

**REPORT ON THE IMPLEMENTATION DESIGN SURVEY  
OF THE MODEL INFRASTRUCTURE WORK  
FOR THE FOREST RESEARCH PROJECT  
IN PAPUA NEW GUINEA**

JULY 1990

**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**





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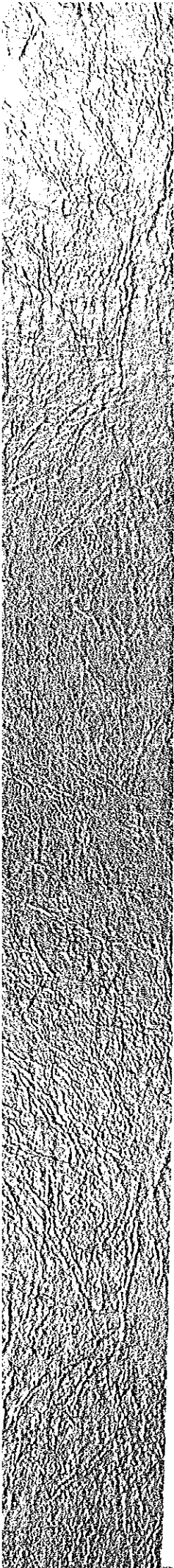
JULY 1990

JAPAN INTERNATIONAL COOPERATION AGENCY  
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国際協力事業団

21409



Nursery site (Lae)



Nursery site (Lae)



Experimental plantation site (Bulolo)



Experimental plantation site (Bulolo)



Proposed experimental natural forest (Oomsis)



Proposed experimental natural forest (Oomsis)

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## ABBREVIATION

AGK	: AGK Pacific (NG) PTY. LTD. (Lae)
C/P	: Counterpart,
DBH	: Diameter at Breast Height,
F'c	: Design strength of concrete
FRI	: Forest Research Institute (Lae)
JANT	: JANT PTY., LTD. (Madang)
JICA	: Japan International Cooperation Agency
JOCV	: Japan Overseas Cooperation Volunteers
kPa	: Kilopascal, $1\text{kPa} \approx 102\text{kg/m}^2$
MPa	: Megapascal, $1\text{MPa} \approx 102\text{t/m}^2$
OIDA	: Office of International Development Assistance, Department of Finance and Planning (Port Moresby)
POM	: Port Moresby
PNG	: Papua New Guinea
R/D	: Record of Discussions
TITC	: Timber Industry Training College (Lae)
TRP	: Timber Right Purchase
UNITEC	: The Papua New Guinea University of Technology (Lae)
UNDP	: United Nations Development Programme
UPNG	: University of Papua New Guinea (Port Moresby)



## 1. Dispatch of Implementation Design Survey Team

### 1-1. Objectives of the Team

Papua New Guinea Forest Research Project which is the first Japanese technical cooperation project has started on April 1, 1989 in order to conduct studies on forest establishment, conservation of forest resources, and efficient utilization of forest products in Papua New Guinea on the basis of Forest Research Institute which was established by the Japanese grant aid.

Up to this time, three long term experts, including team leader, and eight short term experts were dispatched to establish of the implementation system for the research.

The Implementation Design Survey Team (hereinafter referred to as the "Team" was dispatched to Papua New Guinea in order to design model infrastructures (nursery, experimental forest, and attached facilities) which are necessary for the research cooperation, after consultations with officers concerned of PNG's government, Japanese experts, and the JICA Consultation Team with regard to the arrangement.

### 1-2. Members of the Team

*The Team consisted of the following members:*

- 1) Dr. Yutaka Taguchi, Chief Researcher, Japan Forest Technical Association, team leader and in charge of design of nursery and experimental forests.
- 2) Mr. Tsutomu Yoshimura, Chief Investigator, Japan Forest Technical Association, in charge of design of attached facilities.

### 1-3. Survey Schedule

Survey schedule is shown in the following table.

Table 1. Survey Schedule

Date	Place	Activity
Sun. Apr. 8	Tokyo	
Mon. Apr. 9	POM	Courtesy call on JICA office
Tue. Apr. 10	POM	Courtesy call on Embassy of Japan, OIDA
Wed. Apr. 11	POM ——— Lae	Meeting with Japanese Experts
Thu. Apr. 12	Lae ——— Bulolo	Observation of FRI Bulolo Station, National Forest
Fri. Apr. 13	Bulolo ——— Lae	Observation of McAdam National Park, Mumeng Forest Station, Proposed site at Oomsis
Sat. Apr. 14	Lae	Rough mapping of Oomsis site
Sun. Apr. 15	Lae	Visiting UNITEC, Arrangement of survey equipment
Mon. Apr. 16	Lae	Meeting with Japanese experts
Tue. Apr. 17	Lae	Visiting TITC, Meeting with director of FRI
Wed. Apr. 18	Lae	Meeting with director and Management Branch head of FRI
Thu. Apr. 19	Lae	Arrangement of surveying materials, Determination of nursery site
Fri. Apr. 20	Lae	Arrangement of surveying materials, Surveying of nursery site
Sat. Apr. 21	Lae	Mapping of nursery site, Visiting UNITEC, Arrangement of materials
Sun. Apr. 22	Lae	Mapping of nursery site
Mon. Apr. 23	Lae ——— Bulolo	Reconnaissance of proposed sites
Tue. Apr. 24	Bulolo	Surveying of experimental plantation site
Wed. Apr. 25	Bulolo	Surveying of experimental plantation site
Thu. Apr. 26	Bulolo	Surveying of experimental plantation site
Fri. Apr. 27	Bulolo	Surveying of experimental plantation site
Sat. Apr. 28	Bulolo ——— Lae	Observation of nurseries at Bulolo
Sun. Apr. 29	Lae	Mapping of experimental plantation site

Table 1. Survey Schedule. (Continued)

Date	Place	Activity
Mon. Apr. 30	Lae	Meeting with head and staff of Management Branch, FRI
Tue. May 1	Lae	Surveying of nursery site, Information collection
Wed. May 2	Lae	Reconnaissance of natural forest at Oomsis
Thu. May 3	Lae — Madang	Visiting Office of JANT
Fri. May 4	Madang	Observation of Nurseries of JANT and National Forest
Sat. May 5	Madang — Lae	Observation of plantation at Markahm basin
Sun. May 6	Lae	Arrangement of materials
Mon. May 7	Lae	Informations collection at the Department of Works
Tue. May 8	Lae	Data collection at UNITEC and hardware shops, Surveying of nursery site
Wed. May 9	Lae	Data collection at Provincial Forest Office and hardware shops
Thu. May 10	Lae	Final meeting with director and staff of FRI
Fri. May 11	Lae — POM	Meeting at JICA office
Sat. May 12	POM	Information collection at UPNG
Sun. May 13	POM	Arrangement of collected data and materials
Mon. May 14	POM	Data collection at the Department of Forests, Mapping Bureau and Geological Survey
Tue. May 15	POM	Data collection at the Embassy of Japan, Department of Agriculture and Livestock
Wed. May 16	POM — Cairns	Data collection at Department of Agriculture and Livestock and Department of Forests
Thu. May 17	Cairns — Tokyo	

#### 1-4. Related Persons

Related persons to this project in Papua New Guinea are shown in the following table.

Table 2. List of Related Persons

Name	Position
Embassy of Japan	
Mr. Yasuo Noguchi	Ambassador Extraordinary and Plenipotentiary
Mr. Kenro Iino	Councillor
Mr. Shinsuke Yamazaki	First Secretary
Mr. Yutaka Fujiwara	Secretary
Japan International Cooperation Agency (JICA), Papua New Guinea Office	
Mr. Toshio Okazaki	Resident Representative
Mr. Akira Kumano	Assistant Resident Representative
Mr. Masayoshi Ohno	JOCV Coordinator
Mr. Toshiyuki Miyazawa	JOCV Coordinator
Office of International Development Assistance, Department of Finance and Planning	
Mr. Christopher Mero	Assistant Director
Mr. Francis Wagaia	Officer
Mr. Masanobu Kiyoka	Advisor, JICA Expert
Department of Forests	
Mr. Alan B. H. Ross	Assistant Secretary, Task Force
Mr. Max L. M. Marupi	Cartography and Publications Section
Mr. Charlie Tawhiao	Forest Mapping Advisor, Cartography and Publications Section
Mr. David J. Skelton	Project Manager, Bulolo/Wau National Forest
Forest Research Institute (FRI), Department of Forests	
Dr. Simon Saulei	Director
Mr. Chawi Konabe	Deputy Director

Table 2. List of Related Persons. (Continued)

Name	Position
Mr. Edward Nir	Head, Forest Management Branch
Mr. Neville H. S. Howcroft	Section Head, Forest Management Branch
Mr. John Howard	Head, Bulolo Research Station
Dr. Tsutomu Kayama	Team Leader, JICA Expert
Mr. Masao Okada	JICA Expert
Mr. Masao Kohira	Coordinator, JICA Expert
Morobe Provincial Headquarters	
Ms. Agatha Poratou	Assistant Secretary, Provincial Forest Office
Mr. Poni Mitio	Head, District Forest Office at Mumeng
Mr. Marcel Oreke	Senior Works Supervisor, Department of Works
Timber Industry Training College	
Mr. Selarn Nawayap	Principal
University of Technology	
Mr. G. Vatasan	Senior Lecturer, Forestry Department
Mrs. Nina R. Vatasan	Senior Lecturer, Civil Engineering Department
Others	
Mr. Hiromitsu Doi	Advisor, JICA expert, Mapping Bureau
Mr. Joe Rau	Geological Survey, Department of Minerals and Energy
Mr. Vaughan Redfern	Senior Land Use Officer, Land Use Section, Department of Agriculture and Livestock

## 2. Survey Area

The field survey was executed at Lae in which the nursery site is located, at Oomsis in which the proposed experimental natural forest is located, and at Bulolo in which the experimental plantation site is located (see Fig. 1. & 2.).

