used as revolving fund while personnel expense is born by the government.

(8) Administrative organ

: Department of Agriculture, Ministry of Agriculture & Forestry

(9) Personnel : 265 persons (1986)

(10) Offices : Phuntsholing headquarters
Thimphu branch
Samchi branch

(11) Transport fleet : 14 trucks

(12) Current activities :

a) Importing and distributing basic cereals (handling volume : 9,000 tons/year)

b) Operation of auction yards
(Phuntsoling auction yard : potatoes, oranges
Gaylegphug auction yard : potatoes
Samchi auction yard : oranges
FCB is handling 37% of potatoes, 16% of apples and 3% of oranges)

c) Operation of a cold store in Phuntsholing (capacity : 1,200 tons)

d) Sale of fruit boxes

e) Buying of oranges for Bhutan Fruit Products Ltd., Samchi

f) Emergency food supply

g) Storage and distribution of World Food Program commodities (4,000 tons/year)

(13) Historical aspects :

1982 : Was entrusted to handle World Food Program commodities.

1984 : Ceased to trade domestic crop including cash crops after accumulating loss.

(14) Problems :

a) FCB earned consistent trading margins in trading basic cereals, but lost in trading cash crops (cardamon and potatoes) because of adverse trading conditions resulting in withdrawal from this area.

b) FCB's distribution of basic cereals has been concentrated in western and southern regions leaving the other regions less-served.

c) Substandard storage facilities

d) High cost of working capital

e) Lack of clarity and conflicting policy objectives, shortage of skilled and qualified staff, inadequate financial management, lack of communication facilities and absence of company law

f) Cold store in Phuntsholing is deemed to have been ineffectively set up.

(15) Future reforming plan

: a) Re-constitution as an autonomous corporation

b) Privatization of "Fair Price Shop"

c) Promotion of private enterprises through "Licensed Commission Agent"

d) Improvement of storage facilities

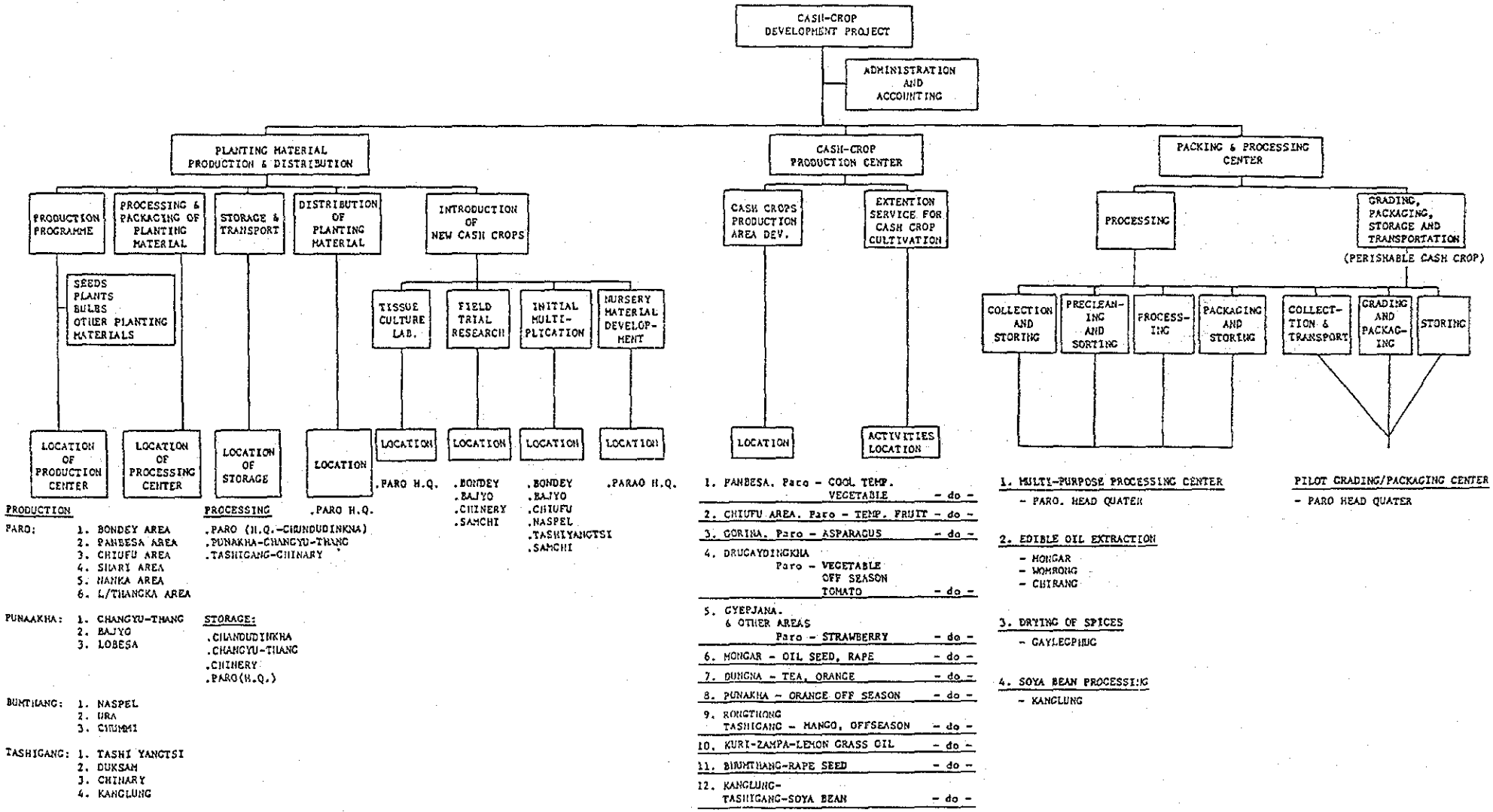
e) Integration of activities for World Food Program

f) Reinforcement of market information services

g) Reviewing use of cold store

h) Efficient planning of reserve food trade

i) Training of qualified staff



PRODUCTION

PARO:
1. BONDEY AREA
2. PANBESA AREA
3. CHIUFU AREA
4. SHARI AREA
5. NANKA AREA
6. L/THANGKA AREA

PUNAAKHA:
1. CHANGYU-THANG
2. BAJYO
3. LOBESA

BUMTHANG:
1. NASPEL
2. URA
3. CHUMEY

TASHIGANG:
1. TASHI YANGTSI
2. DUKSAM
3. CHINARY
4. KANGLUNG

GELEPHUG:
1. BHUR

SAMCHI:
1. SAMCHI

PROCESSING

.PARO H.Q.

.PARO (H.Q.-CHUNDUDINKHA)
.PUNAKHA-CHANGYU-THANG
.TASHIGANG-CHINARY

STORAGE:
.CHUNDUDINKHA
.CHANGYU-THANG
.CHINERY
.PARO(H.Q.)

.PARO H.Q.

.BONDEY
.BAJYO
.CHINERY
.SAMCHI

.BONDEY
.BAJYO
.CHIUFU
.NASPEL
.TASHIYANGTSI
.SAMCHI

.PARAO H.Q.

