As Fiji lies in a tropical zone in the southern hemisphere, the positioning of the building is also planned to minimize the direct sunlight allowing for the elevation of the sun and the angle of the sun's rays.

In addition, the building is designed to afford a good view in both the direction of the runway and in the East~South East seaward direction from which the weather changes occur.

The electrical power supply will be taken from the commercially available source offered by the Power Centre of Fiji Electricity Authority. As a transformer, switchboad, and engine generator are to be installed in, the Power House is planned to constructed on the site where there is no residencial area around and in the close proximity to the Power Centre, and thus provide savings in construction costs to the Fiji side.

In order to improve the accuracy of meteorological observations from the observation field, a position higher than surrounding structures would be ideal, however for this particular project, the field must be positioned at a distance of around 30m from the building.

(Building height 8.0m + NOAA antenna height 3m- 1.5m) X 3 = 28.5m $\leqq$ distance of the observation field from the building. Size of the field is required at least 20 m.

The antenna for GMS will be erected on the site. The antenna for NOAA will be mounted on the roof of the Centre.

3-3-2 Architectural Design

1. Floor Plan

1) Floor plan

The Centre is to be divided by floor according to function. The ground floor mainly accommodates the reporting and climatology rooms, training room, control room and workshop. The 1st floor includes the forecasting and observation room, computer related rooms, cyclone warning and briefing room. As to the arrangement of each room, such floor planning is to be provided to enable FMS to perform as RSMC of WMO, taking the existing facilities and current service system into consideration.

Departments such as reporting, climatology, training, instrument, building maintenance, and workshop are to be located on the ground floor. On the 1st floor, forecasting and observation departments, computer, research and development, and meteorological service are to be provided.

In particular, the forecasting and observation room, and the computer related rooms on the 1st floor are to be operated on a round-the-clock basis as forecasting and observation departments. Therefore, these rooms are to be arranged as one zone, for the security at night. In addition, it is necessary to observe and determine accurately the outside meteorological conditions from the forecasting and observation room. For this purpose, the room is proposed to have a fine view, especially in the direction of the coastline, the runway, and to the East~South East, from which the weather changes.

2) Area of main rooms

The adequate size of the rooms is to be evaluated based on the system, equipment, service form, and work content necessary for RSMC, and the arrangement plan of the personnel of FMS.

The area of the rooms is applied the standard unit area in Japan, as follows:

General offices: 6 m^2/person to 8 m^2/person

Forecasting & observation room and other operation rooms:

12 m^2/person to 15 m^2/person

The area of data rooms and stores are applied by 1.2 times to 1.5 times of the area in the existing FMS building.

(Ground Floor)

a. Reporting Room

The functions of the reporting room include the management of the local observation stations, maintenance of the observation instruments for Nadi and the local observation stations, automatic meteorological observation instrument, meteorological observation radar, etc., and training service.

The number of the reporting department staff: 6 persons

Calculation of the floor area: 6 m^2 x 6 = 36 m^2

b. Calibration Room

The calibration room is controlled and managed by the reporting department. The accuracy of the meteorological observation instruments owned by FMS and those of the meteorological organizations of neighboring countries on request, is to be regularly calibrated, and the accuracy is to be adjusted in the calibration room.

The number of the calibration room staff: 2 persons

Calculation of the floor area: 6 m^2 x 2 = 12 m^2

c. Instrument Room

The instrument room is managed and operated by the reporting department. The room accommodates mainly the meteorological observation instruments to be provided in the observation stations and observation fields.

d. Training Room

The training room is controlled and managed by the reporting department. In addition to the training engineers from neighboring countries engaged in meteorological services, the room is used for the conference of the 5th Area of WMO and seminars. The room is divided into 2 by a removable partition wall, for the conference of the interior Fiji and FMS. The room is planned to be used for holding two conferences at the same time.

-Participants in the 5th Area of WMO or seminars: about 35 persons

-Training of 2 persons from each of the neighboring 12 meteorological organizations: 24 persons at least

Furthermore, it is to be used for the interior conferences of Fiji and FMS.

Calculation of the floor area: 3.5 m^2 x 24 = 84 m^2

e. Library

The library will be used mostly by trainees and staff. The room is to be located next to the training room, near the entrance hall to enable public use of the library facilities. The existing library is devoid of reading space, and provides insufficient services for the public. In the Project, the size of the library is to be fixed in view of the volume of books and publications to be available in the future; the release of valuable materials to the public and data lying idle is to be made available. The reading space can also be used for small staff meetings when the library is closed. One librarian works full time in the library.

The number of staff and users: 10 persons

Calculation of the floor area: 6 m^2 x 10 = 60 m^2

f. Climatology room

The functions of the climatology room include the preparation of climatology statistical data, long-range forecast and analysis, analysis of the global environment and climatological change (global warning), preparation of agricultural weather information, and services provided to general users of meteorological information. The preparation of annual and monthly meteorological reports for the whole country are carried out in the climatology room. Consequently, the computer systems are required for data processing and analysis, and research. The computer systems are to be connected with the computer room on the 1st floor.

The number of the climatology department staff: 12 persons

Calculation of the floor area: 6 m^2 x 12 = 72 m^2

g. Weather data room

The weather data room is managed and operated by the climatology department. The services of the climatology department are mainly data processing, analysis, and research. Therefore, the accumulation of numerous annual climatological statistical materials and meteorological data is required. The 30 year accumulation of the climatological normal year value is an obligation imposed by the standard of WMO. These are renewed every 10 years.

Incidentally, the data is stockpiled in the climatology room of the existing FMS building.

h. Control room

The control room manages and maintains mainly the building and the vehicles. In the control room, a private branch exchange, monitor boards and operation boards are to be installed to control the whole building.

The number of the control room staff: 4 persons

Calculation of the floor area: 6 m^2 x 4 = 24 m^2

i. Workshop, workshop store, workshop office

The meteorological observation instruments are to be manufactured, repaired and maintained in this space. The workshop store to store the tools and materials, and the workshop office to operate and supervise are to be attached to the workshop. The workshop space is to be arranged remote from the meteorological service related rooms due to the noise produced during manufacture and repair of meteorological observation instruments.