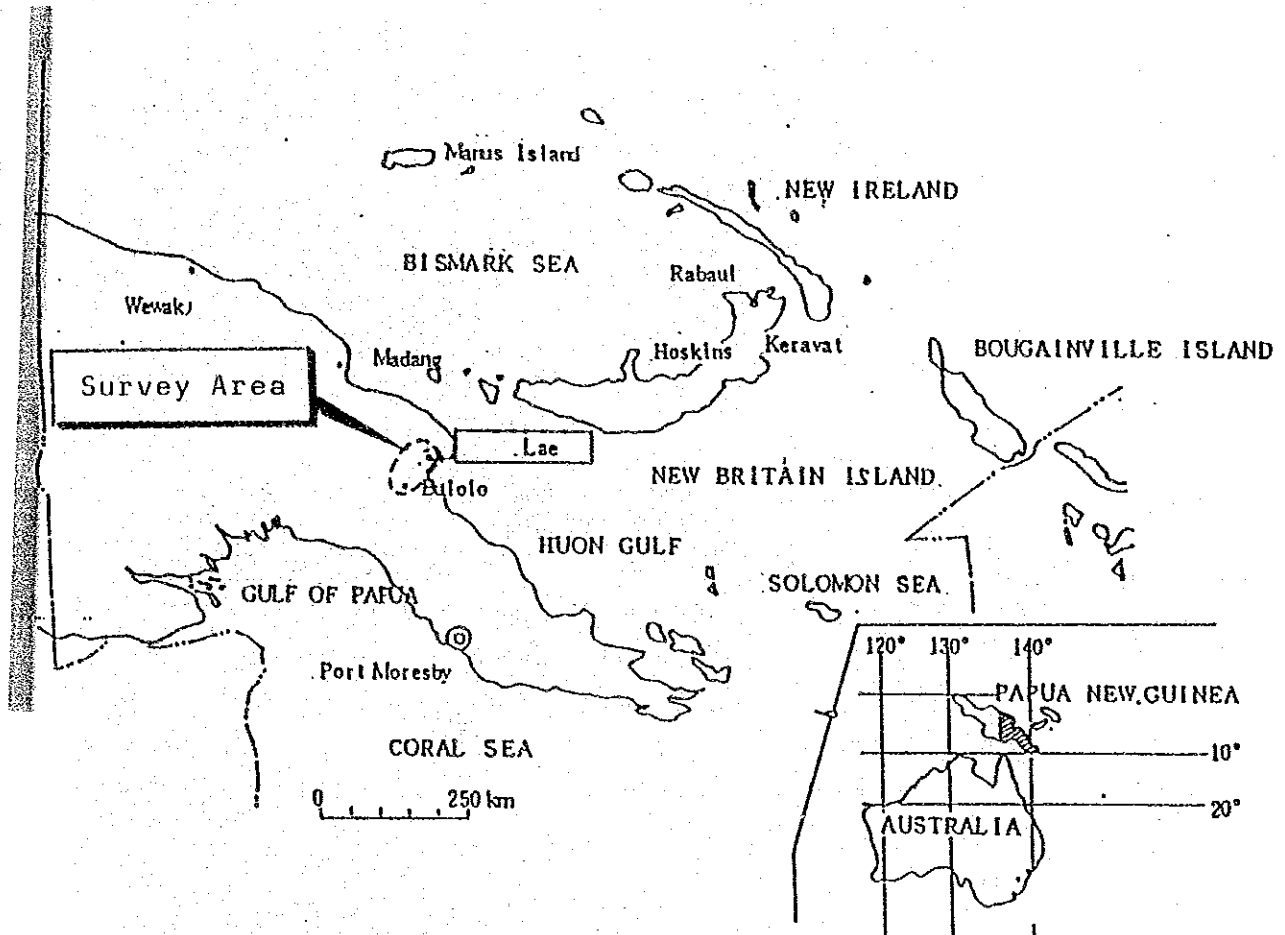
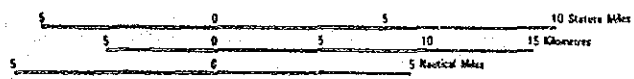
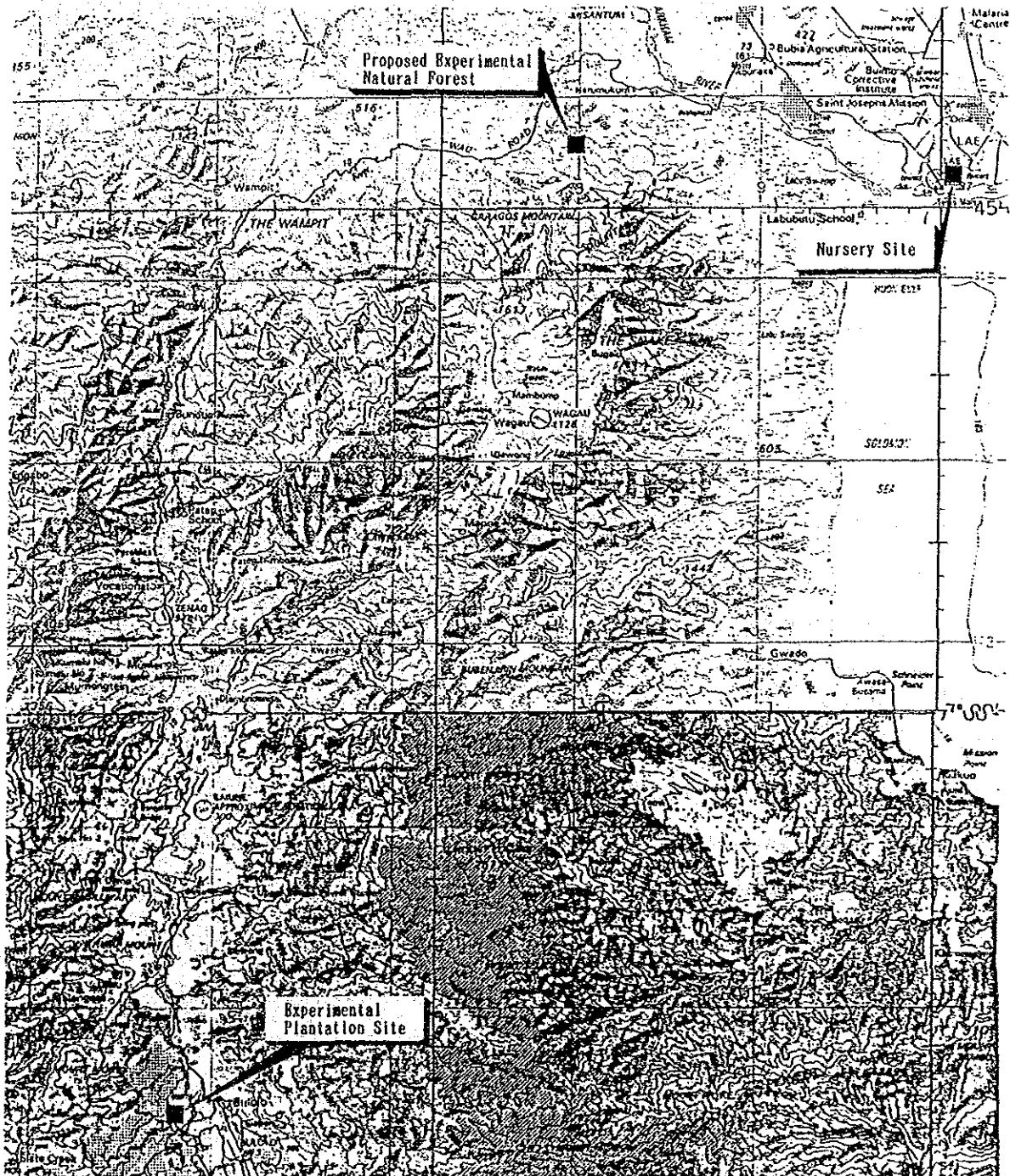


Fig. 1. Location of Survey Area



CONTOUR INTERVAL 200 METRES  
 WITH SUPPLEMENTARY CONTOURS AT 50 METRE INTERVALS BELOW 200 METRES

Fig. 2. Location of Nursery Site, Experimental Plantation Site and Proposed Experimental Natural Forest



### 3. Implementation Design of Nursery

#### 3-1. Basic Principle

The nursery will be used for research and is intended to meet as much as possible the general needs of researchers.

Nursery field will have germination beds, raised beds, irrigation and drain facilities, and shade facilities. In particular, raised beds will be for potted or bare root seedlings, and rooted cuttings. Annual production capacity of raised beds will be five-thousand seedlings for each of twenty species and one-thousand rooted cuttings for each of ten species.

Attached facilities will include a materials store (100 m<sup>2</sup>), a garage (60 m<sup>2</sup>), an oil store (10 m<sup>2</sup>), power, irrigation and drainage facilities, a laboratory, a working house, a hoister, shelter belts and wire fences.

#### 3-2. Circumstances of Determination of the Site

According to the report of the JICA Implementation Survey Team which was dispatched from November 5 to 19, 1988, three sites, including premises of FRI, provincial nursery at Oomsis, and a place at Bulolo were selected and Bulolo was excluded because of long distance from FRI.

This time, at first, it was requested to establish two nurseries, one at Oomsis and one at premises of FRI, but later it was found that the site at Oomsis is too small to establish a full-scale nursery which was intended in the basic principle and FRI can provide larger area at their premises than original one. At last, it was decided to establish a nursery at premises of FRI by agreement of the FRI officer, the Japanese experts and the JICA Consultation Team.

#### 3-3. General Situation of the Site

The site extends to the northwest of the north wing of the main building and is flat land between the cliff faced botanical garden and a kindergarten along Huon Road. The area of the site is about 3,500 m<sup>2</sup> and

its shape is shown in Fig. 3.

The site is covered with grass. There are sparsely planted trees within the site and forest belts on the cliff adjacent to the botanical garden.

The site is descending from the side of the botanical garden to Huon Road gently.

There stands a wire netting fence within the site. The fence has to be transferred to the northern boundary, because it will be useful for the protection of the nursery.

#### 3-4. Layout of Raised Beds and Attached Facilities

Because the area of the site is very small in comparison with the area mentioned in the basic principle and the site is very near the main building, kind and size of attached facilities were reinvestigated in order to use efficiently the land and increase the area of raised beds as much as possible.

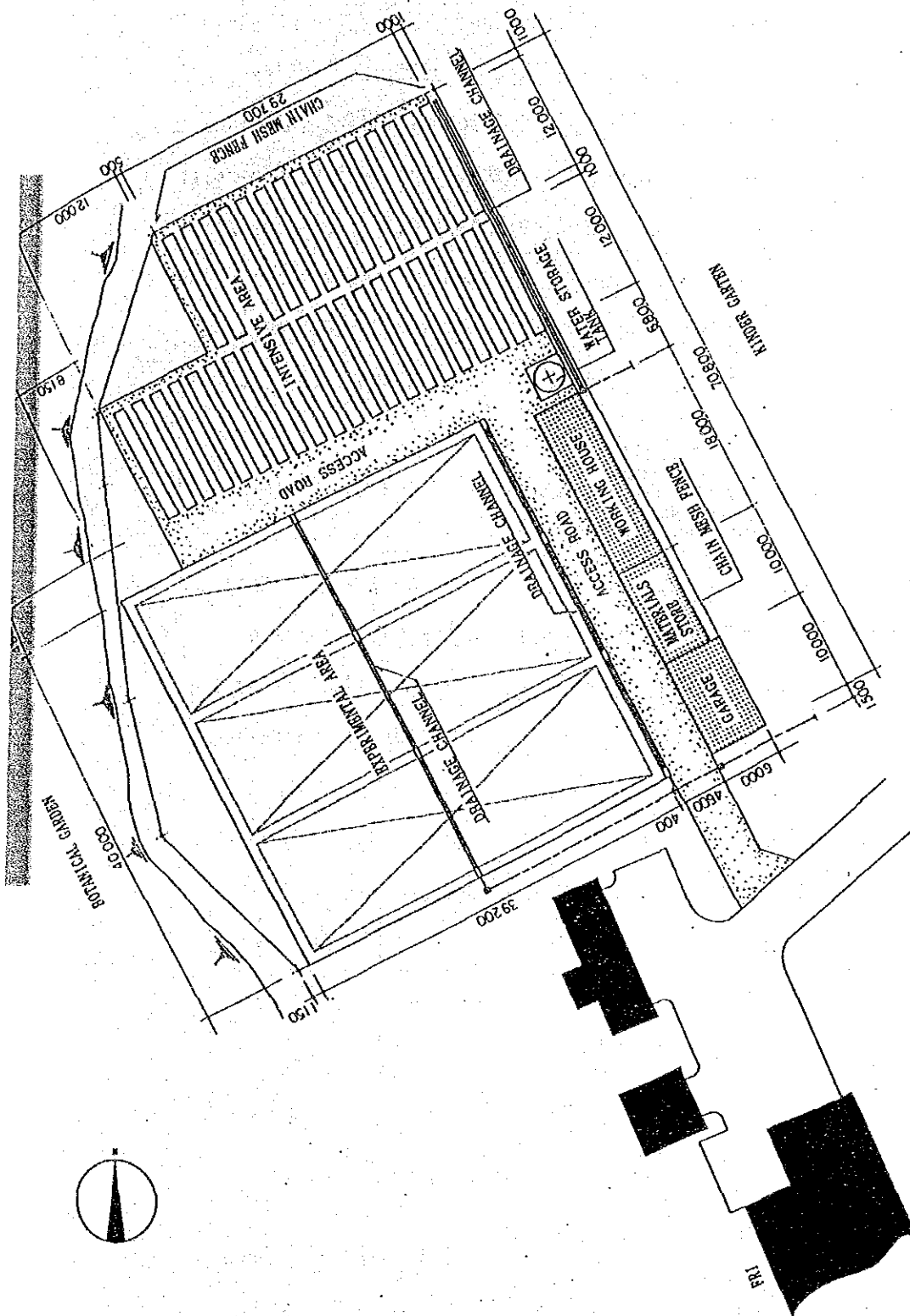
The kind, size, and layout of facilities are shown in the Fig. 3.