1. PANBESA, Paro - COOL TEMP. VEGETABLE - do -
2. CHIUFU AREA, Paro - TEMP. FRUIT - do -
3. GORINA, Paro - ASPARAGUS - do -
4. DRUGAYDINGKHA Paro - VEGETABLE OFF SEASON TOMATO - do -
5. GYEPJANA, 6 OTHER AREAS Paro - STRAWBERRY - do -
6. MONGAR - OIL SEED, RAPE - do -
7. DUNGNA - TEA, ORANGE - do -
8. PUNAKHA - ORANGE OFF SEASON - do -
9. RONGTHONG TASHIGANG - MANGO, OFFSEASON - do -
10. KURI-ZAMPA-LEMON GRASS OIL - do -
11. BUMTHANG-RAPE SEED - do -
12. KANGLUNG-TASHIGANG-SOYA BEAN - do -

1. MULTI-PURPOSE PROCESSING CENTER
- PARO, HEAD QUATER

2. EDIBLE OIL EXTRACTION
- MONGAR
- WOMRONG
- CHIRANG

3. DRYING OF SPICES
- GAYLEGPHUG

4. SOYA BEAN PROCESSING
- KANGLUNG

PILOT GRADING/PACKAGING CENTER
- PARO HEAD QUATER

Fig-Ⅵ.1 MASTER PLAN OF CASH CROP DEVELOPMENT PROJECT

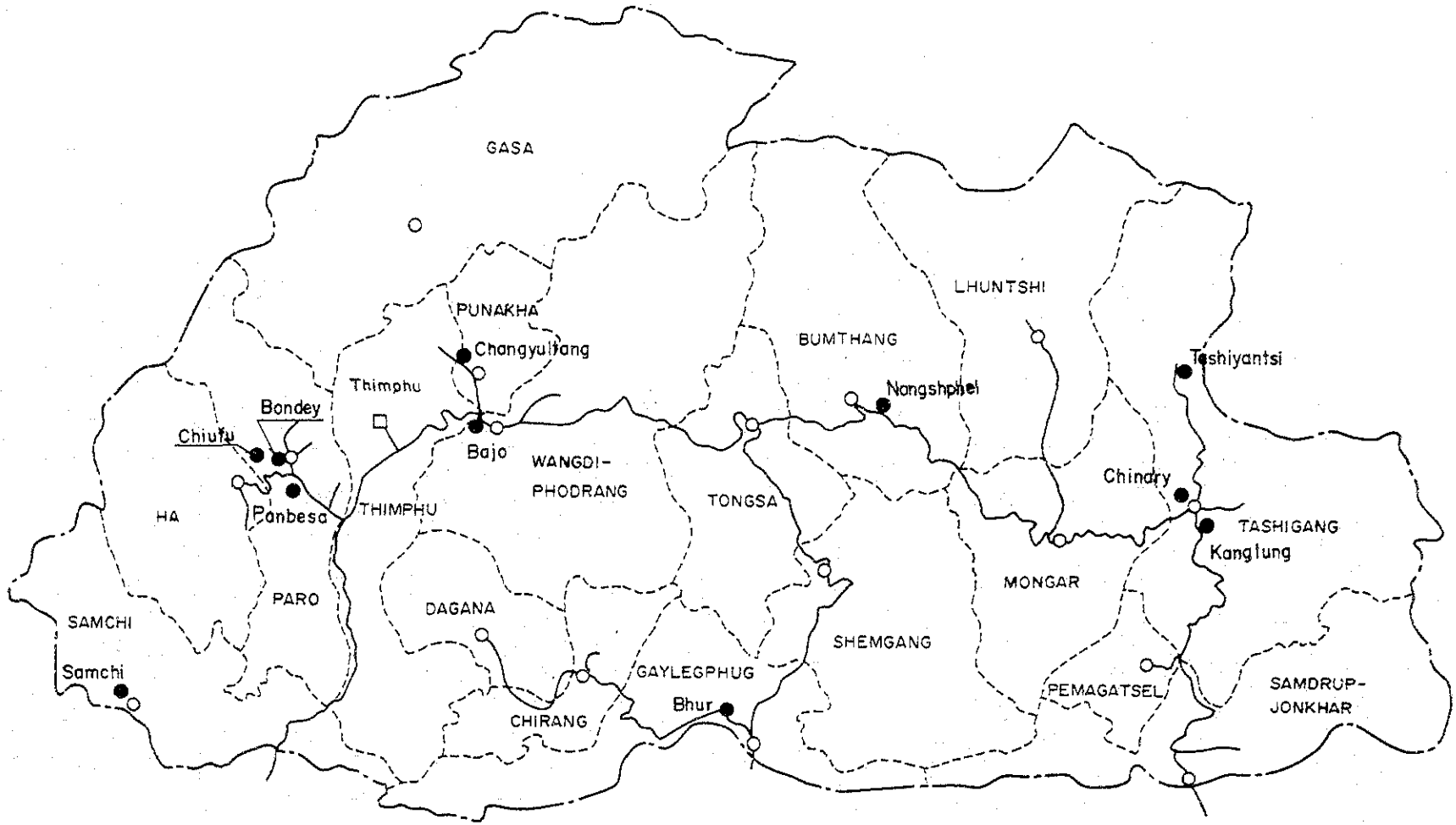


Fig-Ⅶ.2 EXISTING NASEPP FARMS

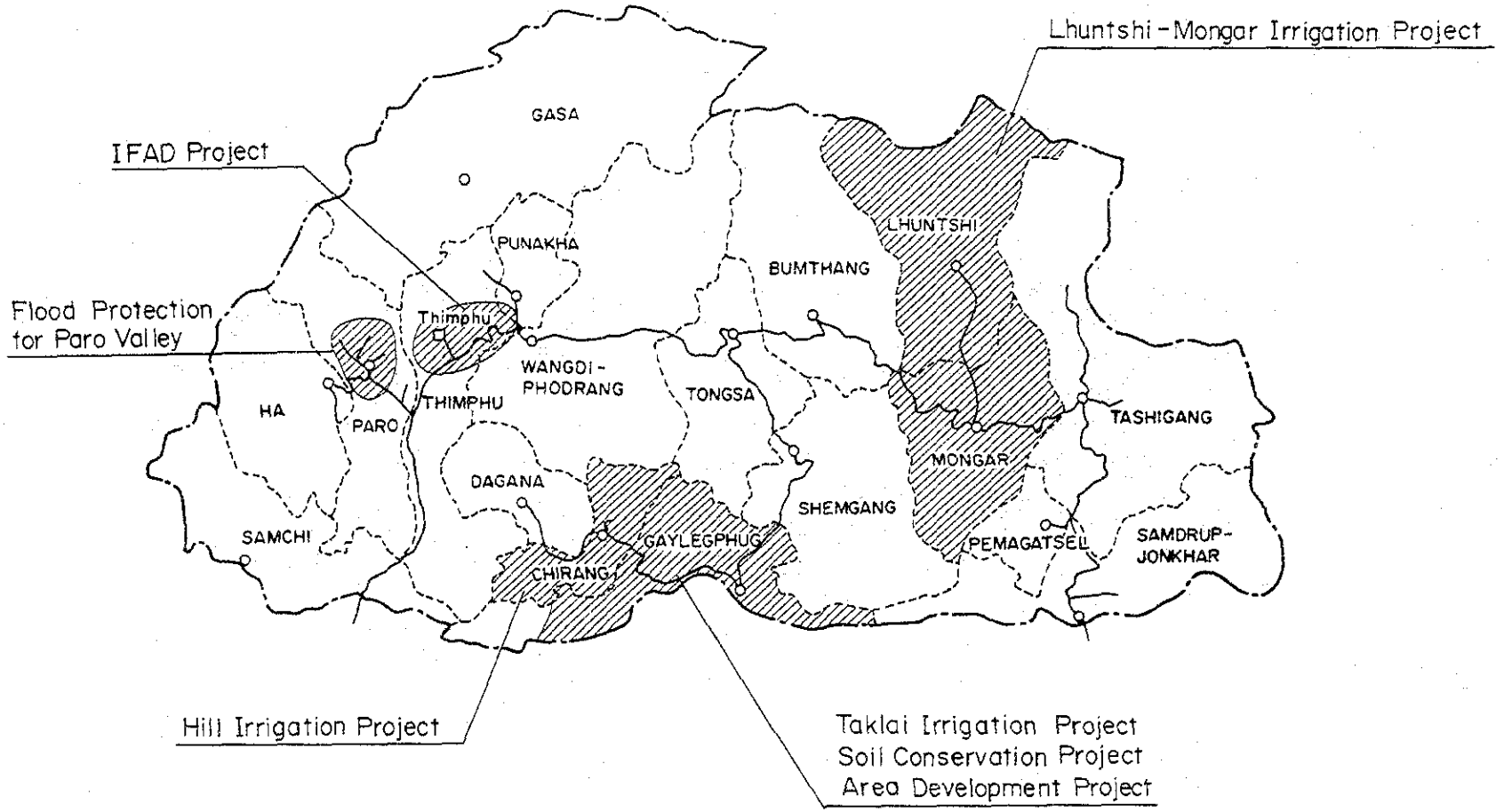


Fig-VII.3 ONGOING AND PLANNED AGRICULTURAL PROJECTS

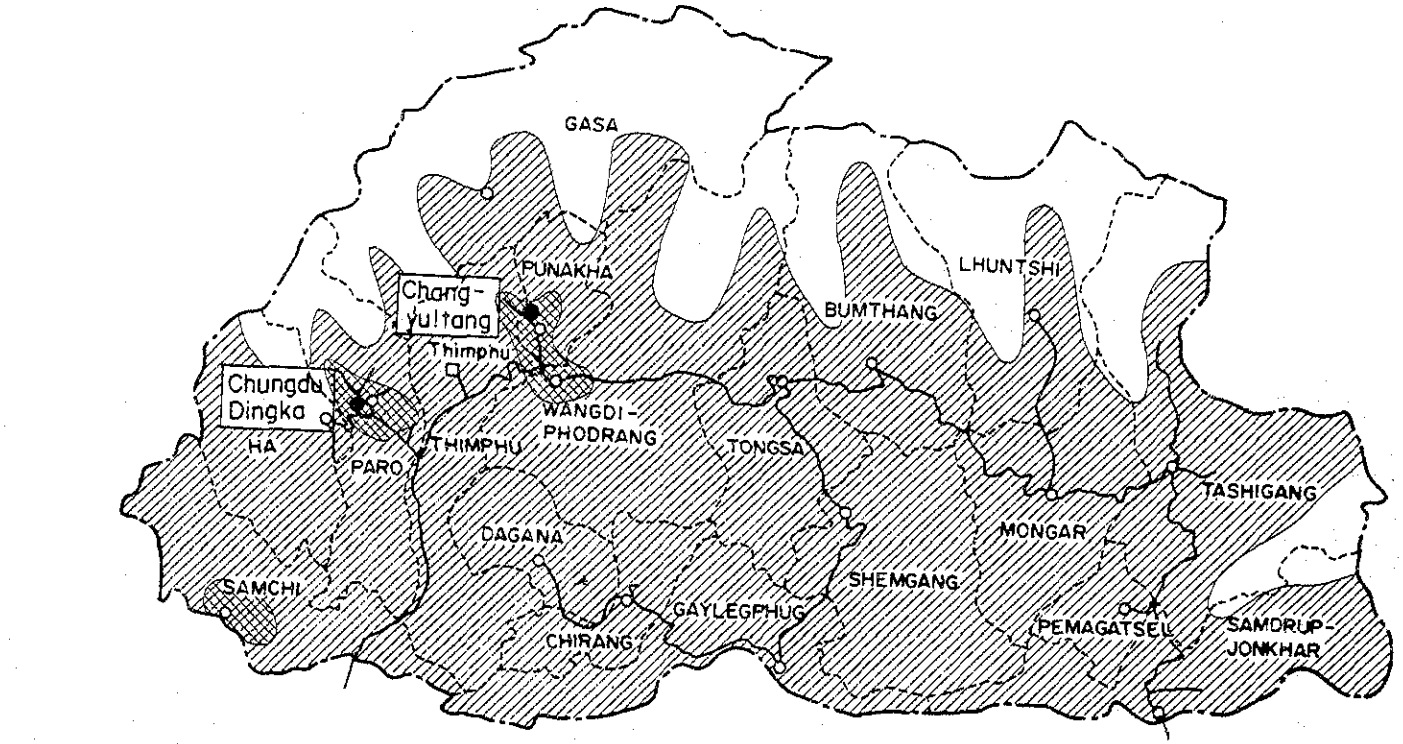
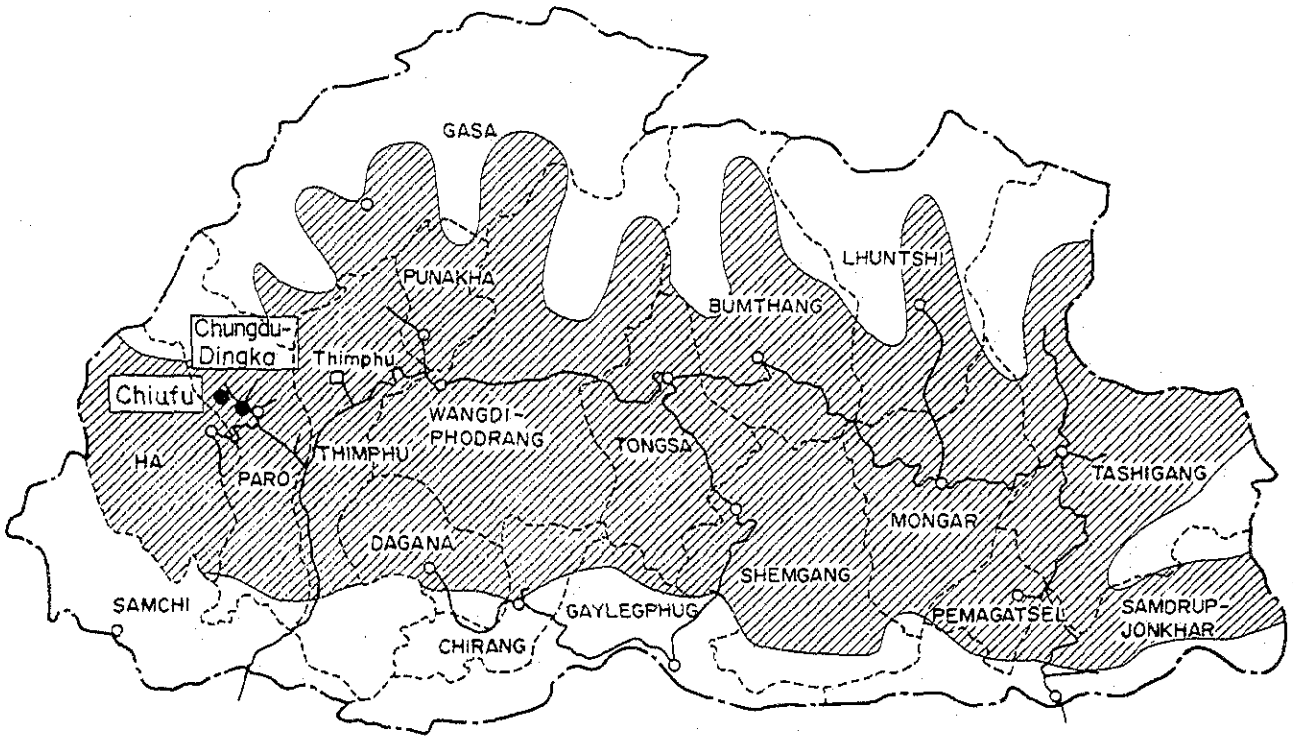