(1st Floor)

a) Forecasting and observation room

The forecasting and observation room is managed and operated by the forecasting department. This room is the heart of the Centre.

The main services of the observation department are the collection of meteorological data, satellite images and various numerical prediction products, the preparation of weather charts of various kinds and analytic charts, radar monitoring, input of the observation data to GTS and AFTN, preparation of the monthly observation report of Nadi, etc.

The main services of the forecasting department are forecast meetings, general, sea and air forecasts, analysis of cyclone forecasts, preparation of forecasting and warning announcements, forecast input to GTS and AFTN, preparation of facsimile drafts, furnishing of information to public institutions and disaster prevention organizations, monitoring of the broadcast weather forecast and disaster conditions, etc.

The chief of forecasting room and the pen plotter room to prepare the weather charts are to be attached to the forecasting and observation room. These rooms are to be used in the round-the-clock system. Accordingly, it is planned to facilitate crime prevention during the night. It is necessary to monitor and accurately determine outside meteorological conditions from the forecasting and observation room. Therefore, the room is to be arranged to afford a fine view, especially in the direction of the coastline, the runway and the east-south east direction, from which the weather changes.

Total staff of forecasting and observation room: 41 persons
Day sift staff of the forecasting and observation department: 17 persons
Night sift staff of the forecasting and observation department: 8 persons
Calculation of the floor area: 14 m^2 x 17 = 238 m^2

b. SSB room

It is necessary to provide the space for the existing high frequency radio telephone system (SSB), to be removed from FMS. The room will mainly be operated by the observers, but the maintenance of the equipment is to be performed by the reporting department.

The main work is to collect, via HF radio telephone, the meteorological data observed and collected by respective regional observation stations.

The number of the SSB room staff: 2 persons
Calculation of the floor area: 6 m^2 x 2 = 12m^2

c. Computer room, computer operation room, computer maintenance room, and spare parts room

The computer department is to be composed of 4 rooms: computer room, computer operation room, computer maintenance room, and spare parts room. In the computer room, the centre computers (for GTS data reception and transmission, data processing and analysis, data server, existing AFTN) of all the computer systems are to be installed. All the data required for the meteorological services are to be supplied from the computer room, and all the data prepared are to be kept in that room.

In addition to the monitoring control and telecommunications operation and maintenance of the centre computers, the maintenance, installation, version up, change, etc., of the software, are to be provided by the computer department. The computer service to the meteorological engineers, and end users, is a function of this room.

The computer maintenance room is provided to maintain, repair, etc., the computers to be installed by the Project as well as the existing computer systems. Performance tests are to be carried out after repair and adjustment of computers. For this purpose, electrical power for the computers and a comparatively large space for maintenance and repair are required.

The spare parts room is to store the computer related spare parts.

The number of the computer operation room staff: 4 persons
Calculation of the floor area: 9 m^2 x 4 = 36m^2

d. Research and development room

In the research and development room, the study, research and development, task that were impossible to execute by the engineers during their work-site operation, are to be carried out during the day. For this purpose, the room is to be located adjacent to the forecasting room. The improvement and development of forecasting and observation technology, and the development of the new software are to be carried out. In addition, the meteorological year book is to be prepared, based on the annual and monthly meteorological reports prepared by the climatology department.

The number of the Research and development room staff: 4 persons

Calculation of the floor area: 9 m^2 x 4 = 36m^2

e. Tropical cyclone forecasting, warning, and briefing room

At the time of the tropical cyclone, several forecasters are to monitor the movement of the cyclone, and prepare and issue the tropical cyclone forecasting and warning hourly. For this purpose, the room is to be located close to the forecasting room.

Usually, the room is used for the briefing of the meteorological conditions for the air pilots, ships related and information facilities' personnel, government authorities concerned and general meteorological information users, who visit the Centre daily. The briefing is also the service of the forecasters. The room is to be located close to the forecasting room to physically shorten the flow line.

The number of the Tropical cyclone forecasting, warning, and briefing room staff: 3 persons

Calculation of the floor area: 10 m^2 x 3 = 30m^2

f. Regional meteorological service room

The department is to be the window to provide the meteorological services to the South Pacific area in charge of the Regional Specialized meteorological Centre. The work includes advice and support on the meteorological services proffered to neighboring countries, upgrading of the meteorological service in the area concerned, etc. In the future, the RSMC experts dispatched from WMO shall work in this room.

The number of staff of FMS: 3 persons

The number of RSMC experts of WMO: 1 person

Calculation of the floor area: 6 m^2 x 4 = 24m^2

g. Weather chart room

The room is used to store various weather charts. Of these, the ground weather charts are usually kept permanently. Japan Meteorological Agency keeps the annually increasing weather charts on microfilm. The other weather charts are accumulated annually as well. It is necessary to store the charts for a long term for study and research.

h. Studio

The general weather forecast, cyclone forecasting and warnings announced and issued at the time of the cyclones are to be recorded in the studio and broadcast by the information facilities. The broadcasting equipment in the studio are to be introduced by the information facilities.

The following shows the area of the respective departments of the Centre.