In order to minimize the length of the access road that will be constructed newly, near the existing road and adjoining the boundary between the kindergarten and the site, from the main building side a garage ( 60m<sup>2</sup> ), a materials store ( 50m<sup>2</sup> ), a working house (90 m<sup>2</sup>), and a water storage( 3,000gal. ) will be constructed. Because facilities of the main building can be used, the oil store, the laboratory, and the hoister which were mentioned in the basic principle will not be constructed.

An access road will be constructed to the west of the buildings mentioned above. The road will turn left at opposite side of the water storage and will extend to the western boundary of the site.

U-gutters will be constructed to drain the water from the nursery area to the side ditch of Huon Road.

Raised beds will be constructed in all of the area except in these facilities. To the north of the road which runs across the site, beds of 12 m length will be constructed in two groups, and to the south beds of 12



THE MODEL INFRASTRUCTURE WORK FOR  
THE FOREST RESEARCH PROJECT  
IN PAPUA NEW GUINEA

SITE PLAN

S = /

MR-01

Fig. 3. Layout of Nursery Facilities

m length will be constructed in three groups. Northern beds will be used for intensive experiment exclusively (hereinafter, referred to as "intensive area"), and southern beds will be used for production mainly (hereinafter, referred to as "experimental area").

Sprinkler facilities will be installed to irrigate raised beds using water supply from the  $\phi 40$ mm terminal of the north wing of the main building. And in the intensive area beds will be also irrigated by hand using water from the tank.

In both areas water proof power outlet for various measuring instruments will be constructed.

### 3-5. Nursery Establishment Works

#### 3-5-1. Felling, Stump Extraction and Land Preparation

##### (1) Stump Extraction

The trees which are planted within the site will be felled and their stumps will be removed. The number and DBH of these trees are shown in the following table.

Table 3. Trees that will be felled and their stumps will be extracted.

No	DBH	cm	No	DBH	cm	No	DBH	cm	No	DBH	cm	No	DBH	cm
2	40		11	90		15	34		19	94		23	38	
3	28		12	28		16	22		20	78		24	222	
8	26		13	72		17	120		21	18				
10	20		14	34		18	104		22	46				

Note: Trees No. 17, 18, 24 belong to *Pandanus* spp. and trees No. 19, 20, 21 have single stump.

##### (2) Land Preparation

The site has 1.5 to 2.0% of the gradient in east west direction and west side is higher than east side. And there is height difference of about 1m between the the highest point and the lowest point. However, it is about level in north and south direction.

Land preparation will be carried out as follows:

- a. Top soil of 20 cm in depth will be stripped off to remove grass.
- b. Intensive area will be prepared with backfilling and compaction work.
- c. Production area will be prepared with a gradient of 1.0 % east and west after backfilling and compaction work.
- d. Building area will be prepared with filling of 15 to 20cm.

### 3-5-2. Raised Beds

According to the observation and investigation of the production nursery of Bulolo National Forest, the experimental nursery of Bulolo Forestry College, the production nursery of Mumeng District Forest Office, the production-experimental nursery of Botanical Garden of FRI, the experimental nursery of UNITEC, the production nursery of Madang National Forest, and the production nursery of JANT. PTY. LTD., fundamental structures of raised beds and paths will be designed as follows:

#### a. Intensive Area

- (a) Raised beds of 1.2 m width and 12 m length will be constructed using concrete slabs reinforced with wire netting.
- (b) Paths, 0.8m wide in north south direction and 1.0m wide in east west direction, will be constructed using river sand.

#### b. Experimental Area

- (a) Beds and paths will be constructed all together using a concrete slab of 40m×39.2m in size reinforced with fabric square meshes.
- (b) Width of paths will be 0.6 m in north south and 1.0 m in east west directions.
- (c) The concrete slab will have elastic joints at every 10m interval and a gradient of 1.0 % in east and west direction.

Detailed structures of these beds are shown in Fig.4. and 5.

### 3-5-3. Shades

#### (1) Intensive Area

Shades, each 0.8m tall, will be installed on each bed using steel frames.

Detailed structures of frames which support shades are shown in Fig. 4.

#### (2) Experimental Area

Shades, 2m in height, will be installed at on the whole surface of the concrete slab which forms beds and paths.

Detailed structures of frames which support shades are shown in Fig. 6.

#### 3-5-4. Irrigation

The following irrigation systems will be considered:

- a. A  $\phi 100\text{mm}$  pipe which will be connected to the main  $\phi 250\text{mm}$  pipe laid underground along Huon Road will be extended to the side of the garage and a  $\phi 75\text{mm}$  pipe and a  $\phi 25\text{mm}$  pipe which will be connected to the  $\phi 100\text{mm}$  pipe will be extended to beds and buildings respectively,
- b. A  $\phi 32\text{mm}$  pipe which will be connected to the  $\phi 40\text{mm}$  terminal of the north wing of the main building will be extended to the middle path in the intensive area and  $\phi 25\text{mm}$  pipes will be extended to beds and buildings from the  $\phi 32\text{mm}$  pipe.

Because irrigation is possible by the latter, it was adopted.

Movable sprinkler systems will be installed as shown in Fig. 7.

In addition to sprinkler systems, beds in intensive area will also be irrigated by hand using water from the water storage.

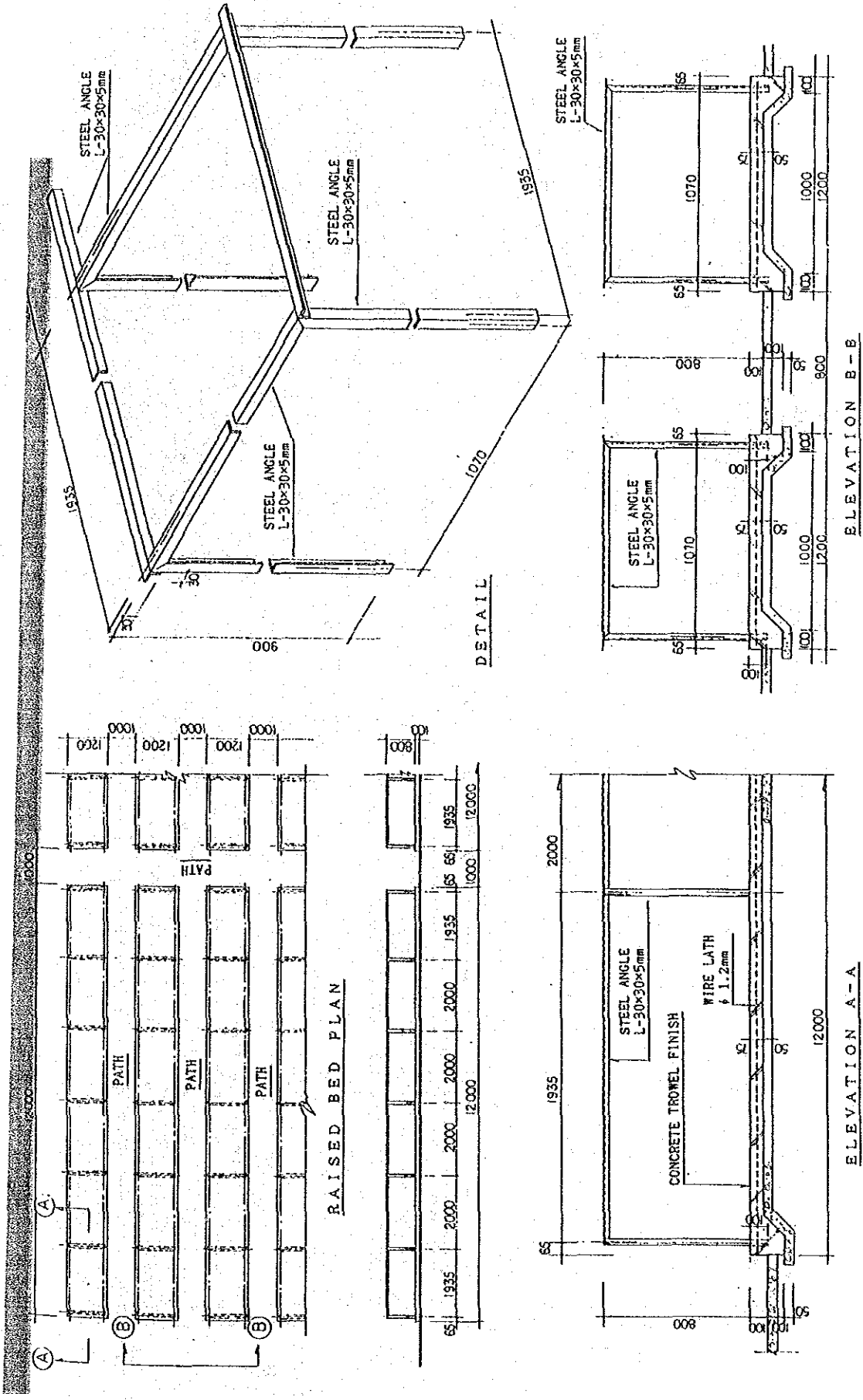
Layout of the water supply system is shown in Fig. 7.

#### 3-5-5. Drainage

Drainage will be constructed at locations as shown in Fig. 7.