Fig-VII.4 COVERAGE AREAS OF CHUNGDU-DINGKA HEADQUARTERS AND CHANGYULTANG BRANCH



Seedling Supply of Temperate Fruits

Fig-VII.5 COVERAGE AREAS OF CHUNGDU-DINGKA HEADQUARTERS AND CHIUFU BRANCH

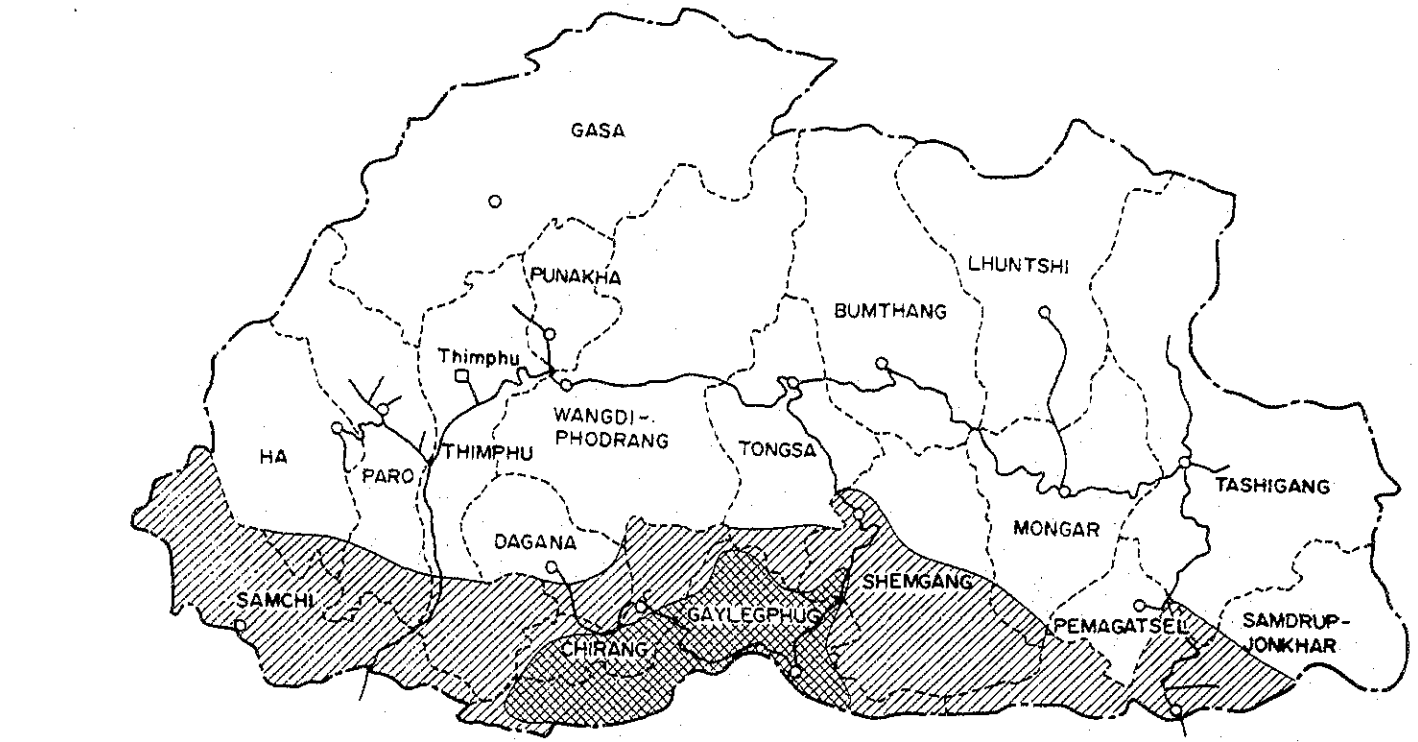


Fig-VII.6 COVERAGE AREAS OF GAYLEGPHUG BRANCH