Room Name	Area	Room Name	Area
Ground Floor		**First Floor**	
Reporting Room	36.50 m^2	Forecasting & Observation Room	236.65 m^2
Reporting Data & DCP Room	21.35 m^2	Pen Plotter Room	13.75 m^2
Training Room	79.19 m^2	Chief Of Forecasting Room	7.31 m^2
Equipment Room	4.30 m^2	SSB Room	12.50 m^2
Training Operation Room	5.00 m^2	Computer Room	48.61 m^2
Library	57.14 m^2	Computer Operation Room	33.23 m^2
Climatology Room	69.02 m^2	Computer Maintenance Room	18.50 m^2
(Including Chief of Climatology		Spare Parts Room	11.25 m^2
Room,Data Analysis Room)		Tropical Cyclone Warning	28.62 m^2
Weather Data Room	17.94 m^2	& Briefing Room	
Calibration Room	13.20 m^2	Studio	16.08 m^2
Instrument Room	11.31 m^2	(Including Entrance Room)	
Control Room	26.71 m^2	Stationery Room	9.80 m^2
Workshop	69.35 m^2	Building Maintenance Room	6.77 m^2
(Including Workshop Office, Toilet)		Weather Charts & Documents Room	25.04 m^2
Workshop Store	20.31 m^2	Research & Development Room	33.23 m^2
Entrance	10.41 m^2	Regional Service Room	17.17 m^2
Shower Room	9.31 m^2	Rest Bay	13.47 m^2
Electricity Room	30.47 m^2	Director Room	26.33 m^2
Locker Room	13.56 m^2	(Including Meeting Room 11.93m^2)	
Tea Kitchen	7.50 m^2	Secretary Room	8.11 m^2
Lavatory	28.56 m^2	Locker Room	13.56 m^2
Toilet, Hall, Staircase	122.93 m^2	Tea Kitchen	7.50 m^2
		Lavatory	28.56 m^2
		Store	4.25 m^2
		Corridor, Staircase, EPS, D.S.	111.23 m^2
Total Ground Floor Area	654.06 m2	Total First Floor Area	731.52 m2
Total Centre Building Area	**1,385.58 m^2**		
Power House Area	**57.97 m^2**		
Grand Total Area	**1,443.55 m^2**		

2. Section Plan

It is assumed that the height between floors is 3,500 mm, the ceiling height of each room is 2,700 mm, the height from the floor to the opening is 1,000 mm, and the height of the opening is 1,100 mm. The girder of 600 mm height can secure 200 mm of the ceiling space.

This space is used for electric wiring, facility trunk circuits, service piping and ducts, etc. The floor of the computer related rooms (forecasting room, observation room, chief forecasting room, SSB room, computer room, computer operation room, computer maintenance room, spare parts room, pen plotter room) is to be raised by 150 mm through the provision of an access floor, to install computer circuit lines and wiring, general receptacles and receptacles for equipment, the transceiver for the computer circuit and the hub, etc.

The section plan is made with careful consideration of protection from direct sunlight and the prevention of rainwater penetration. For this purpose, the roof eaves of each floor are to be extended 1.2 m from the column centre. At the extremity of the eaves of the ground floor, the sagging wall is to be provided to prevent direct sunlight from shining into the room. however the sagging wall is not to be provided at the extremity of the eaves of the 1st floor to enable observation of the meteorological conditions. For the prevention of rainwater penetration, rainwater drain pipes and the raiser part of the waterproof layer can be installed outside the facility by extending the eaves by 1.2 m. The penetration of the rain from the opening can be prevented by providing the sagging wall at the end of the eaves of the ground floor. The ground floor slab is to be raised by 50 cm above the ground level, to prevent the penetration of rainwater.

3. Structural Design

In the Republic of Fiji, many buildings are designed in accordance with the New Zealand Standard (NZS) based on British Standards (BS). The NZS covers the seismic regulations, which are not included in the BS. In the Project, the materials readily available in Fiji are to be utilized and the local construction methods are to be adopted.

The structural plan is based on NZS, taking the current situation of Fiji into consideration. As occasion demands, the Building Standard Act of Japan and the Design Standard of Architectural Institute of Japan (AIJ) shall be referred to.

1) Structure

The structural design is based on the reinforced concrete and rigid-frame structure widely practiced in Fiji, and concrete block structure (140 mm thick).

The floor slab is to be of reinforced concrete while partition walls are of concrete block (100 mm thick).

2) Foundation

According to the result of the geological investigations at the site, the foundation is to be spread foundation (independent footing or continuous footing) on the supporting silt layer of 1.2 m depth from ground level.

3) Structural Design Standard

a. Stress calculation

Calculated in accordance with elastic analysis method.

b. Section design

The elastic design method is to be applied to the reinforced concrete structure, and the structure is to be designed in accordance with the "Reinforced Concrete Structure Calculation Standard" of AIJ.

4) Load Condition

a. Live load

The live load is to be 300 kg/m^2 (Building Standard Law of Japan, enforcement ordinance, article 85, equal to general office).

b. Seismic Force

The standard shearing modules is calculated from "New Zealand Standard NZS 4203, Part 3, Earthquake Provisions." The seismic force is calculated for these modules according to the standard method of the Architectural Standard of Japan.

The standard shearing modules is calculated from the following formula:

$Cd = C \cdot I \cdot S \cdot M \cdot R = 0.2$

C = Seismic zone factor = 0.125

I = Importance factor = 1.6

S = Structural type factor = 1.0

M = Structural material factor = 1.0

R = Risk factor = 1.0

The seismic zone of Nadi is classified in Zone 4, according to the seismic risk zone map (June 1990).

c. Wind load

The wind load is taken from Australia Standard AS 1170, Part 2, Wind Force. 100-year recurrence maximum momentary wind velocity calculated by FMS, is 67 m/s. This value is to be adopted.

d. Soil bearing capacity

According to the result of the geological investigation (Appendix 8.), the Project site is underlain by clayey silty alluvial material with silty and gravelly layers. The materials are generally stiff and the water table is 3 to 4m below surface. The soil bearing capacity of more than 8 t/m^2 can be expected in the dry season. The soil bearing capacity, however, is to be 8 t/m^2 for the long term, taking the worst condition during the rainy season into consideration.

5) Materials and strength

a. Concrete

Ordinary concrete is to be used.

The standard design strength is Fc = 210 kg/cm^2 (28-day compressive strength).

b. Reinforcing bar

Reinforcing bar	Standard	Yield strength (MPa)
Deformed bar	Grade 235	235 MPa
	Grade 275	275 MPa

4. Electricity Installation Plan

1) Power take-in installation

Power take-in installation up to the site is to be provided by the Government of Fiji at its account. The power centre of Fiji Electricity Authority (FEA), located across the front road of the site and covering the whole Nadi International Airport, distributes 11 kV electricity to the site. The Centre is to be served with the electrical power supply in to the facility transformer installation via underground cable. The power is to be 2 circuits, 3 phase, 3 lines, 50 Hz.

2) Sub-station

In the Project, the power house is to be constructed within the site to install the transformer, electricity power generator, electricity receiving and transforming facility, etc.

A door with lock facing the public road is provided since the sub-station will be supervised by FEA.