##### a. Intensive Area

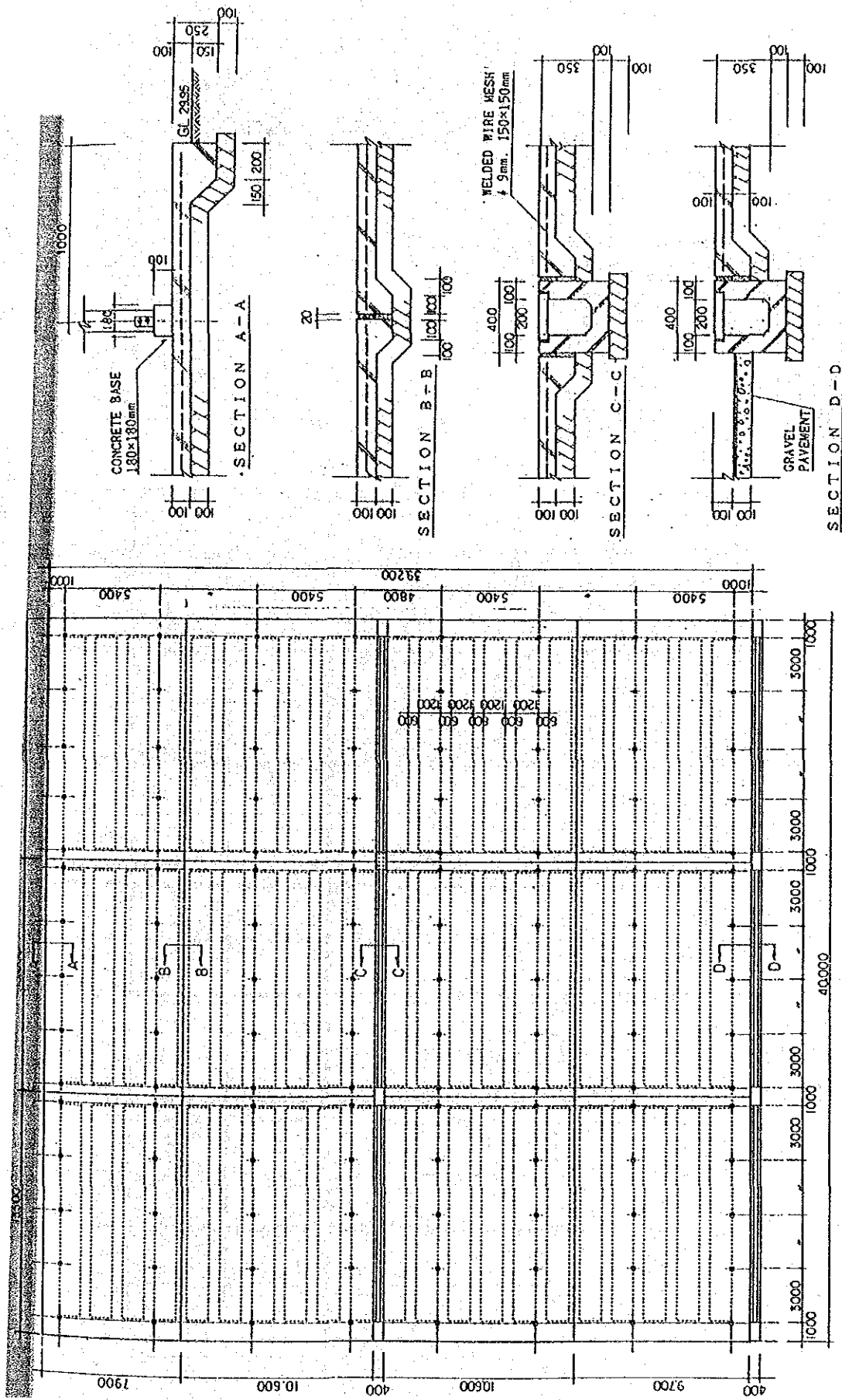
An open ditch (200mm $\times$ 300 mm) will be constructed along the east boundary to the southern end of the site and from there an concrete



THE MODEL INFRASTRUCTURE WORK FOR THE FOREST RESEARCH PROJECT IN PAPUA NEW GUINEA	INTENSIVE AREA	
	RAISED BED PLAN	
	STEEL FRAME PLAN	
		HK-09

Fig. 4. Intensive Area



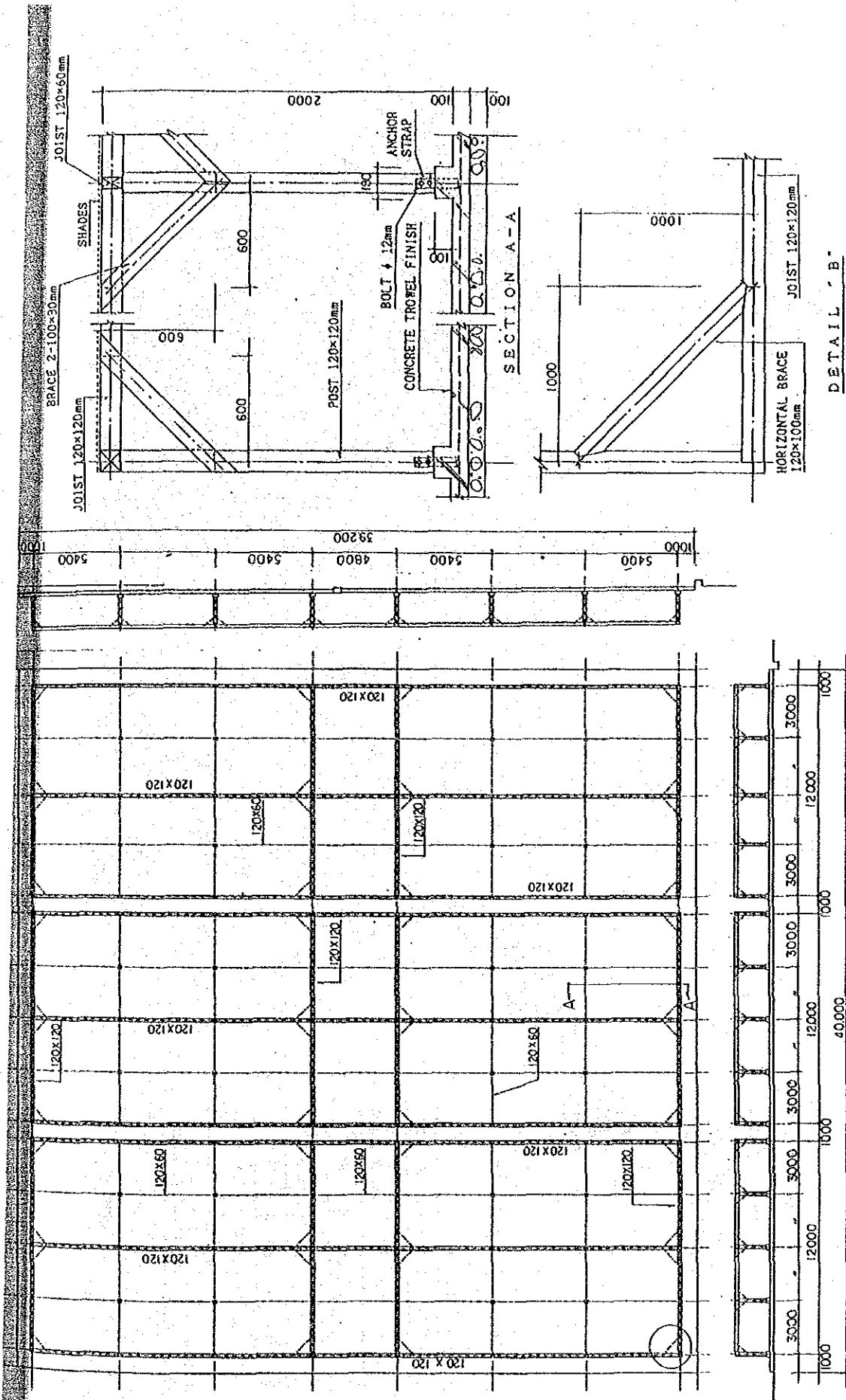


THE MODEL INFRASTRUCTURE WORK FOR  
THE FOREST RESEARCH PROJECT  
IN PAPUA NEW GUINEA

EXPERIMENTAL AREA  
FLOOR PLAN

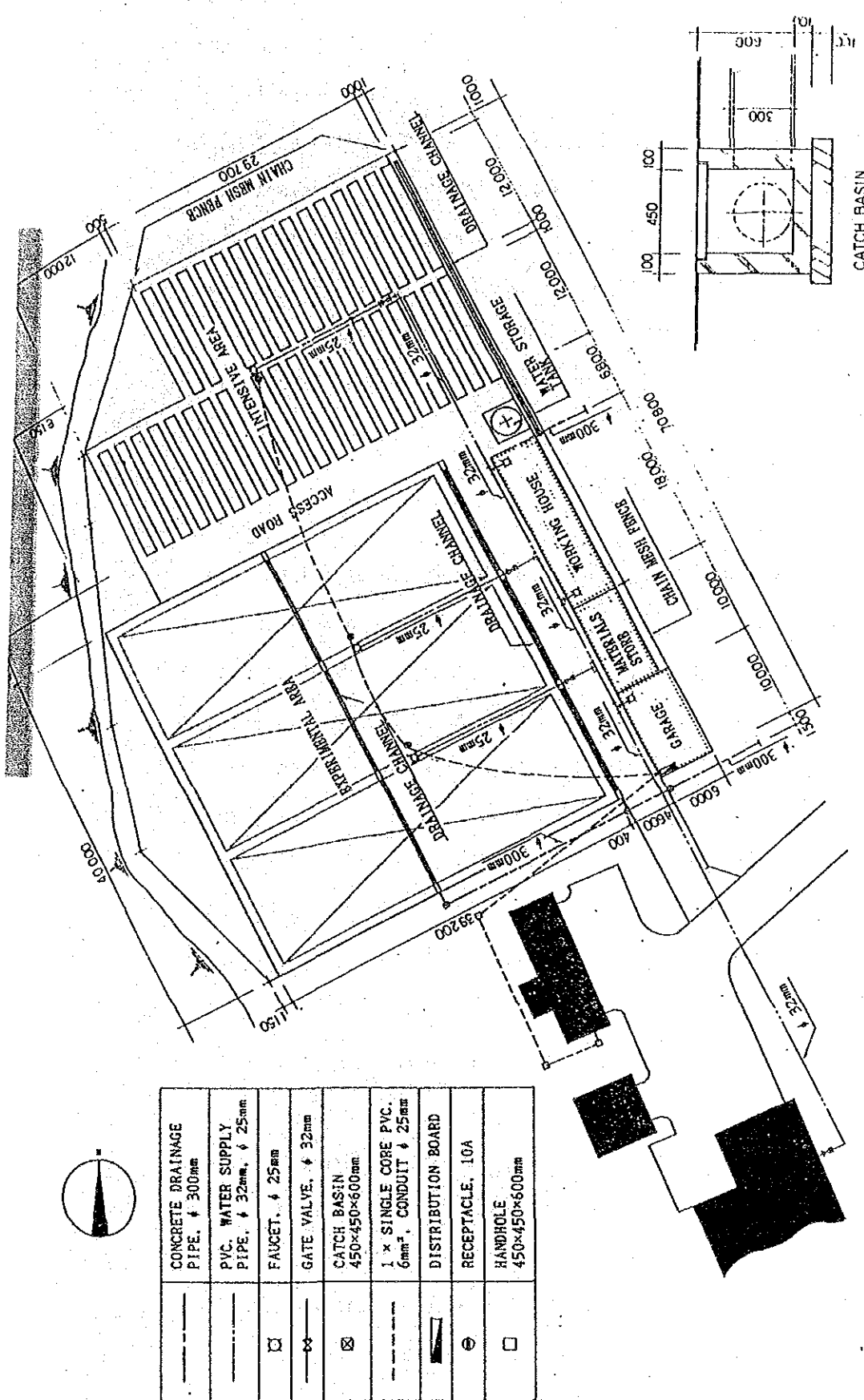
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Fig. 5. Floor Plan of Experimental Area



THE MODEL INFRASTRUCTURE WORK FOR THE FOREST RESEARCH PROJECT IN PAPUA NEW GUINEA	<b>EXPERIMENTAL AREA</b>		S = / S = /
	TIMBER FRAME PLAN		MK-03

Fig. 6. Detailed Structure of Frames Supporting Shades of Experimental Area



---	CONCRETE DRAINAGE PIPE, $\phi$ 300mm
---	PVC. WATER SUPPLY PIPE, $\phi$ 32mm, $\phi$ 25mm
□	FAUCET, $\phi$ 25mm
⊗	GATE VALVE, $\phi$ 32mm
⊗	CATCH BASIN 450x450x600mm
---	1 x SINGLE CORE PVC. 6mm <sup>2</sup> , CONDUIT $\phi$ 25mm
▮	DISTRIBUTION BOARD
⊙	RECEPTACLE, IOA
□	HANDHOLE 450x450x600mm

THE MODEL INFRASTRUCTURE WORK FOR THE FOREST RESEARCH PROJECT IN PAPUA NEW GUINEA	SITE PLAN	S = /
	ELECTRIC INSTALLATION WATER SUPPLY & DRAINAGE PLUMBING	MK-12

Fig. 7. Plan of Water & Power Supply

drainage pipe( $\phi$  300mm) will be constructed to the east to a ditch along Huon Road.

b. Experimental Area

- (a) An open ditch (200 mm $\times$ 300 mm) will be constructed north and south in the center of the concrete slab.
- (b) An open ditch(200mm $\times$ 300mm) will be constructed along the east margin of the concrete slab. At the south end concrete drainage pipe( $\phi$  300mm) will be constructed under the access road to be connected to the concrete pipe from the intensive area.