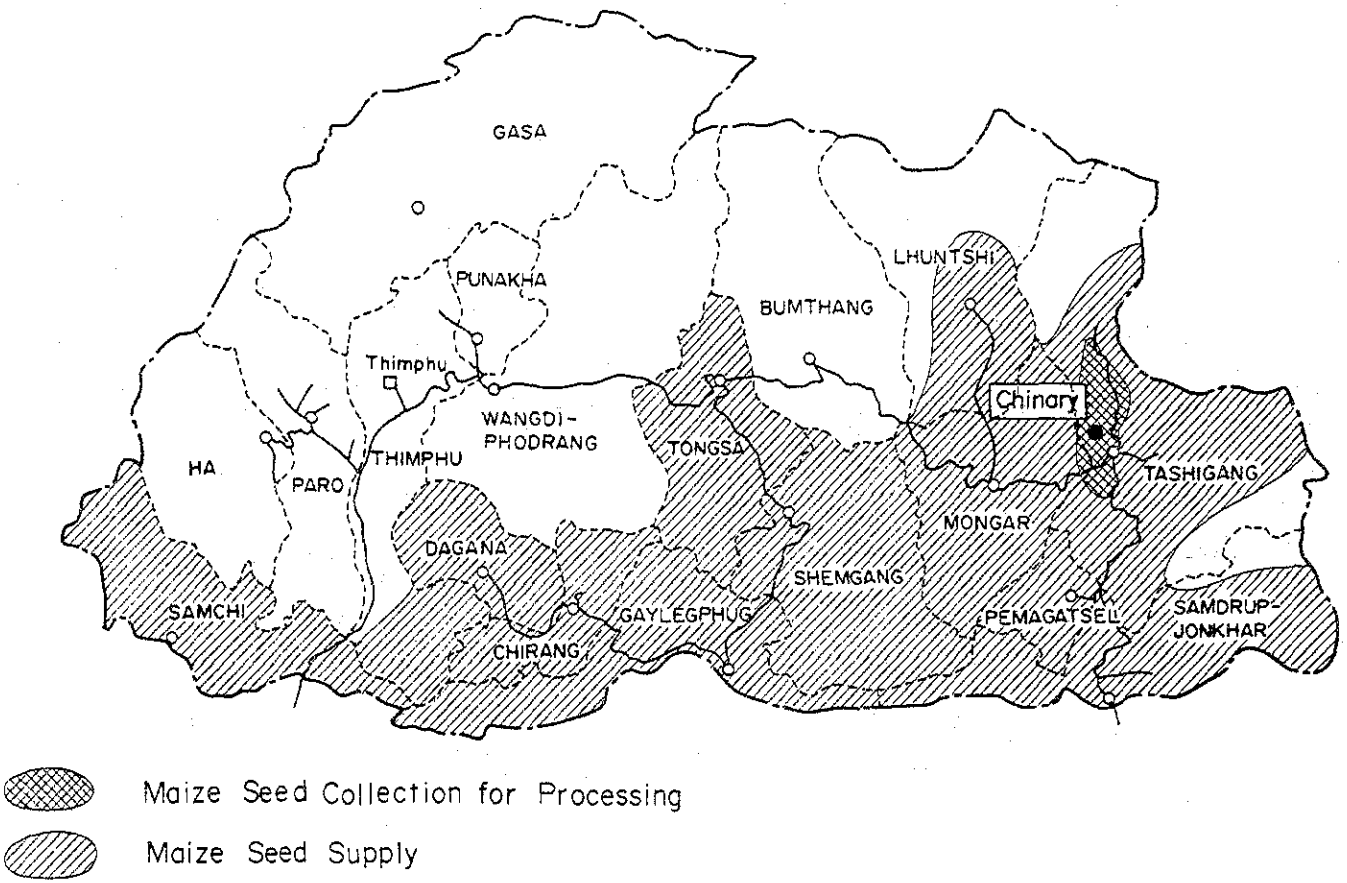


Fig-Ⅶ.7 COVERAGE AREAS OF CHINARY BRANCH

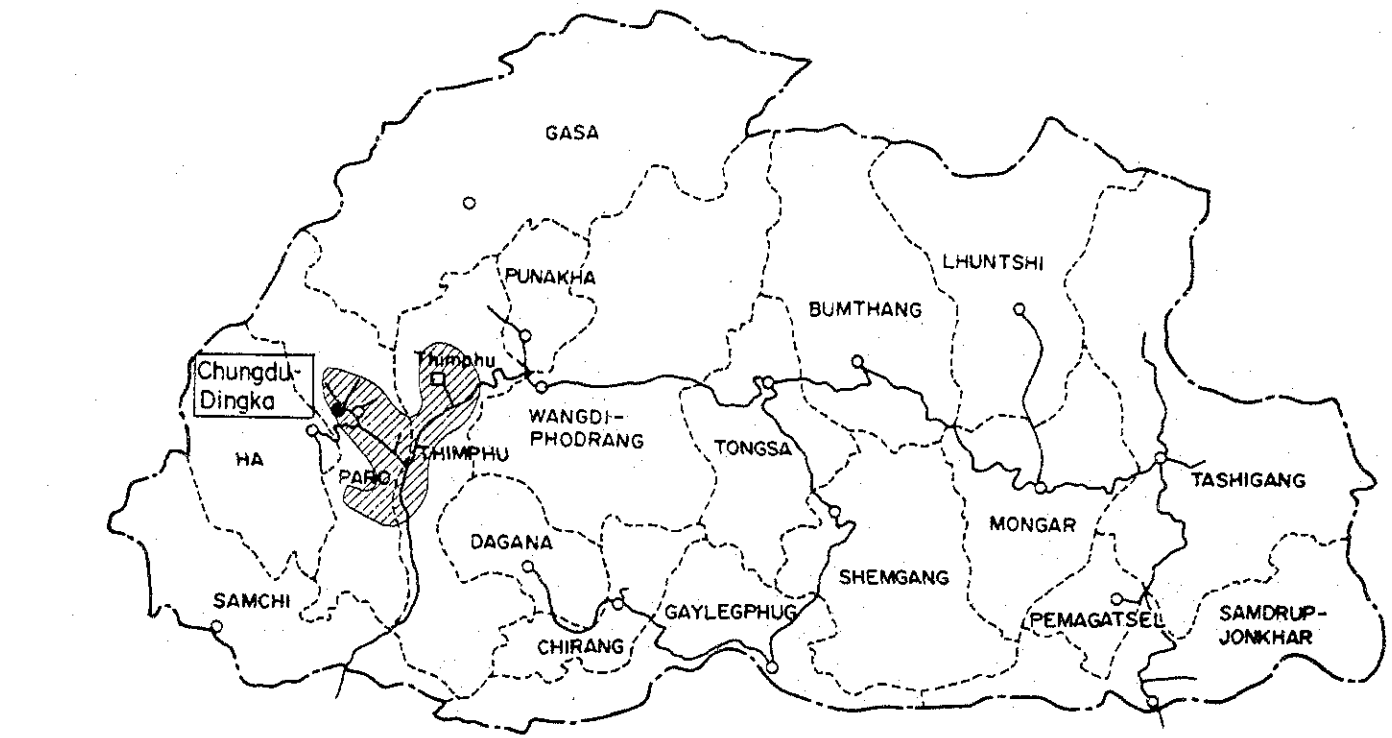


Fig-VII.8 .COVERAGE AREA OF CHUNGDU-DINGKA HEADQUARTERS

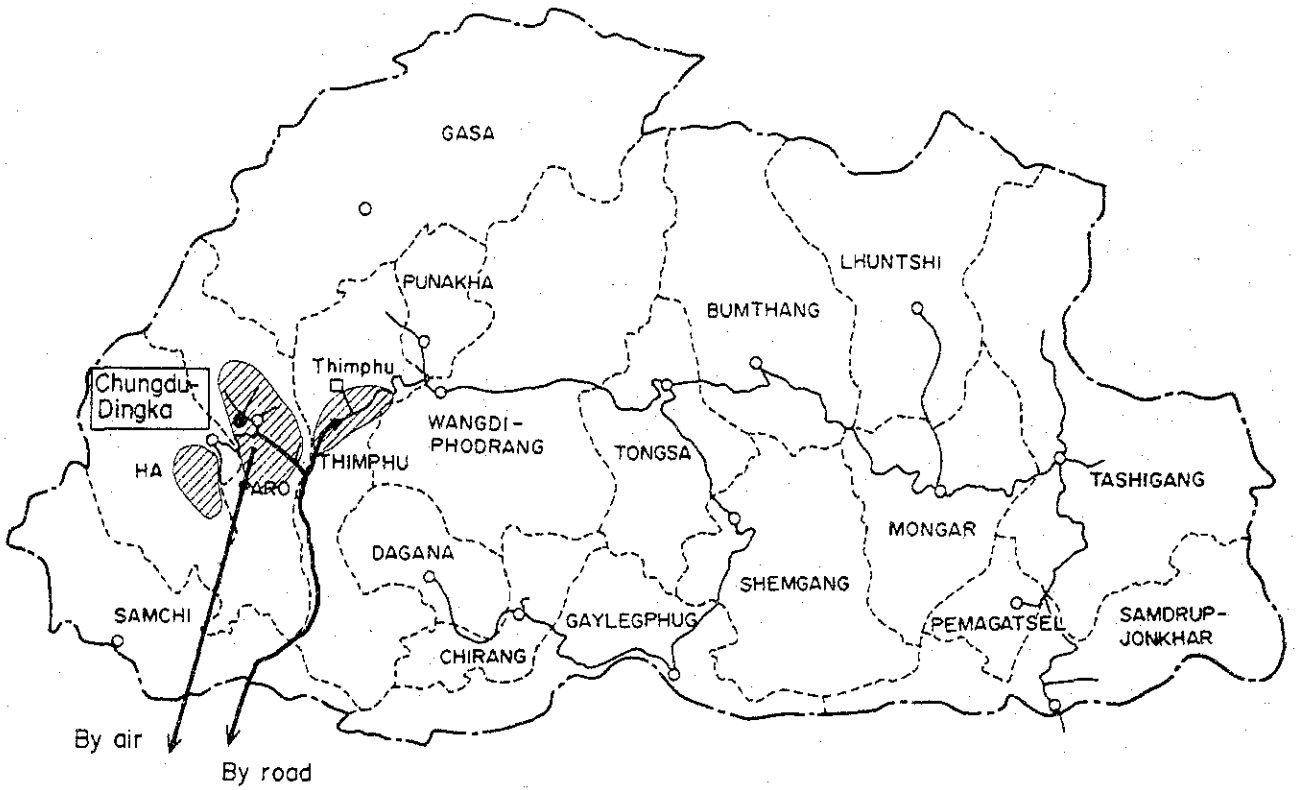
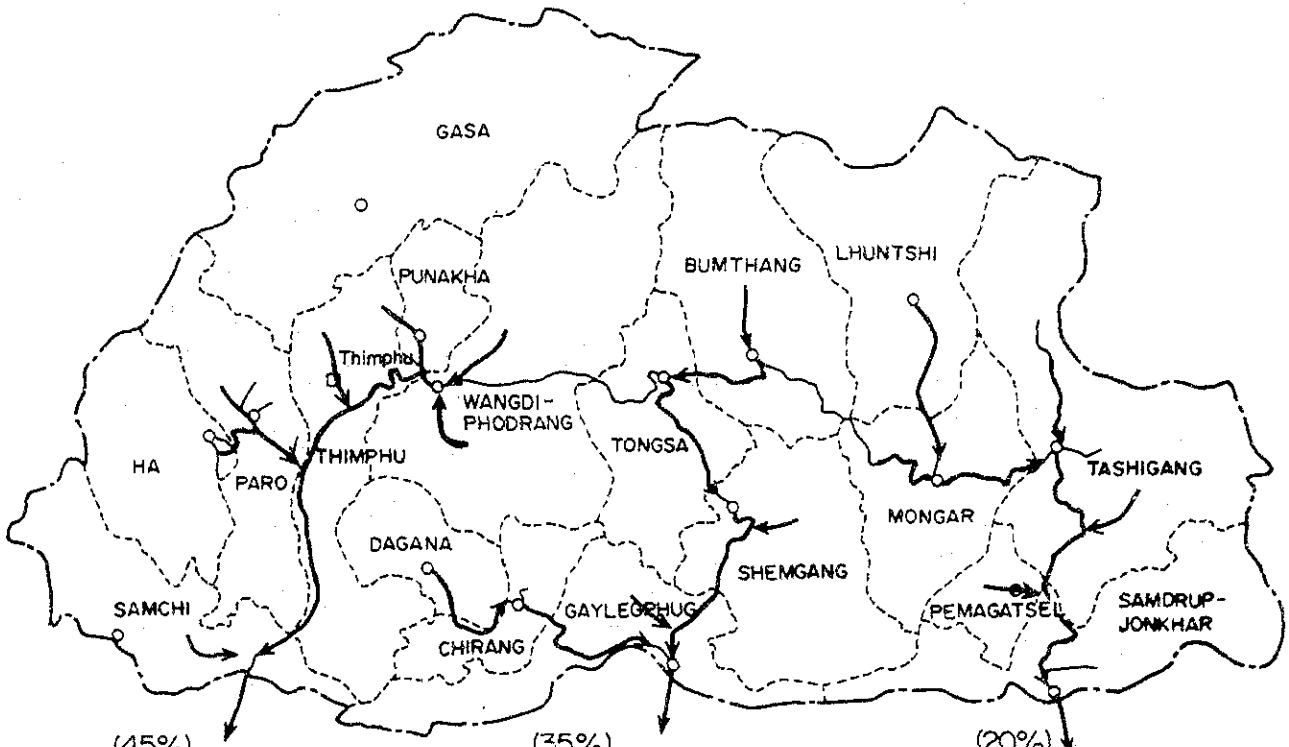