Power within the site is supplied through the low voltage switchboard.

An open standing type switchboard is installed in the sub-station

-Rated power capacity: 200 kVA
-Rated voltage: 11 kV/415V-240V
-Wiring system: 3 phase 4 line, 50 Hz
-Voltage drop: less than 4%

3) Power generator

The power generator is to be provided as a back-up electric power source for the computer system and equipment, etc., working 24-hours a day throughout the year, to provide continuous forecasting and warning even during the tropical cyclones.

-Capacity: 150 kVA

-Voltage: 3f 4 W, 415/240 V, 50Hz

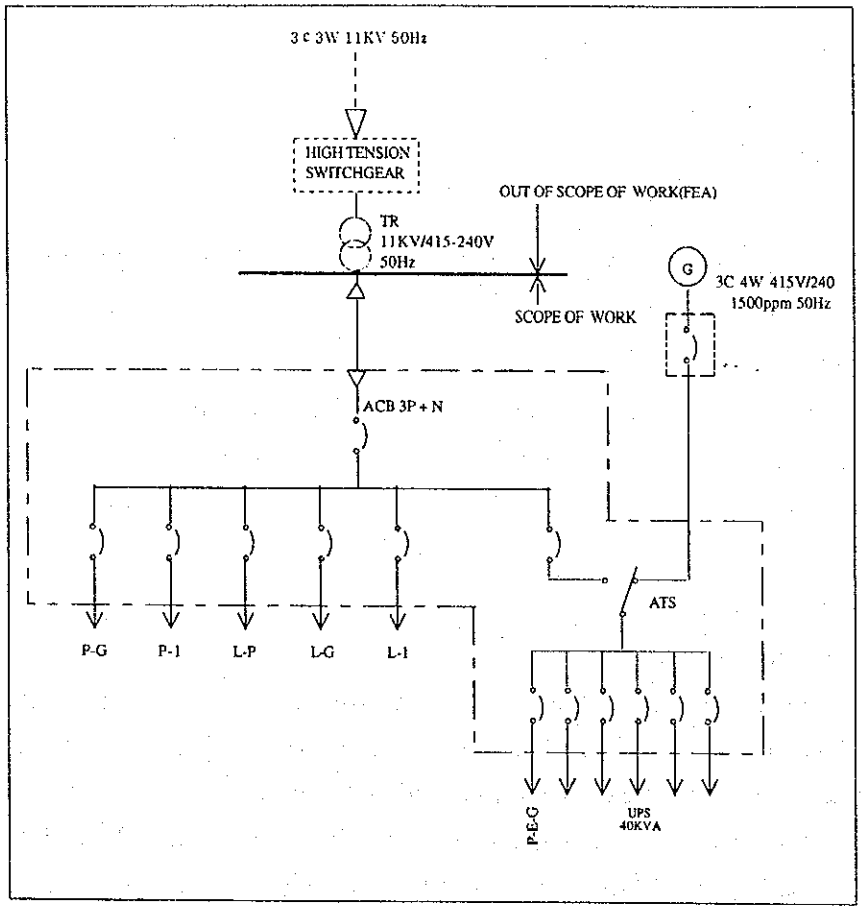


Fig. 3-1 Power Distribution Diagram

4) Trunk line and power installation

Vinyl pipe is to be employed for the exterior pipe line, to avoid salt damage and corrosion. The interior parts of the building are of cable rack system. The air conditioners, etc., are unit type. The ceiling fans and ventilators are manually controlled.

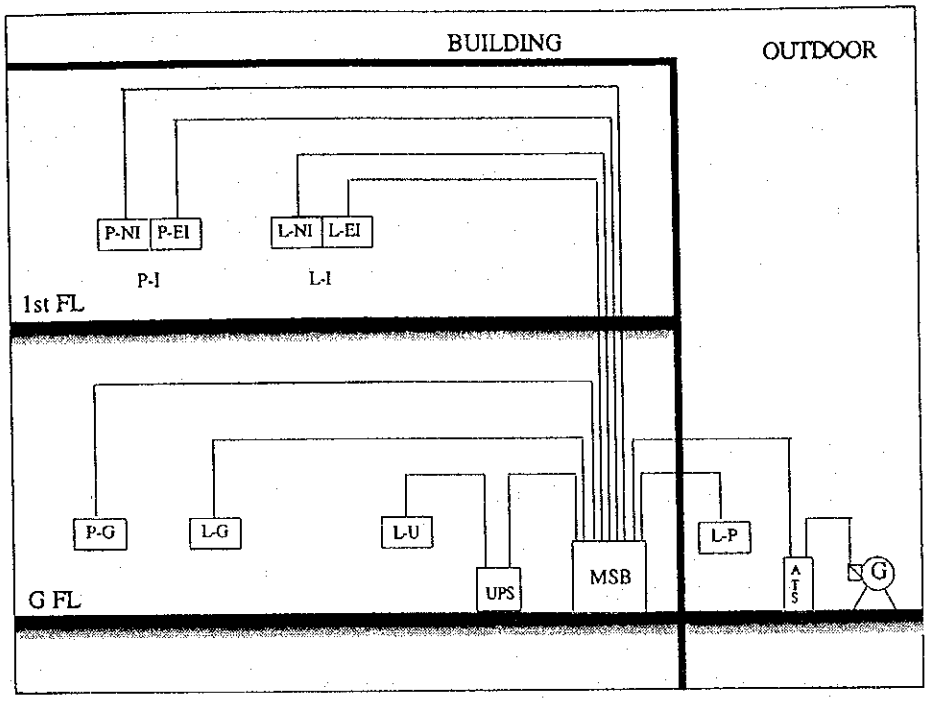


Fig. 3-2 Circut Diagram

5) Lights and Receptacles

a. The wiring is to be carried out in accordance with the electricity installation engineering standard of Fiji and wiring regulations of Australia. The voltage to be used is single phase 240 V, and all the equipment is to be provided with earthing.

b. Piping is standard vinyl pipe normally used in Fiji.

c. Energy efficient fluorescent lamps are to be used as the main lighting source. Incandescent lamps or high intensity lamps are to be used where required.