3-5-6. Buildings

(1) Garage

Fundamental structures of the garage are as follows:

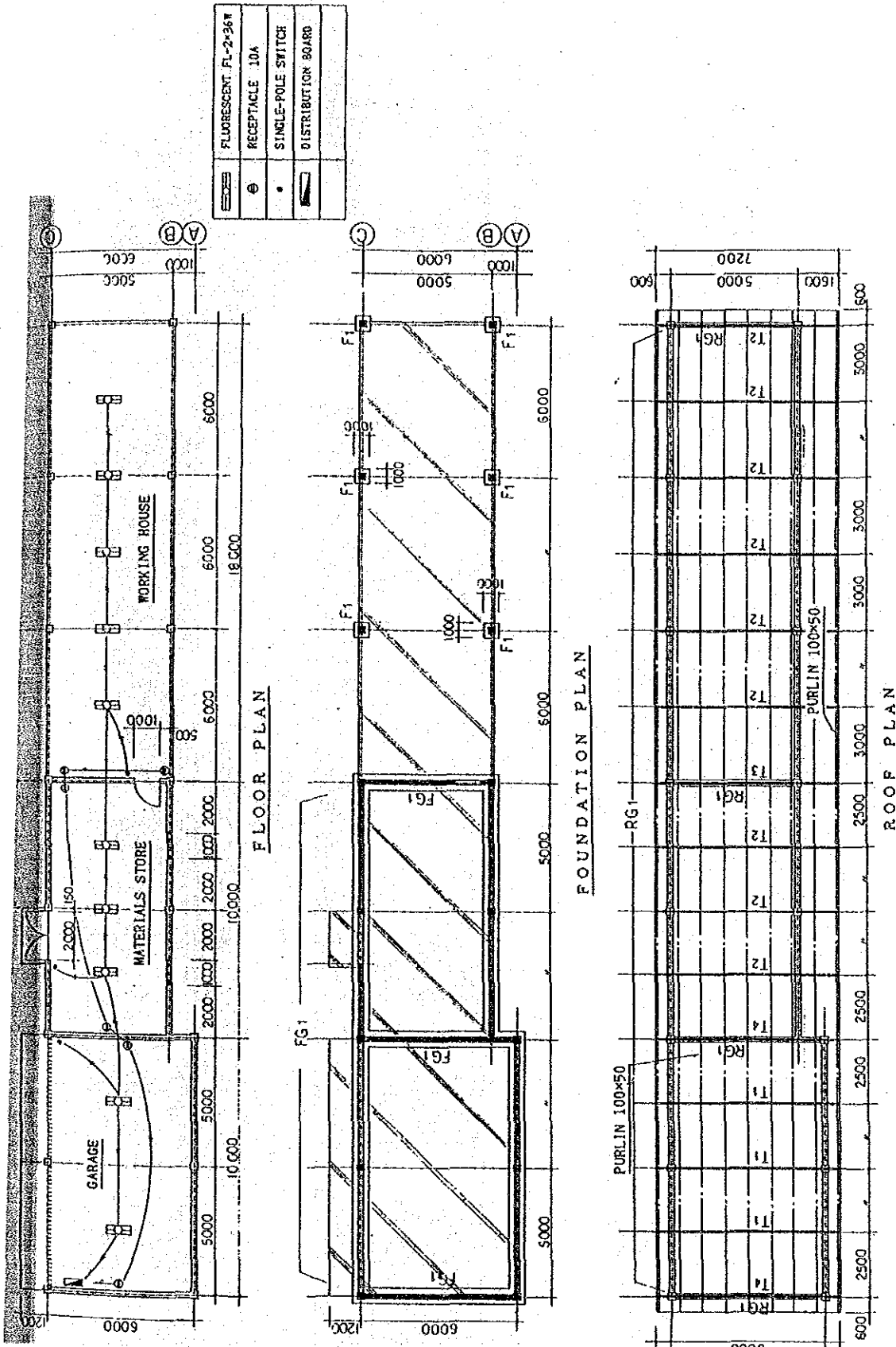
- a. Floor area 60m<sup>2</sup>( 6m $\times$ 10m ),
- b. Floor, column and beam will be constructed with reinforced concrete.
- c. Wall will be constructed with concrete blocks,
- d. Roof will be constructed using corrugated iron and will have gutterings,
- e. One wall will be common with one wall of the adjoining materials store.
- f. Entrance will be constructed using roller shutters to save space in front of the garage.

Detailed structures are shown in Fig. 8~10.

(2) Materials Store

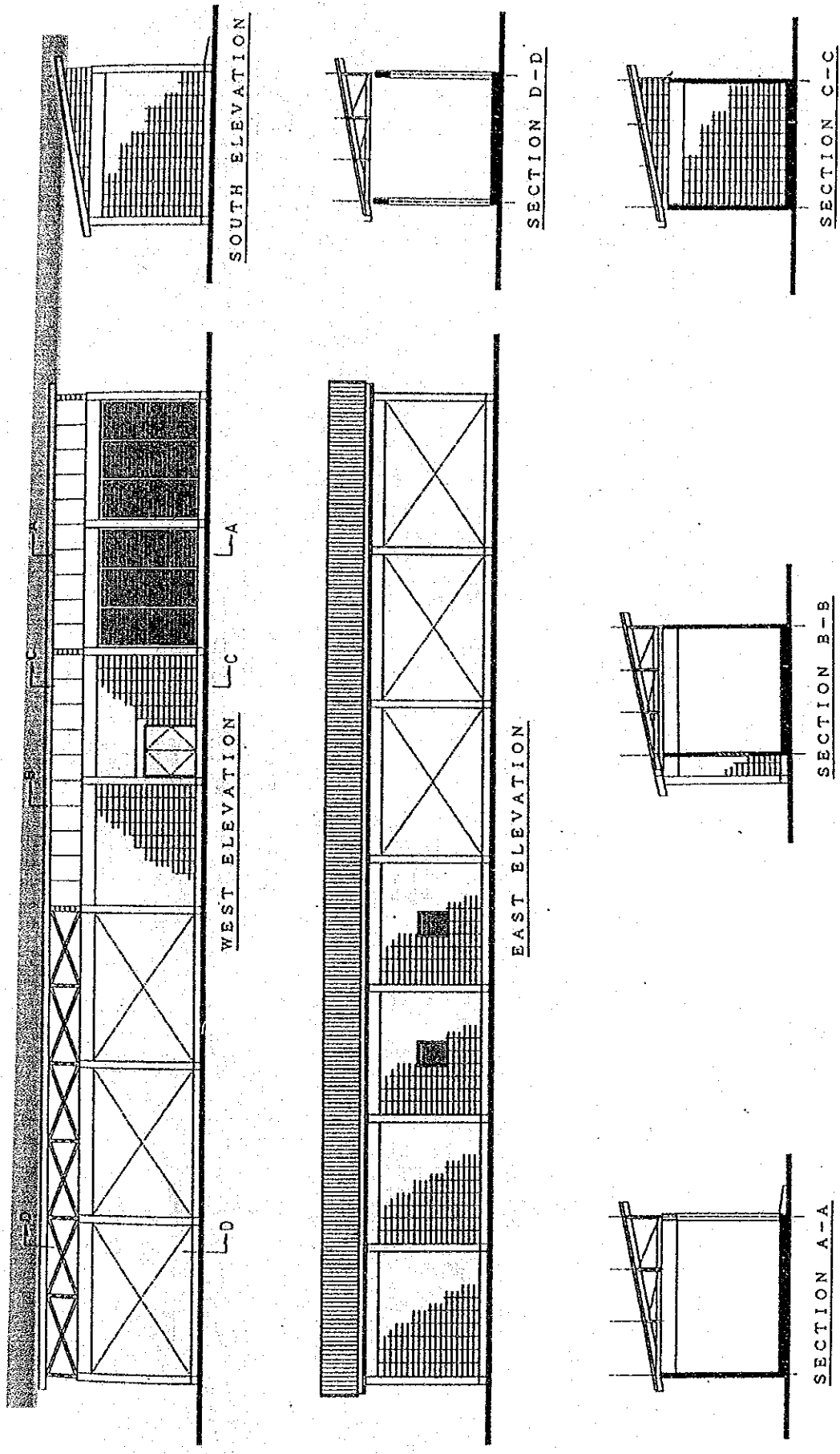
Basic structures are as follows:

- a. Floor area 50m<sup>2</sup>( 5m $\times$ 10m ),
- b. Floor, column and beam will be constructed with reinforced concrete,
- c. Wall will be constructed with concrete blocks,
- d. Roof will be constructed using corrugated iron and will have gutterings,



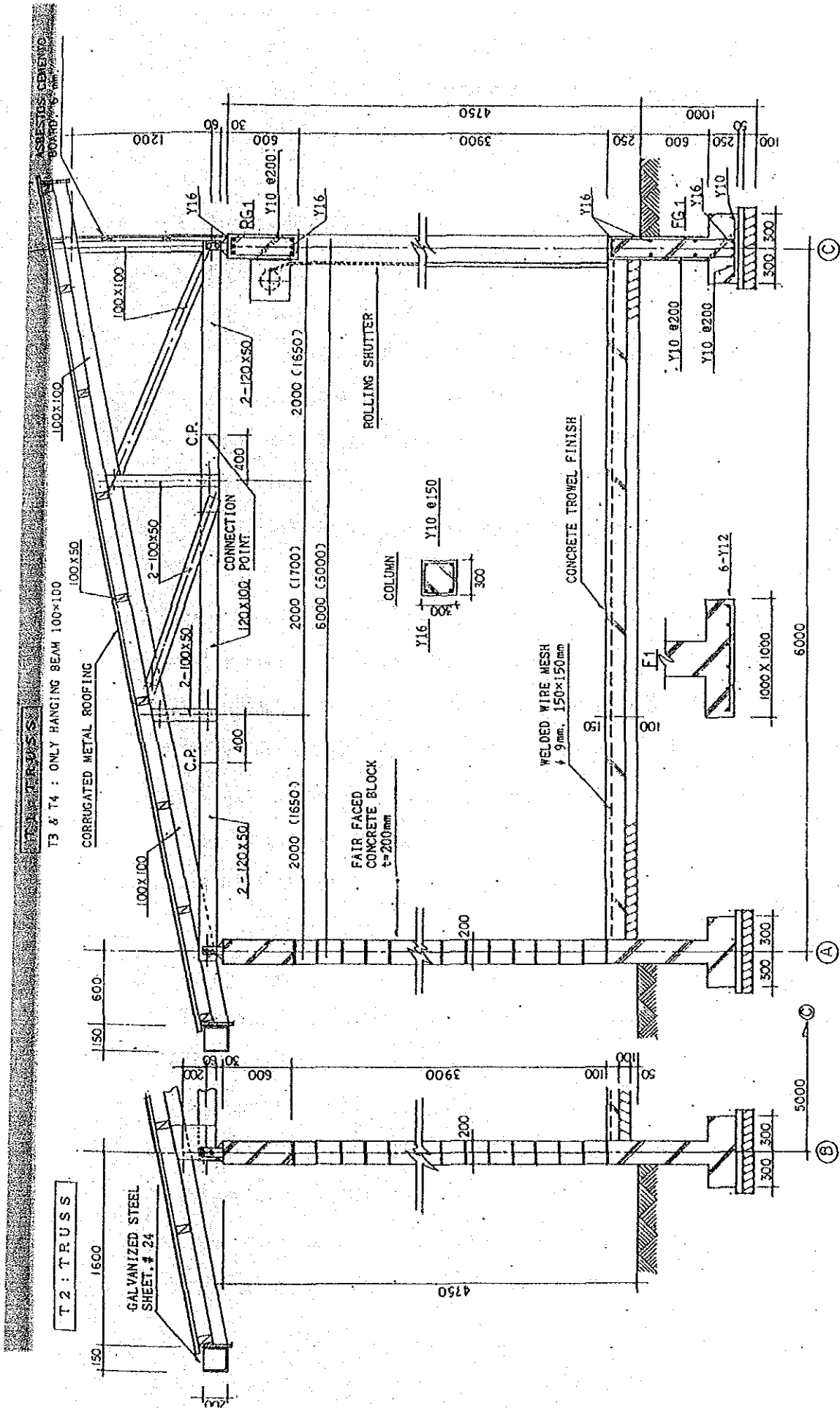
THE MODEL INFRASTRUCTURE WORK FOR THE FOREST RESEARCH PROJECT IN PAPUA NEW GUINEA	GARAGE, MATERIALS STORE, WORKING HOUSE	S = /
	FLOOR PLAN, FOUNDATION PLAN, ROOF PLAN	
	ILLUMINATION PLAN	HK-04