Fig-Ⅶ.9 COVERAGE AREAS OF CHUNGDU-DINGKA HEADQUARTERS



Note:
Percentages are weights each outlet occupies

Fig-VII.10 CASH CROP COLLECTION & EXPORT OUTLETS

VII-2 Construction

1. Bhutan Architecture

Bhutan's traditional architecture has a telltale influence of Tibetan architecture. The castle-like dzongs and farm houses are the typical Bhutanese architectural scenery. Gently tapering walls and wooden superstructure are the major components and cornice type decor on the wall, curved window frames and painted mandala patterns on walls and ceilings are a unique feature of these buildings.

Modern high-rise buildings are not in existence. Government offices, schools, apartment houses and commercial building are all built preserving the traditional design. Flat-roofed buildings are only found in towns along the southern border such as in Phuntsholing city.

The Royal Government is determined to preserve the traditional architecture incorporating modern technology; in urban areas, flat roofed buildings are prohibited and the exterior of the buildings are required to incorporate the traditional design features.

(1) Farm House

Bhutanese farm houses are primarily independent house, 3-storied, in which farm families are living the sitting life. Ground floor is constructed of masonry-mud wall and used as livestock barn or crop storage. Second floor is the living space and roof attic open barn for drying and storing seed and crops. Details of a typical farm house is given in Fig.-VII.11.

1) Daily life is led on the second floor where the Buddhist altar room plays an important role.
2) Second floor is wooden structure where walls are made of mud with bamboo reinforcement and finished with plaster.
3) Roof is also constructed of wood, with not framed truss but beam-and-post type structure to form the roof ridge.
4) Exterior and interior walls and ceilings are decorated with colorful mandala patterns. Painting materials are rock pigments.
5) Windows are all sliding window.

6) Timbers are primarily local blue pine.

7) Roofs are tiled with shale stone tile or wood shingles. Stone roof tile are becoming expensive because of scarcity besides it is liable to cause leakage. Wood shingle on the other hand is not so durable, requiring a replacement every 5~6 years. Corrugated iron sheet roofing is gradually becoming popular.

8) Construction is done by farm carpenters. Apprentice system is still widely practiced.

9) No metal nail or clamp was used in construction in the old days. Jointing of timbers is rather simple.

(2) Castle Building (Dzong)

The buildings are called "Dzong". There is a Dzong in every district and used as district government office, and sometimes as residence of monks. The Dzong is a symbol and the center of administration and religious life of the district. They have been built strategically on commanding hills or at confluence of rivers as they were castle in origin. Their gently tapering white wall and colorful, decorated wooden superstructure well match with surrounding forest green making an impressive landmark. Their classic beauty is widely referred to as the major tourism attraction.

Construction and architectural features are the same as the farm house.

(3) Modern Buildings

Construction materials available in Bhutan are such basic materials as timber, masonry stone, sand and gravel and roof tiles which the traditional buildings are made of.

Cement and plywoods have come to be available as a new cement and timber processing factories have been completed lately. With the introduction of new materials, building construction is being modernized; reinforced concrete structure and hollow concrete masonry block walls. This is more conspicuous in public and commercial buildings in cities such as Thimphu. Roofs of these buildings, however, are not allowed to be flat as discussed previously. With those cornice type decor, curved window frame and colorful mandala patterns, external look of these modern buildings is still very much of the traditional Bhutan architecture.

Corrugated iron sheet roofing is becoming widespread in urban areas, however it is giving a little monotonous and poor scenery as the colors of imported paint are limited.

Construction of public buildings are usually entrusted to contractors where some of the basic materials are often supplied by Public Works Department.