Forecasting Room	: 500 lx	Reseach & Development Room	: 400 lx
Observation Room	: 500 lx	Training Room	: 400 lx
Computer Room	: 500 lx	Library	: 400 lx
Computer Operation Room	: 500 lx	Control Room	: 400 lx
Climatology Room	: 400 lx	Others	: 400 lx
Reporting Room	: 400 lx	Corridor, Store	: 200 lx

All the electric power for the computer system is to be supplied through constant frequency and constant voltage equipment to ensure appropriate operation of the equipment and achieving of the full service life. An emergency generating system is to be supplied as back-up in the event of power failure.

The capacity of the constant frequency and constant voltage equipment is calculated with 37.8kVA of total power consumption of computer equipment which requires a back-up system (refer to "Air conditioning installation" mentioned later) and increases for the future. The power failure will not occur frequently, as the Centre is supplied the power from FEA Power Centre which has a back-up system. The capacity of the battery is, therefore, planed to supply adequate power to the computer equipment while the engine generator starts after the power failure.

-CVCF: 40 kVA
Input 3f, 415V, 50Hz
Output 3f 4 W, 415/240 V, 50Hz, 40 kVA
-Battery: Vent Sinterd Type Alkaline battery
276V, 80Ah (1HR), for 5 minutes

Electricity conditions for the computer systems are as follows:
-Voltage: within ± 10% of rated voltage
-Frequency: within ± 1% of rated frequency
-Wave form distortion factor: less than 5%
-Earthing resistance: less than 10 Ω (independent earthing)
Receptacles incorporating a switch are to be provided.

6) Telephone installation
The telephone line in the Centre is to be branched from the Private Branch Exchange (PBX) of the facility installed by FPTL. The size of the pipeline is to be greater than 22 mm.

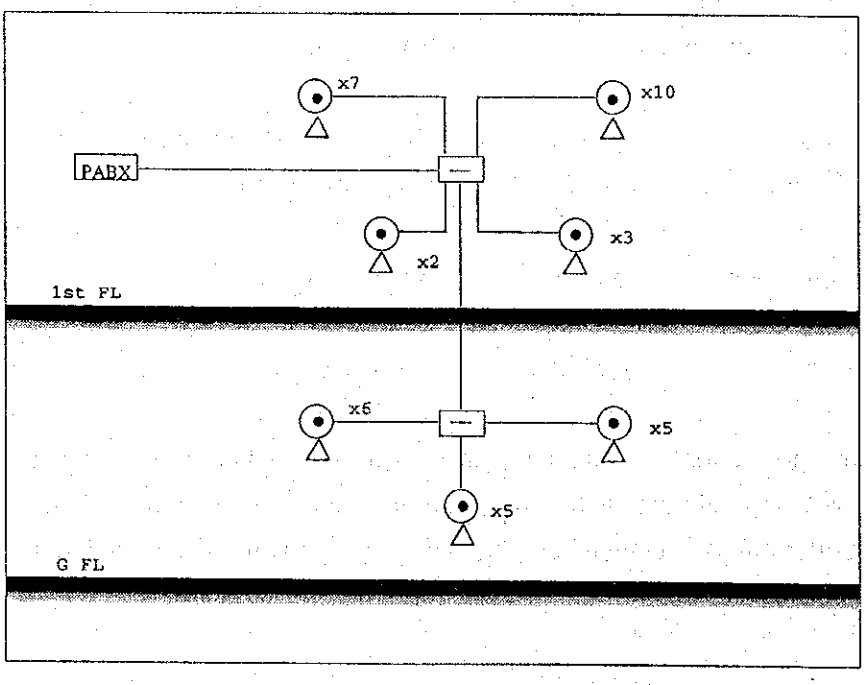


Fig. 3-3 Telephone Diagram

7) Interphone installation

The interphone is to be provided at the entrance of the Centre on the ground floor and the entrance of the forecasting and observation departments on the 1st floor, for night security of night sift staff of the forecasting and observation department and visitors. The receiving set is to be installed in the forecasting and observation room.

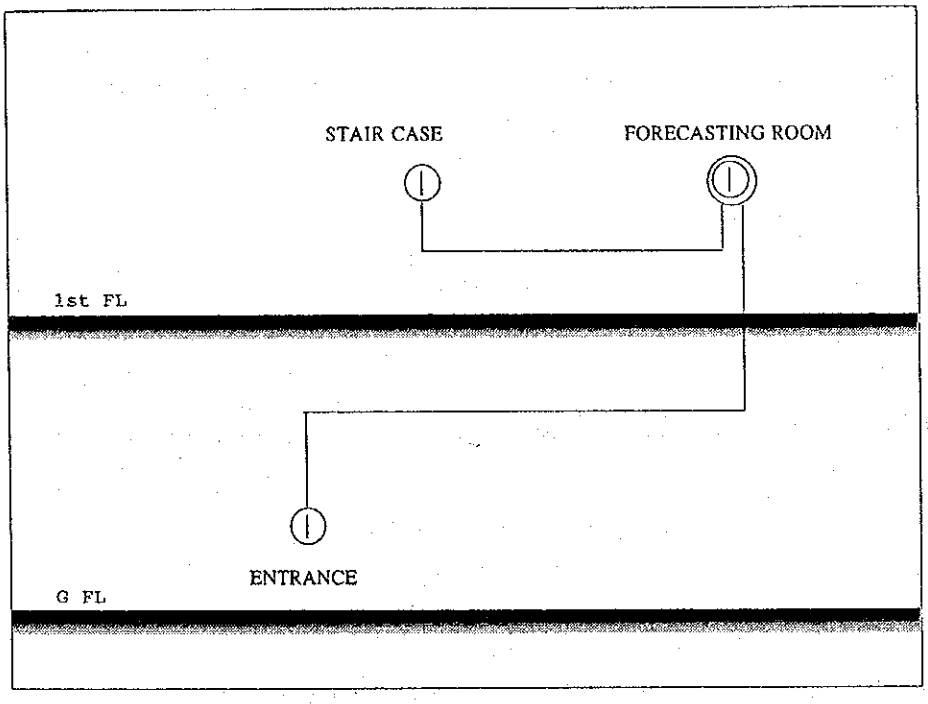


Fig. 3-4 Interphone Diagram

8) Clock

Clocks powered by the storage battery are to be provided in the forecasting and observation rooms to carry out the services at the precise fixed times.