Fig. 8. Plan of Building



THE MODEL INFRASTRUCTURE WORK FOR THE FOREST RESEARCH PROJECT IN PAPUA NEW GUINEA	GARAGE, MATERIALS STORE, WORKING HOUSE	S - /
	ELEVATION, SECTION	MK-05

Fig. 9. Elevation and Section of Building



THE MODEL INFRASTRUCTURE WORK FOR  
 THE FOREST RESEARCH PROJECT  
 IN PAPUA NEW GUINEA

GARAGE  
 DETAIL SECTION

S = /  
 MK-06

Fig. 10. Detailed Design of Garage



- e. One wall will be common with one wall of the adjoining garage.
- f. Entrance will have a double leaf door which has a width of 2m.

Detailed structures are shown in Fig. 8. ~10.

### (3) Working House

Basic structures of the working house are as follows:

- a. Floor area 90m<sup>2</sup> ( 5m×18m ),
- b. Floor, column and beam will be constructed with reinforced concrete,
- c. Wall will not be constructed.
- d. Roof will be constructed using corrugated iron and will have gutterings.

Detailed structures are shown in Fig. 8. ~10.

### 3-5-7. Water Storage

Water storage will be composed of a water tank and a support structure for the tank. Capacity of the water tank is planned to be 3,000gal. the diameter and height of which will be 3.05m and 1.87m respectively.

The water tank will be set on the support structure which will be 2m in height to gain water pressure.

Detailed structures are shown in Fig. 11, 12.

### 3-5-8. Access Road

The access road will be constructed as shown in Fig. 3 diverged from the existing road.

The formation width of the access road will be 4.6m and effective width of 4m will be paved with ballasts in thickness of 0.15m.

Diverging part dose not need to set a curve because of the relation between car-length and road-width, but the inside corner has to be rounded off along the circumference of a radius of 10m.

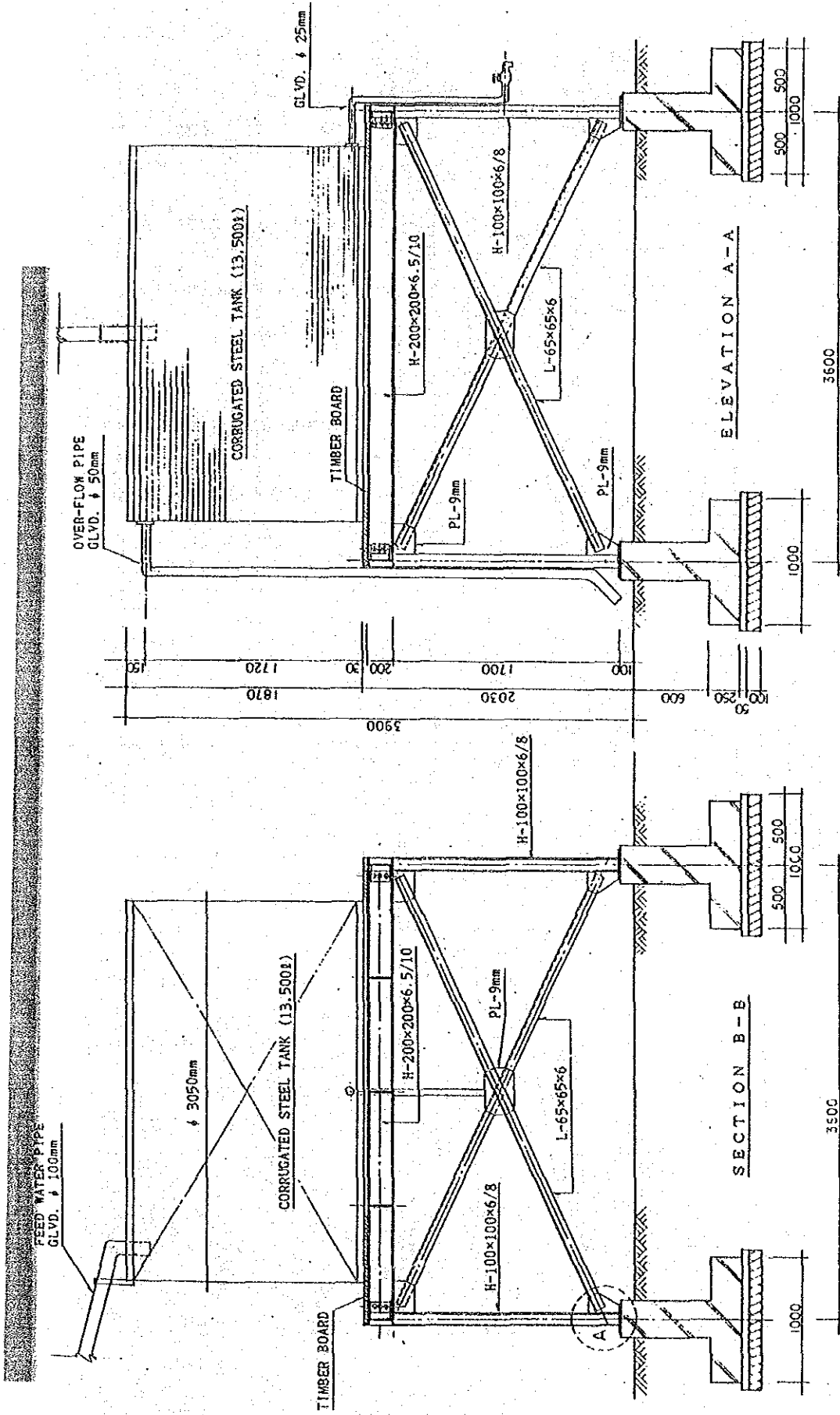
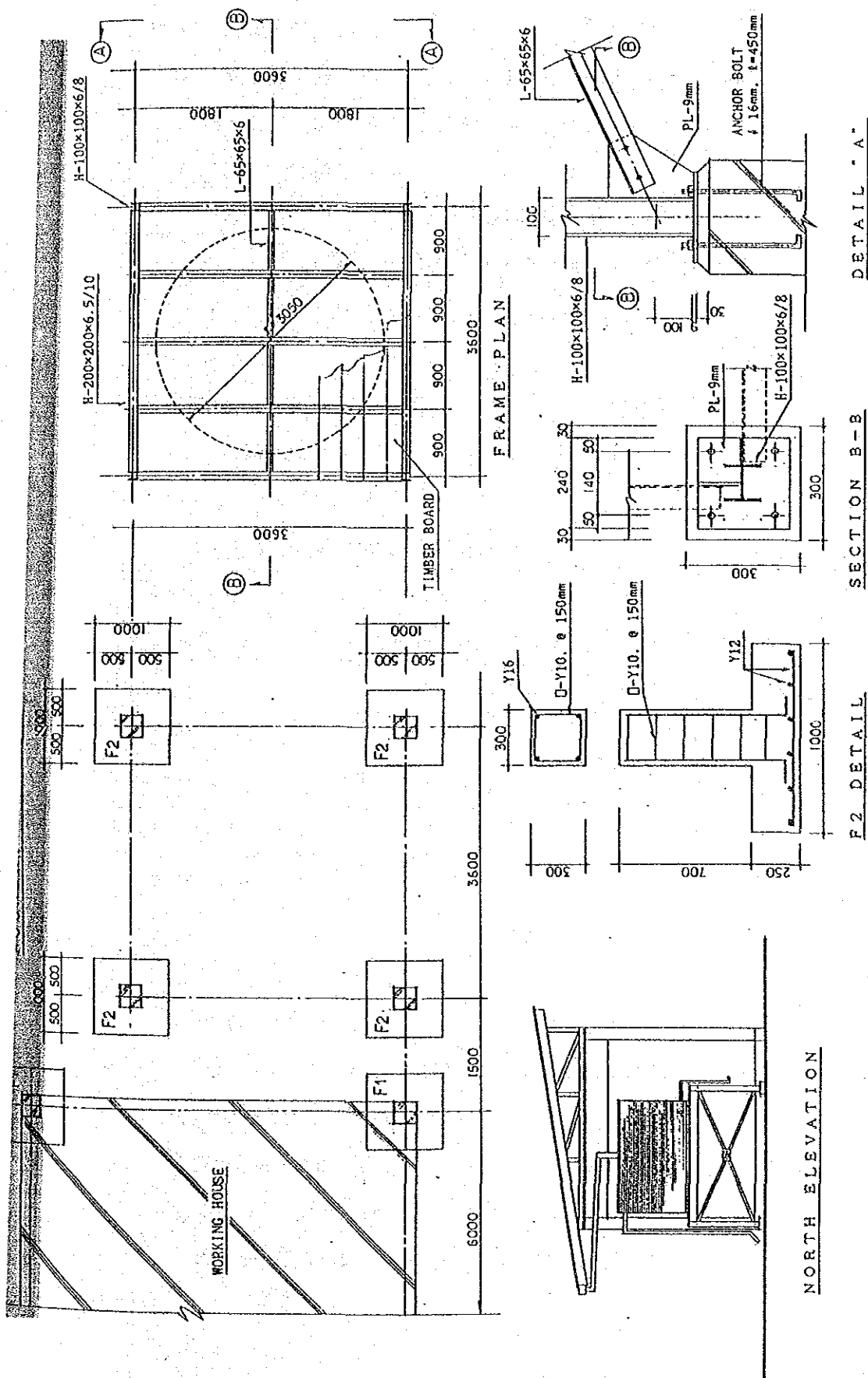


Fig. 11. Structure of Water Storage Tank

THE MODEL INFRASTRUCTURE WORK FOR	WATER STORAGE TANK
THE FOREST RESEARCH PROJECT	ELEVATION SECTION
IN PAPUA NEW GUINEA	MK-11



THE MODEL INFRASTRUCTURE WORK FOR  
 THE FOREST RESEARCH PROJECT  
 IN PAPUA NEW GUINEA

WATER STORAGE TANK

FOUNDATION PLAN, FRAME PLAN  
 ELEVATION, DETAIL

SS  
 SS  
 SS

MK-10

Fig. 12. Detailed Design of Water Storage Tank

### 3-5-9. Power Facilities

#### (1) Power Supply

An underground conduit will be extended from the existing building to the distribution board in the garage to be built.