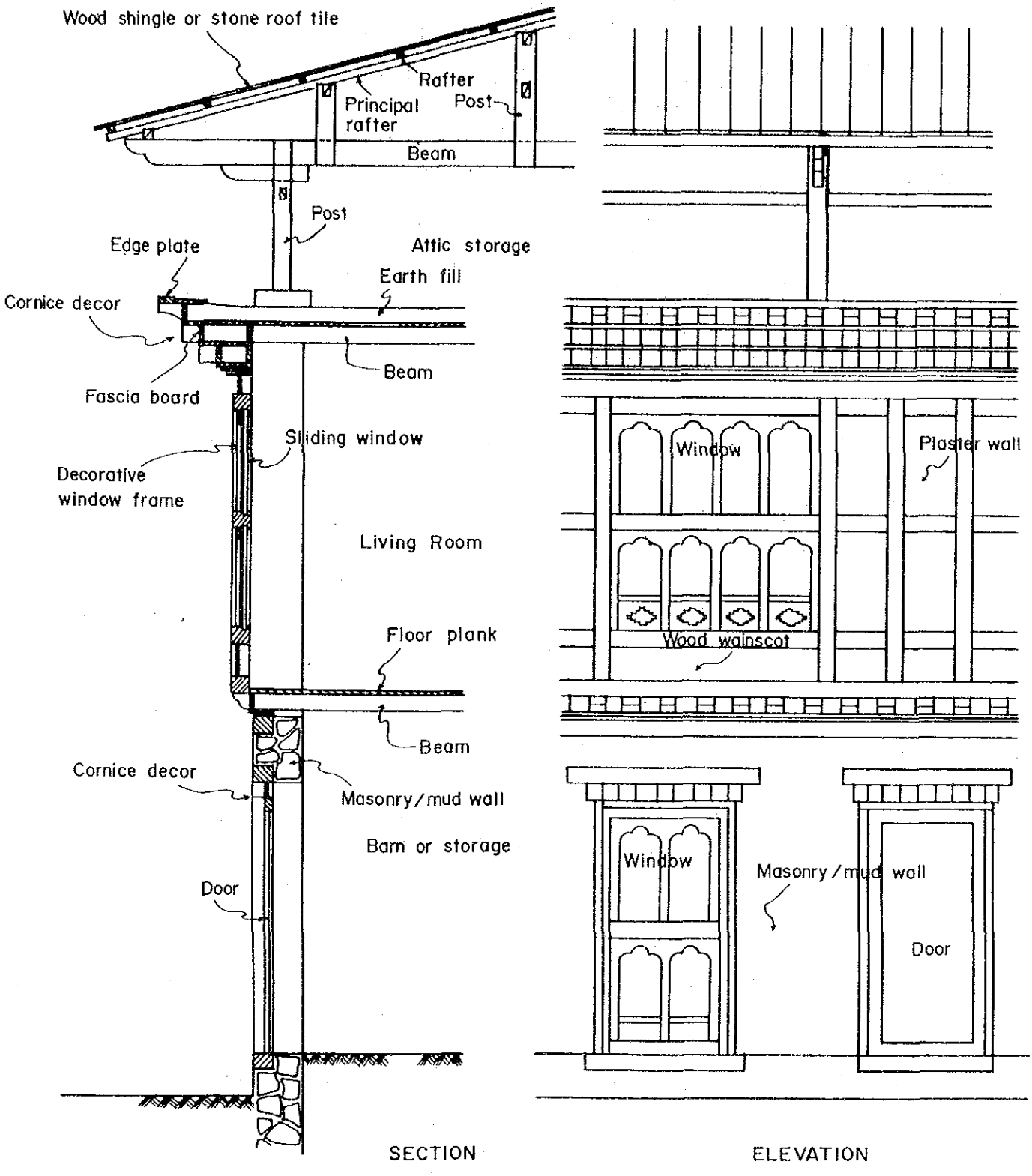


Fig.-VII. 11 TYPICAL BHUTANESE BUILDING (FARM HOUSE)

2. Codes and Standards

(1) Building code in Bhutan is the Bhutan Building Rules established in 1983. The Rules are however applied in urban area only and not nationwide yet.

(2) Any design standard has yet to be established. The Public Works Department has its own specifications for public works constructions, which is based on the Indian specifications.

(3) Design criteria applicable to the design of the Project are as follows:

a)	Material specifications	:	Indian standard
b)	Civil/building structural design standard	:	Indian design standard of ultimate strength design for R.C & semi rigid steel structures
c)	Structural design factor		
	Seismic horizontal coefficient	:	K = 0.08 (applicable to not less than 4-storied building)
	Wind force	:	q = 150 kg/m^3
	Concrete strength (4-weeks)	:	M150 = 150 kg/cm^2 M200 = 200 kg/cm^2 M250 = 250 kg/cm^2
	Tensile strength of reinforcement bar	:	Ultimate fu = 4,250 kg/cm^2 Elastic design ft = 2,300 kg/cm^2
	Tensile strength of structural steel	:	Ft = 1,500~1,600 kg/cm^2
d)	Characteristics of electric power	:	ϕ3, 4 wires, 425/230 V, 50 Hz
e)	Road design standard	:	Guidelines for Urban Roads in Bhutan - Naitonal Urban Development Corporation

(4) Building permit is required in urban areas only. Application is made to the District Officer with such drawings as site plan, building plans, elevation, drainage plan and structural plan (as required).

3. Contractors

There are no large-scaled contractors in Bhutan. This is because of sluggish construction business and meager private capital. Large-scaled constructions such as Chuka Hydro-power Project are mostly financed by Indian aid and executed by Indian contractors.

Bhutanese contractors are classified into ranks from A to E according to the content and scale of the works by the Public Works Department for public constructions as shown in the following table.

OFFICE OF THE DIRECTOR
P.W.D. THIMPHU, BHUTAN — 1 July, 1986

LIST OF CONTRACTORS

10 lakh = 1 mill. Nu.

Name of Contractor/Firm	Category	Remarks
1. Major Kuenley Dorji Post Box No. 190, Phuntsholing	A (for both bldg. & road works)	Can be awarded more than 20 lakhs
2. Mr. Gaseb Gyeltshen c/o Dawa Yargay T/Khang, Shop 1, Line-2, Thimphu	- do -	- do -
3. M/s Yarkey Enterprises (Mr. Omtey Penjor), Phuntsholing	- do -	- do -
4. Mr. Gap Gyeltshen c/o Phuntsho Rapten T/Khang P.O. Box - 194, Thimphu	- do -	- do -
5. M/s Tashi Commercial Corporation Phuntsholing	A (for bldg. works)	- do -
6. M/s Nima Tshongkhang Phuntsholing	- do -	- do -
7. Mr. Lhenkey Gyaltsheng M/s Dhendup T/Khang, Phuntsholing	- do -	- do -
8. M/s Dharhlar Construction Company Thimphu	- do -	- do -
9. ~ 23. (Omitted)	B	Up to 20 lakhs
24. ~ 35. (Omitted)	C	Up to 10 lakhs
36. ~ 39. (Omitted)	D	Up to 5 lakhs
40. ~ 47. (Omitted)	E	Up to 1 lakh

4. Construction Cost

(1) There are obvious regional difference in construction costs in Bhutan. This is due to the fact that all imported materials and equipment come from India through border towns, most of the contractors have their head offices in these border towns, and transportation of materials is very difficult due to the rugged terrain.

Regional cost differentials are usually indicated based on Phuntsholing city by applying coefficients as shown below:

	Cost differencial
Phuntsholing city (Southern region)	100
Thimphu city (Western region)	115
Paro city (Eastern region)	113
Gaylegphug city (Southern region)	110
Tashigang city (Eastern region)	125

(2) Construction costs are susceptible to price hikes of Indian materials. Lots of materials such as reinforcement bars, structural steels, roofing sheets, paints, electric equipment and materials, pipes, sanitary ware, etc. are imported from India and their price hikes, often abrupt, are directly reflected in the costs in Bhutan. Overall construction cost hike is said to be around 15% a year in recent years. Statistic variables are not available.

Construction cost and consumer price index are not always collateral, in Bhutan, however, the both show a similar tendency (Refer to Fig.-VII.12)

(3) Construction cost can be divided into two components, material cost and labor cost. Material cost is predominant with 65~70% share. There are also regional differences in the proportion as shown below:

	Material Cost	Labor Cost
Western region	70 %	30 %
Central & Eastern region	65	35
Southern region	65	35

(4) Average costs per unit floor area of various kind of buildings are as given below:

Thimphu city (1986)

a)	Farm houses	@2,500~3,000 Nu./m^2 (or 130,000~140,000 Nu./house)
b)	Office buildings	2,500~3,250
c)	Hotels	3,250~4,000
d)	Warehouses	2,250~2,500
e)	Private residences	2,500~3,500

Phuntsholing city (1986)

a)	Farm houses	@2,500~3,000 Nu./m^2 (or 130,000~140,000 Nu./house)
b)	Office buildings	2,500~3,250
c)	Hotels	3,250~4,000
d)	Warehouses	2,250~2,500
e)	Private residences	2,500~3,500

Generally speaking, there is not a large difference in grades of buildings in Bhutan; they all have an average quality as urban slum or modern buildings are not existing. It is generally said that genuinly traditional Bhutanese buildings cost about 15% more than the contemporary buildings because of lot more use of timber with much dexterity and decorations.