9) Lightning Conductor

The lightning conductor is to be provided to protect the computer system.

10) Automatic fire alarm

An automatic fire alarm is to be installed based on the Fiji standard for the early warning of fires and protection of human life. The receiving set is to be installed at the outside of the entrance (in accordance with the Fiji standard).

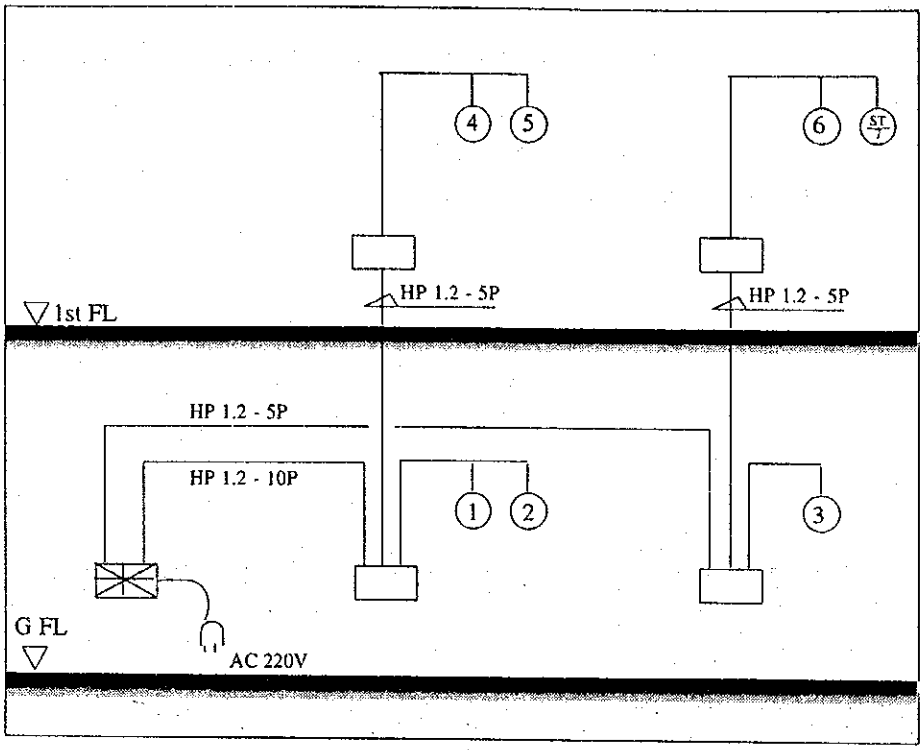


Fig. 3-5 Alarm System Diagram

11) Television set

For the monitoring of television by the forecaster, the TV antenna wiring and TV connection terminal are to be installed in the forecasting room and the cyclone forecasting and warning room (the costs related to TV set and antenna shall be borne by the Fiji side).

The weather forecast broadcast through TV is to be monitored by the forecaster to confirm the accuracy of the weather forecast, this is also done in Japan by the Japan Meteorological Agency. The television is also indispensable in receiving the information without delay during disasters.

5. Plumbing plan

1) Water supply

The lead-in of water supply to the Center shall be borne by Fiji. The service pipe is branched from 6 inch buried trunk water pipe in the front road of the site. The branch pipe is to be led to the site via a water volume meter. The water is to be supplied by 2.5 inch water pipe from the gate valve to the Centre.

2) Hot water supply

The electric hot water heaters are to be installed in the shower room on the ground floor and the tea kitchens on the ground and 1st floor.

3) Drainage installation

Drainage is to be separated into storm water line and sewage and waste water line.

-Storm water is collected in storm water drainage from the standing tub, and released to the storm water pipe installed by CAAF located adjacently to the site.

- Sewage and waste water are combined into one system, and the pipe is joined with the sewage line already buried at the site. The sewage and waste water from the Center are to be disposed of in the sewage facility (small purification system) under the administration of CAAF.

4) Sanitary equipment

The closet, urinal, lavatory, hand-basin, shower, etc., is to be provided in the places required. Water-efficient flushing valves are to be used for closet and urinal.

5) Fire extinguisher

A fire extinguisher is to be provided in each room required.

6. Air conditioning and ventilation installation plan

Since humidity is high in Fiji, air conditioners are to be installed in the rooms as required for the meteorological services for the retention of the service life and operation and maintenance of the computer system.

1) Environmental conditions

Allowable dust concentration: less than 15 mg/m^3

Operating temperature: 17~25° C (around the equipment)

Operating humidity: 45~65%

2) Air conditioning installation

The air conditioner shall be of a type locally available, and the separate units shall be installed for energy saving and differing purposes and use. The outside units shall be installed on the roof floor. Filters shall be attached to the air intakes to prevent salt damage and maintain the room condition within the allowable dust concentration.

3) Ventilation

The ventilator shall be provided in places of unpleasant smell or high humidity, such as tea kitchen, lavatory, shower room, workshop, etc. Forced ventilation will be employed.

All the openings of the forecasting room, observation room, computer room and computer control room will be provided with embedded windows. Ventilation installation shall be installed to maintain appropriate interior conditions.

The number, power consumption, generated heat from the computer and computer related equipment installed in each room, are as follows. Based on this, the power supplied through constant frequency and constant voltage system, emergency power equipment and back-up generating equipment, is to be calculated, and the specification of electric power equipment and air conditioning equipment is to be decided.