#### (2) Distribution

From the distribution board mentioned above power will be distributed to each building and bed areas. Underground conduits will be extended under concrete slabs to distribute power to water proof socket in bed areas.

#### (3) Electric Equipment

Electric equipment to be installed are shown in the following table.

Table-4. Electric Equipment.

Equipment \ Building etc.	Working house	Materials store	Garage	Intensive area	Experi-mental area	Total
Fluorescent lamp	4	3	2			9
Socket	2	1	1			4
Switch	2	1	1			4
Water proof socket				1	2	3
Distribution board			1			1

### 3-5-10. Fence

The existing fence will be removed and a new fence will be constructed on the northern boundary.

The length of fences to be removed and to be constructed is 57.5m and 33.5m respectively.

The specification of the new fence is same as that of the existing fence.

## 4. Implementation Design of Experimental Plantation

### 4-1. Basic Principle

Experimental plantation will be established on a flat site or a site of uniform land condition. One square plot of 45m×45m will be allotted to each one of thirty species. In the future a total of one hundred species will be planted.

Within one plot, two hundred trees will be planted at an interval of 3m.

Species which belong to the same genus will not be planted closed to each other, taking into consideration that each plot will be utilized as a seed orchard.

### 4-2. Circumstances of Determination of the Site

According to the report of the JICA Implementation Survey Team which was dispatched from November 5 to 19, 1988, two sites, including a site adjoining the provincial nursery at Oomsis and a site at Bulolo were selected as proposed areas at first, and later, Bulolo was excluded because of a long distance from PRI.

This time, Oomsis site and Bulolo site were investigated. At the beginning of discussion, Bulolo site was excluded because of a long distance from PRI.

However, later it was found that Oomsis site has still a problem concerning land use and available land is too small to establish an experimental plantation of the scale mentioned in the basic principle. Then, Bulolo site was resurrected and determined by agreement of the staff of PRI, Japanese experts and the JICA Consultation Team.

In Bulolo area, Mr. David J. Skelton, Project Manager of Bulolo/Wau National Forest proposed two sites. Of these two sites, the site of Sawmill Creek basin was selected because it has comparatively uniform land conditions.

#### 4-3. General Situation of the Site

The site is located mainly in one corner divided by roads crossing at about right angles as shown in Fig. 13. Total area of the site is 8.38 ha, but effective area is not so large, because crooked Sawmill Creek is a difficult obstacle to allotment of square plots.

There are steep slopes to the east of Old Watut road running about north and south and altitude rises and slope become steeper to the southwest of the creek.

There are some grasslands in the flat area around the creek. Except these grasslands, the site is covered with second growth.

There are dense stands of young trees with DBH of several centimeters to about 20cm, in the flat area and around roads. Except these stands there are mixedstands of various broad leaved species and among these trees Araucaria sp. and some species of palm are dotted. On the upper slopes regenerations of Araucaria sp. are seen. There are also small bamboos, climbing bamboos, and climbing palms in the area.

According to a geological map of PNG(Wau), the geology of the area in which the experimental plantation is located consists of lacustrine and fluvial material; poorly consolidated tuffaceous siltstone, sandstone, conglomerate and tuff which belong to Pliocene-Otubanda Formation.

Soil seems to be suitable for growth of various tree species judging from the growth of natural trees.

#### 4-4. Layout of Experimental Plots

Because of small effective area of the site stated above, size of one plot in the basic principle is decreased to 30m × 30m within which 100 trees will be planted at a spacing of 3m × 3m.

Layout of plots in the site is shown in Fig. 14.

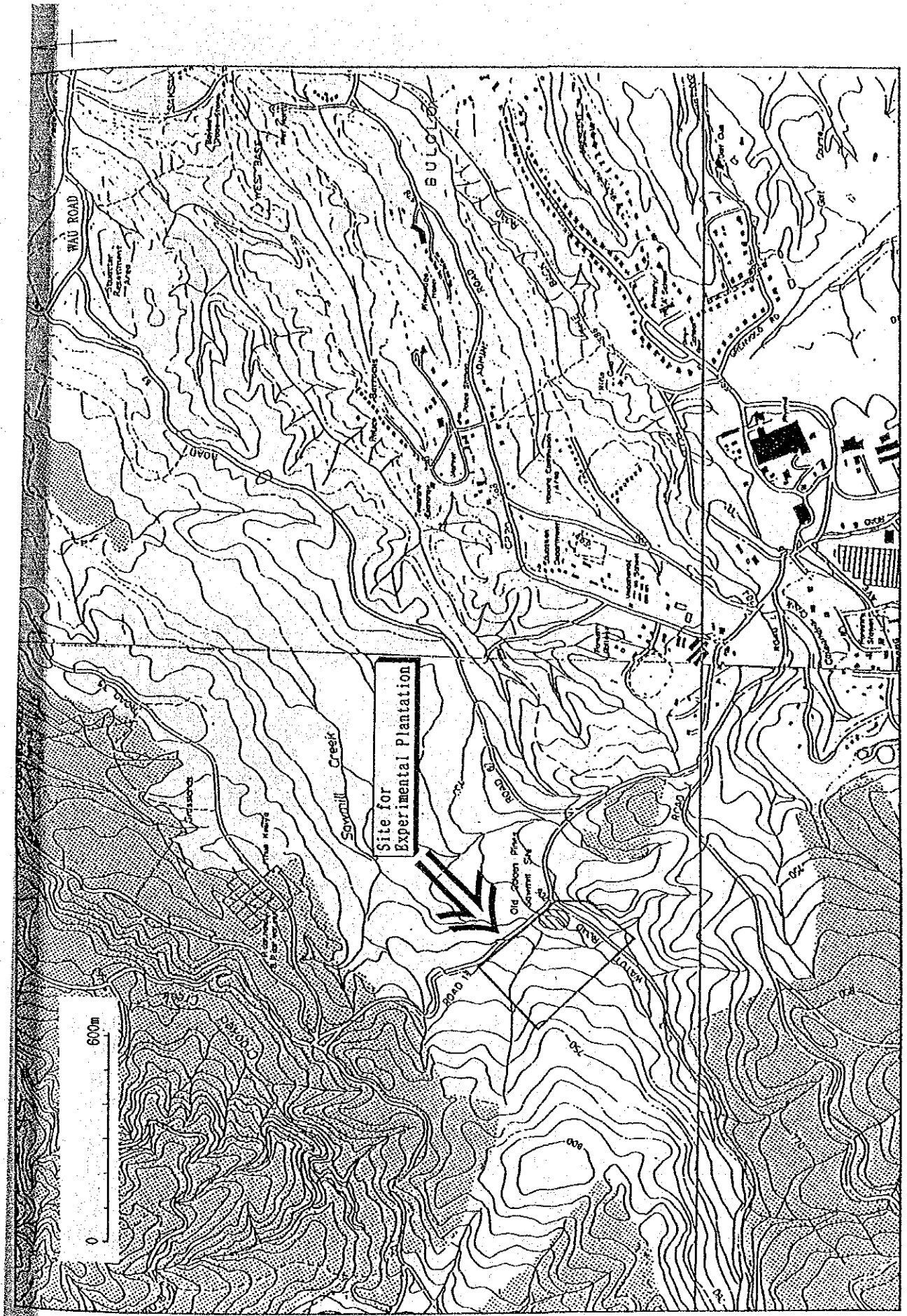
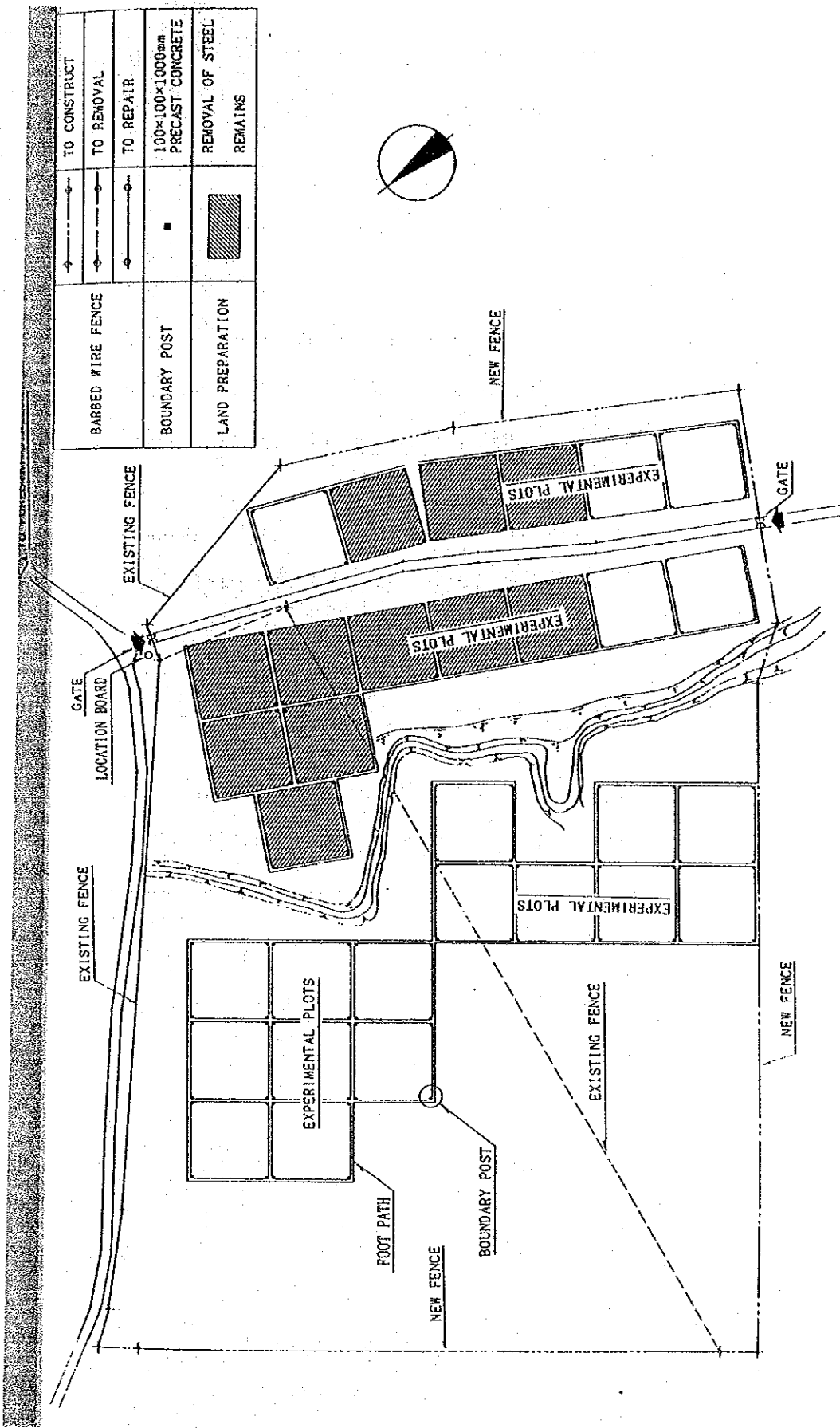


Fig. 13. Location of Site for Experimental Plantation



THE MODEL INFRASTRUCTURE WORK FOR  
 THE FOREST RESEARCH PROJECT  
 IN PAPUA NEW GUINEA

EXPERIMENTAL PLANTATION

SITE PLAN

S = /

MK-07

Fig. 14. Experimental Plantation



Department of Forests  
Forest Research Institute  
BULOLO EXPERIMENTAL PLANTATION

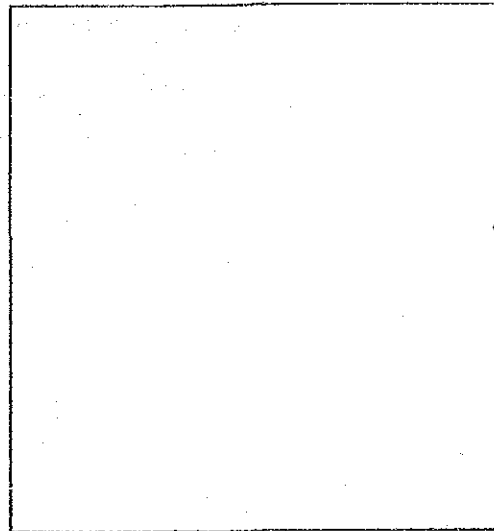
Area : 8.38 ha

Number of tree species planted : 30

Size of one plot : 0.09ha (30m×30m)

Number of trees in each plot : 100

Grazing, starting fires, collecting  
wild plants as well as damaging  
the planted trees are strictly  
prohibited.