(5) Labor wages and their trend is as shown below:

Labor Wages (Phuntsholing city)

(Unit: Nu.)

Description	Unit	1984/85	1985/86	1986/87	Average Annual Hike
1. Skilled labor	day	25	30	35	13 %
2. Unskilled labor	day	8	12	15	30
3. Draftsman	month	650	800	1,000	18
4. Driver	month	400	500	650~800	25
5. Plumber	day	15	20	25	22
6. Carpenter	day	20	25	30	17
7. Mason	day	20	25	30	17
8. Steel bar bender	day	15	20	25	22
9. Painter	day	15	20	25	22
10. Electrician	month	600	650	750	8
11. Mechanic	month	600	700	800	11

Average Wages (Thimphu city 1986)

1. High ranking government officer (minister level) : 5,000 Nu./month
2. Ordinary government employee : 1,000~1,100 Nu./month
3. New graduate : 800 Nu./month

Labor Wages (Thimphu city 1986)

Description	Nu./day	Description	Nu./day
1. Field supervisor	125	15. Plumber	50
2. Engineer	300	16. Mason	50
3. Junior engineer	100	17. Painter	50
4. Accountant	100	18. Machine operator	50
5. Office clerk	75	19. Driver	50
6. Secretary	100	20. Interpreter	-
7. Typist	75	21. Draftsman	75
8. Foreman	125	22. Common labor	27
9. Carpenter	50	23. Servant	27
10. Plasterer	50	24. Maid	25
11. Steel bar bender	50	25. Cook	30
12. Welder	65	26. Store keeper	100
13. Mechanic	65	27. Guardsman	27
14. Electrician	65		

(6) Major material costs and their trend are as follows:

Major Material Costs (Phuntsholing city)

Materials	Unit	1984/85	1985/86	1986/87	Average Annual Hike
1. Cement	bag	41.87	46.64	46.64	4 %
2. Brick	200 pcs	700	750	850	7
3. Re-bar	ton	5,900	6,500	7,500	9
4. Timber	ft^3	30	40	50	22
5. Gravel	m^3	70	85	105	17
6. Sand	m^3	20	22	35	25
7. Iron sheet	sheet	52	58	67	10
8. Plywood	sheet	2.1	2.45	3.0	14
9. Paint	ℓ	26.5	29.0	34.0	9
10. Finished timber	ft^3	125.0	150.0	200.0	20

Major Material Costs (Thimphu city)

Materials	Unit	1984	1985	Average Annual Hike
1. Cement	kg	1.22	11.44	9 %
2. Sand	m^3	122.5	158.0	14
3. Gravel	m^3	105.0	200.0	45
4. Timber	m^3	1,348	1,750	15
5. Structural steel	ton	6,853	10,500	27
6. Re-bar	ton	5,866	8,000	18
7. Diesel oil	ℓ	3.50	3.78	4
8. Light oil	ℓ	2.14	2.60	11
9. Gasoline	ℓ	6.40	7.64	10

(7) Construction Machines

The Bhutanese contractors do not possess heavy construction machine; those in hand are portable concrete mixer, rock crushing machine, bar bending machine, carpentry machine and the like. Hereunder given are the hire charges of heavy construction machines of Bondey Farm, the sole institute having such machines in Bhutan.

(Unit: Nu.)

Machine	Per Hour	Per Day
1. Bulldozer D50	500	3,000
2. Bulldozer D20	350	2,100
3. Caterpillar loader	500	3,000
4. Wheel loader	500	3,000
5. Excavator	400	2,400
6. Air compressor	250	1,500
7. 4-wheel tractor	100	600

Hire charge of truck (8 ton) : 800 Nu./day or 1.8 Nu./ton/kg

(8) Other Costs

Fuel Prices (Phuntsholing city)

	Materials	Unit	1984/85	1985/86	1986/87	Average Annual Hike
1.	Gasoline	ℓ	5.88	6.72	7.12	7 %
2.	Diesel oil	ℓ	3.08	3.23	3.35	3
3.	Lubricant	ℓ	15.94	15.90	15.90	0

Hotel Charges

Paro city	:	165 Nu./day (excl. meals)
Thimphu city	:	165
Gaylegphug city	:	-
Phuntsholing	:	275
Tongsa city	:	-
Mongar city	:	-

House Rent

Thimphu city	:	5,000~8,000 Nu./month

Car Hire Charge (Thimphu & Paro city)

Land cruiser	:	350 Nu./day (4.9 Nu./km for excursion)
Sedan	:	250 Nu./day (4 Nu./km for excursion) (incl. fuel and driver charge)

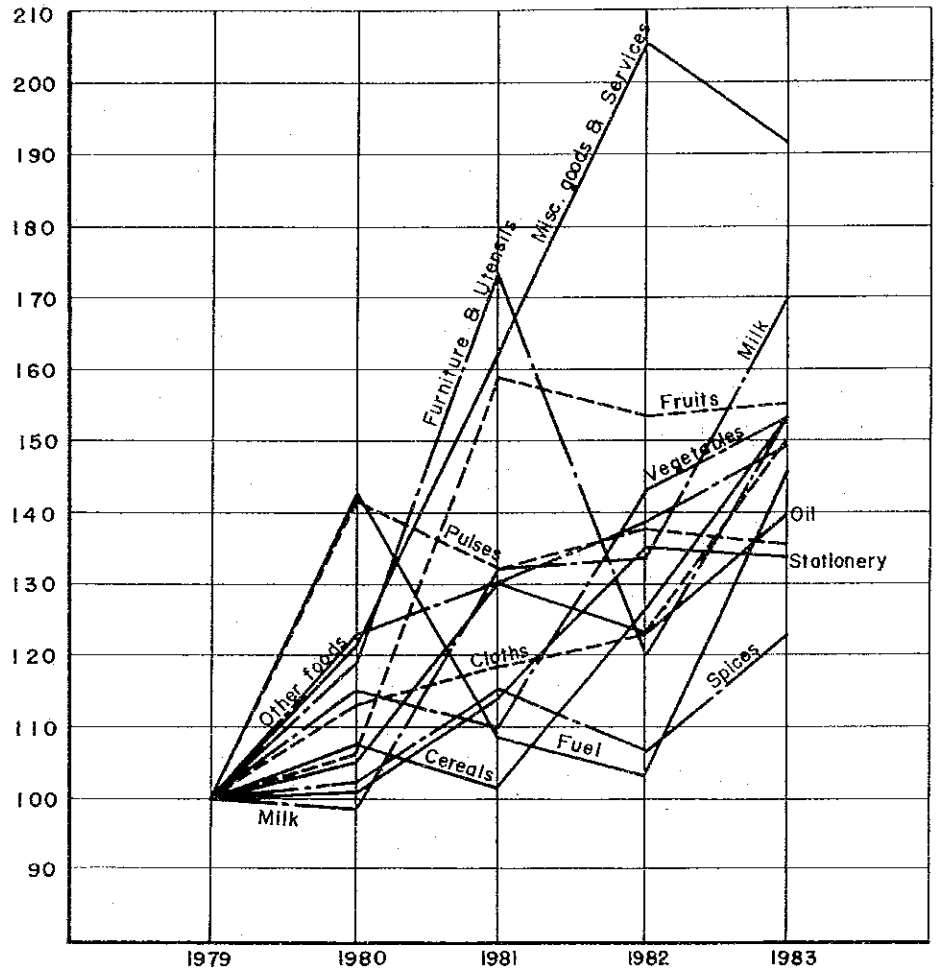


Fig-VII.12 CONSUMER PRICE INDEX