	Nos.	Power consumption	Heat generation
FORECASTING & OBSERVATION ROOM			
Graphic Terminal	5	0.5kVA	260kcal/h
Laser Printer	3	0.8kVA	350kcal/h
Printer of Saterlite Data Receiving System	2	0.8kVA	340kcal/h
	Sub total	13.7kVA	6,305kcal/h
PEN PLOTTER ROOM			
Pen Plotter	2	0.3kVA	39kcal/h
Personal Computer	1	0.6kVA	325kcal/h
	Sub total	1.8kVA	403kcal/h
COMPUTER ROOM			
Desktop type Workstation	6	1.1kVA	900kcal/h
Server Type Workstation	6	0.5kVA	400kcal/h
Monitor Display	6	0.4kVA	200kcal/h
DAT	6	0.05kVA	30kcal/h
	Sub total	12.3kVA	9,180kcal/h
COMPUTER OPERATION ROOM			
Monitor Display	6	0.4kVA	200kcal/h
Laser Printer	1	0.8kVA	350kcal/h
Serial Printer	2	0.7kVA	480kcal/h
	Sub total	4.6kVA	2,510kcal/h
TROPICAL CYCLONE WARNING & BRIEFING ROOM			
Graphic Terminal	1	0.5kVA	260kcal/h
	Sub total	0.5kVA	260kcal/h
RESEACH & DEVELOPMENT ROOM			
Graphic Terminal	1	0.5kVA	260kcal/h
Personal Computer	1	0.6kVA	325kcal/h
Laser Printer	1	0.8kVA	350kcal/h
	Sub total	1.9kVA	935kcal/h

CLIMATOLOGY ROOM			
Graphic Terminal	1	0.5kVA	260kcal/h
Personal Computer	1	0.6kVA	325kcal/h
Laser Printer	1	0.8kVA	350kcal/h
	Sub total	1.9kVA	935kcal/h
REPORTING ROOM			
Personal Computer	1	0.6kVA	325kcal/h
Laser Printer	1	0.8kVA	350kcal/h
	Sub total	1.4kVA	675kcal/h
	Total	37.8kVA	21,463kcal/h

7. Building material plan

Local material or locally available imported material was selected for exterior finishing material and interior finishing material, since maintenance would be easier.

The building materials are listed below:

1) Exterior finishing material

Main building

Skirting:	Cement sand mortar EP
Exterior wall:	Cement sand mortar, spray tile
Roof:	Asphalt waterproofing, protection concrete, cement tile
Window:	Aluminum sash, wired glass 6.8 mm thick
Door:	Steel flush door, aluminumu sash door and steel rool-up door at the main entrance

Power house

Skirting:	Cement sand mortar EP
Exterior wall:	Cement sand mortar, spray tile
Roof:	Coating type waterproofing with reinforcing sheet
Door:	Steel flush door

2) Interior finishing material

General offices

Floor:	Vinyl tile
Skirting:	Vinyl skirting H=100
Wall:	Cement sand mortar EP
Ceiling:	Acoustic panel, grid ceiling system

Entrance, Hall

Floor:	200 square ceramic tile
Skirting:	Ceramic tile H=100
Wall:	Cement sand mortar EP
Ceiling:	Acoustic panel, grid ceiling system

Work-shop

Floor:	Cement sand mortar
Skirting:	Cement sand mortar EP
Wall:	Cement sand mortar EP
Ceiling:	Fair faced concrete EP

Forcasting and observation room, computer related rooms

Floor:	Carpet tile on access floor
Skirting:	Vinyl skirting H=100
Wall:	Cement sand mortar EP
Ceiling:	Acoustic panel, grid ceiling system

Lavatory

Floor:	Mosaic tile
Wall:	100 square glazed tile
Ceiling:	Acoustic panel, grid ceiling system

Power house

Floor:	Cement sand mortar
Skirting:	Cement sand mortar EP
Wall:	Cement sand mortar
Ceiling:	Fair faced concrete

3-3-3 Equipment Plan

1. Computer System for Data Communication, Processing and Analysis

The plan is as shown in Table 3-1 and Fig. 3-6.

The software for GTS communication control and data identification is supplemented below.

1) Outline of software for GTS communication control and data identification

a. Data reception

Data from each channel with respective code are converted to the internal code and stored in a receiving file.

b. Received data processing

The received massage are classified into alphanumeric (A/N) data and binary data.

c. Message identification and processing

After message identification and analysis of the received data, each composed message and information are stored in a receiving file.

d. Data formatting and sorting

The input data are formatted stationwise, and registered in data file with data information after sorting by data content and area.

e. Data selection and editing

- Data selection : Data are selected by the content, area and observation date and time.

- Data editing: Selected data are arranged by deleting unnecessary elements and groups in accordance with the international meteorological data exchange code of WMO and the international aeronautical data communication regulations of ICAO.

- Message compilation: The necessary messages to be sent are gathered together as one compiled massage by grouping in input order, station number order, sea areas, etc.

f. Output processing

Message output processing, and message disposal processing, etc.

-Data transfer and output: to take out waiting data according to the priority order and transfer to transmission queue.

-Disposal processing: to dispose of unnecessary data from transmission queue.

g. Message transmission

The message transferred from output processing are transmitted to the designated channel after code conversion.

h. Pre-processing for weather chart plotting

Data decoding and command preparing for weather chart plotting are included.

i. Urgent report processing

Urgently required data, e.g. earthquakes, tsunami, etc., have priority.

j. Operation processing

- Message reception & transmission records for each channel.
- Manual order of data retransmitting and transferring.
- Retrieval and output of stored data.
- Disposal of queue data or suspension of transmission.
- Others

k. Off-line services

- Gathering of journals
- Received massage statistics: daily, monthly, etc.
- Others

2. Satellite Image Receiving Equipment

The plan is as shown in Table 3-1 and Fig. 3-6.

3. Automatic Meteorological Observation Equipment

The plan is as shown in Table 3-1 and Fig. 3-6. The performance of each observation instrument is as follows.

Name	Measurement range	Accuracy
Barometer	920~1040 hPa	within ±0.5 hPa
Thermometer	-5~50° C	within ±0.5° C
Dew-point thermometer	0~50° C	within ±0.5° C
Hygrometer	0~100 %	within ±2 %
Wind vane (wind direction)	0~540 deg.	within ±5 deg.
Anemometer (wind velocity)	2~70 m/s	
(10 m pole included)	(for wind velocities less than 10 m/s)	within ±0.5m/s
	(for wind velocities more than 10 m/s)	within ±5%
Rain gauge	0~50 mm or 100 mm repeatedly	within ±3%

4. Upper Air Observation Receiving and Analizing Equipment

The plan is as shown in Table 3-1 and Fig. 3-6.