Map of the Area

This Experimental Plantation was established through technical  
cooperation by Japan International Cooperation Agency (JICA)

Fig. 16. Location Board (Draft)

#### 4-5. Attached Facilities

##### (1) Fence

According to Mr. David J. Skelton, there are prowl herds of wild cattle around the site, which were not seen this time but presumed by the footmarks and dungs.

Therefore a fence will be constructed at a circumference of the site to protect experimental plots against these wild cattle. And some parts of an existing fence will be repaired and removed.

The length of fences to be constructed, repaired, and removed is 828.4 m, 364.9m, and 396.7m respectively.

Detailed structures of the fence are shown in Fig. 15.

##### (2) Concrete Posts

A concrete post will be set up at each corner of experimental plots.

The size of concrete post is 10cm × 10cm × 100cm.

##### (3) Location Board

Because a few inhabitants were seen entering the area, an Location board will be set up at the southeast corner of the site to protect the plantation as well as to inform and enlight visitors and spectators.

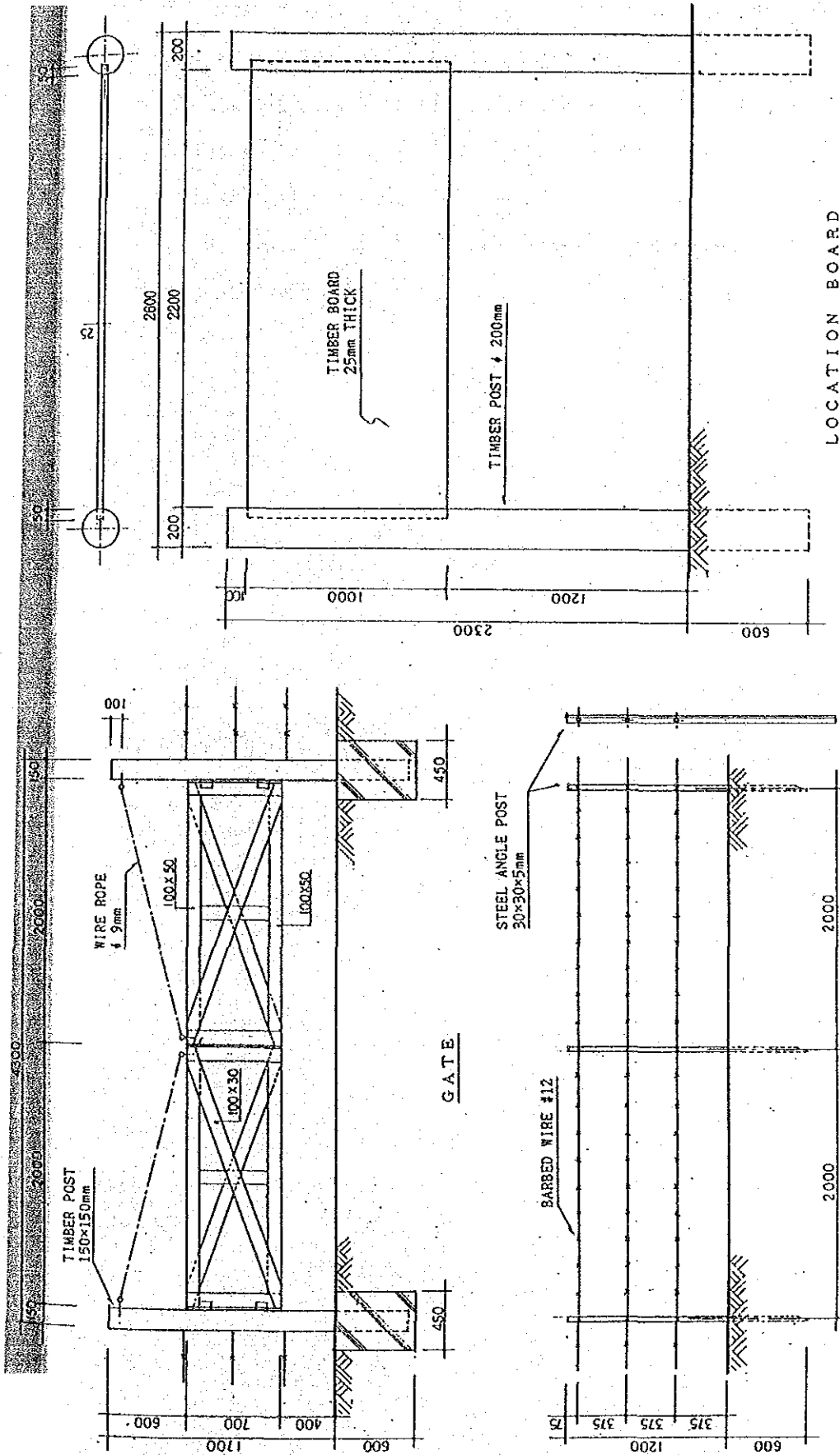
The location and detailed structures of the location board are shown in Fig. 14, 15 and 16.

##### (4) Foot Path

Since the site is very near to the existing roads, no more road need to be constructed. Only foot paths will be constructed to maintain and observe the plots.

Foot paths will be one meter in width and vegetation and obstacles on their surface will be removed.

The layout of foot paths are shown in Fig. 14.



THE MODEL INFRASTRUCTURE WORK FOR  
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IN PAPUA NEW GUINEA

EXPERIMENTAL PLANTATION

GATE, BARBED WIRE FENCE, LOCATION BOARD

S = /  
S = /

MK-08

Fig. 15. Attached Facilities for Experimental Plantation

#### 4-6. Land Preparation

Because most of the site is forested, felling of standing trees are necessary to establish the plantation.

Standing trees should be cut to leave low stumps as possible.

Transportation of felled trees seems to be done easily by permitting inhabitants to collect fuelwoods.

Remains of old trucks, old storage drums, and other iron products on the spots which are shown in Fig. 14. should be removed before the tree planting.

## 5. Implementation Design of Experimental Natural Forest

### 5-1. Basic Principle

Experimental natural forests will be established in each representative forest after natural forests were classified into three to five types, and also in places in which intensive maintenance is easy.

Size of experimental natural forests will be 5 to 10 ha in each natural forest type.

Ridgelines, rivers, creeks, roads, fire breaks, and other natural objects will form the boundaries of the experimental forest.

### 5-2. Circumstances of Determination of the Proposed Site

Concerning experimental natural forests, because study items are not stated clearly in the existing R/D, neither Japanese experts nor FRI have determined concrete proposed sites.

This time, at first, natural forests adjoining the proposed site for a nursery at Oomsis and some stands in McAdam National Park in Bulolo area were investigated. But both sites were found to have some problems. With agreement of FRI, Japanese experts and JICA Consultation Team, it was decided that only promising proposed sites are to be recommended in this report and establishment of concrete experimental natural forests will be designed in the future.

A natural forest was observed as one of promising proposed sites. It is located to the east of Oomsis and has some experimental plots established by UNDP and original project of FRI.

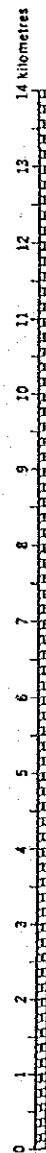
### 5-3. General Situation of the Proposed Site

The location of proposed site is shown in Fig.17. It begins at a place about 2 km along a creek from Wau Road, and extends on a mountain slope at a confluence of about 4km from Wau Road.

The forests around there belong to villages and also to TRP (Timber Right Purchase), and have been cut selectively. The trees with DBH of larger than 50 cm were selected, but not a few trees with DBH of larger than 50cm



SCALE 1:100 000



BLACK NUMBERED GRID LINES ARE 1000 METRE INTERVALS OF THE AUSTRALIAN MAP GRID, ZONE 55  
 GRID VALUES ARE SHOWN IN FULL ONLY AT THE SOUTH WEST CORNER OF THE MAP  
 HORIZONTAL DATUM: AUSTRALIAN GEODETIC DATUM 1966  
 VERTICAL DATUM: MEAN SEA LEVEL  
 TRANSVERSE MERCATOR PROJECTION  
 CONTOUR INTERVAL 40 METRES  
 ELEVATIONS IN METRES

Fig. 17. Location of Proposed Site for Experimental Natural Forest

are left.

According to the geological maps of PNG (Markham), the geology of the area in which the forest is located consists of schist, slate, phyllite, metagreywacke, conglomerate and argillite which belong to Mesozoic-Jurassic to Cretaceous-Owen Stanley Metamorphics.

If land owner accept the establishment, this forest seems to be one of the most promising proposed sites of experimental natural forest on the following grounds:

a. It is not very far from FRI.

It is about 30km from FRI to Oomsis on Highlands Highway and Wau Road, and it is about 4 to 6 km from Oomsis to the proposed site on a forest road.

Therefore it is easy to make a day's survey trip from FRI to the site.

b. It has characteristics as tropical rain forest.

Though it is not a virgin forest because it belongs to T.R.P., it has the species diversity sufficiently and a lot of valuable species and seems to be suitable for studies on natural forests.

Anisoptera spp. which belong to Dipterocarpaceae, Pterocarpus spp. which has excellent quality for furnitures, and Casuarina spp. were seen in the site. In particular, good regenerations of Anisoptera sp. were seen, in which some experimental plots are established.

c. Arrangement of an access road is easy.

The road which was constructed at previous logging time, is abandoned. Though present surface is covered with tall grass and has bushes or fallen trees on some parts, it's sufficiently wide, has a good shaped and firm road bed. Therefore, existing road become easily a driveway if obstacles on its surface are removed, some ballasts are supplemented, and crossing facilities on small creeks are constructed. By the way, it is said that this road was used for transportation by bus at previous logging time.

In addition to the site mentioned above, following sites also seem to be promising for the establishment of experimental natural forests and plantations.

- a. Neighborhood of the diverging point of Highlands Highway and Wau Road (13 km from Lae),
- b. Neighborhood of Munung along Highlands Highway (23km from Lae),
- c. Neighborhood of Nazab Airpot (35km from Lae),
- d. Neighborhood of Gabensis along Wau Road (34km from Lae).