5. Wind vane and Anemometer

The plan is as shown in Table 3-1 and Fig. 3-6.

The performance and specifications are as follows:

Name	Measurement range	Accuracy
Wind vane (wind direction)	0~540 deg.	within ±5 deg.
Anemometer (wind velocity)	2~70 m/s	
(5 m pole included)	(for wind velocities less than 10 m/s)	within ±0.5m/s
	(for wind velocities more than 10 m/s)	within ±5%

Sensor:

Wind vane: potentiometer type

Anemometer: electrical generating type.

With wind direction/velocity indicator in Observation room for remote observation.

6. Calibration Equipment for Meteorological Instruments

The plan is as shown in Table 3-1 and Fig. 3-6.

Table 3-1(1) Major Equipment List

Equipment	Specifications	Quantity
(1) Computer system		
1) Computer		
Computer for GTS communication	X.25 protocol (Logical multiplex packet exchange) UNIX Workstation - Server type, CPU Performance: Spec.92int≧50, Spec.92fp≧100, Disk capacity≧4 GB, Memory size≧64 MB.	2 sets
Computer for GTS data processing	UNIX Workstation - Desktop type, CPU Performance: Spec.92int≧50, Spec.92fp≧100, Memory size≧64 MB, Disk capacity≧4 GB.	2 sets
Computer for GTS data pre-processing & input	UNIX Workstation - Desktop type, CPU Performance: Spec.92int≧50, Spec.92fp≧100, Memory size≧64 MB, Disk capacity≧4 GB.	2 sets
Computer for data serving	UNIX Workstation - Server type CPU Performance: Spec.92int≧75, Spec.92fp≧125, Memory size≧64 MB, Disk capacity≧20GB.	2 sets
Computer for weather chart plotting	UNIX Workstation - Desktop type, CPU Performance: Spec.92int≧150, Spec.92fp≧200, Memory size≧64 MB, Disk capacity≧4 GB.	2 sets
Computer for meteorological data processing / forecast support	UNIX Workstation - Server type CPU Performance: Spec.92int≧150, Spec.92fp≧200, Memory size≧64 MB, Disk capacity≧4 GB.	2 sets

Table 3-1(2) Major Equipment List

Equipment	Specifications	Quantity
Graphic Terminal	24 bit Color, 1100×1024 pixel or more	8 sets
Personal Computer	To support Ethernet-LAN connection CPU: Pentium 66MHz or more	1 2 sets
2) Peripheral Device		
Pen Plotter	A1 size	2 sets
Serial Printer	Print speed≧50 lines/min, (136 column/line or more)	2 sets
Laser Printer	Postscript Printer(A4 size or more)	7 sets
Image Scanner	A4 ~ A3 size	2 sets
DAT	Data capacity≧2 GB/tape	6 sets
Network Equipment	Duplex connecton for all computer system	2 sets
3) Software		
GTS communication and data processing	1. data receiving 2. input pre-processing 3. discrimination 4. data filing 5. editing 6. output pre-processing 7. transmission 8. image pre-processing 9. emergency report handling 10.operation support 11.off line service for GTS	1 set
AFTN communication and data processing	To have the same functions as above.	1 set
Weather Chart Plotting	To plot meteorological data on weather chart in accordance with WMO standard.	1 set
Forecast support	To support forecaster's analisis by displaying obseved & analized data, satellite image and numerical weather prediction products. To have capability for application program modification & development.	1 set

Table 3-1(3) Major Equipment List

Equipment	Specifications	Quantity
(2) Satellite Data Receiving System		
High-resolution satellite data receiver for GMS	1. Allowable wind velocity: 67 m/s, 2.Adopting S-VISSR, GMS-5, 3.To display visible/infrared image and sea surface temperature distribution in false color. 4. Zoom up function, image enhancement, map overlay, latitude/longitude grid overlay 5. Sequencial image display / Cold area rate indication / Dvorak Index / LOG 10 / Cyclone trucking function/ Coordinate conversion. 6. Ethernet LAN connection / Image printing function / Image format conversion / Data receiving schedule management.	1 set
High-resolution satellite data receiver for NOAA	1. Allowable wind velocity: 67 m/s, 2.Adopting HRPT, 3.To display visible/infrared image and sea surface temperature distribution in false color. 4. Zoom up function, image enhancement, map overlay, latitude/longitude grid overlay 5. Sequencial image display / Cold area rate indication / Dvorak Index / LOG 10 / Cyclone trucking function / Coordinate conversion / TOVS data analisis. 6. Ethernet LAN connection / Image printing function / Image format conversion / Data receiving schedule management.	1 set

Table 3-1(4) Major Equipment List

Equipment	Specifications	Quantity
(3) Automatic Meteorological Observation System		
Automatic Meteorological Observation System (DCP)	Observation items: atmospheric pressure, temperature, humidity, wind direction & speed and precipitation. Automatic data transmission to GMS satellite. Interval: hourly.	7 sets
(4) Upper Air Observation Data Analyzer		
Upper Air Observation Data Analyzer	To receive & process data from existing equipment. Automatic data analysis function.	1 set
(5) Meteorological instrument		
Anemometer with wind vane	To meet WMO standard. Wind direction: Potentiometer type, Wind speed: Generator type. To have wind direction & speed remote indicator and pen recorder	1 set
Barometer calibration chamber	To meet WMO standard. To equip standard mercury barometer.	1 set
Thermometer calibration water tank / Thermo-hygrostat	To meet WMO standard.	each 1 set
Wind Sensor Caribration Equipment	To measure revolution speed of anemometer. To have output check function of wind vane.	1 set

Table 3-1(5) Major Equipment List

Equipment	Specifications	Quantity
(6) Training Instrument		
Over Head Projector (OHP)	Suitable for local power supply system	1 set
Video Tape Recorder / Monitor / Video camera	Suitable for local power supply system	1 set
(7) Pick-up truck for maintenance and emergency		
Pick-up truck for maintenance and emergency use	4 wheel drive system. Enough size for load capacity: transportation of equipment for maintenance and spare parts.	2 sets
(8) Spare parts	necessary spareparts for each equipment	

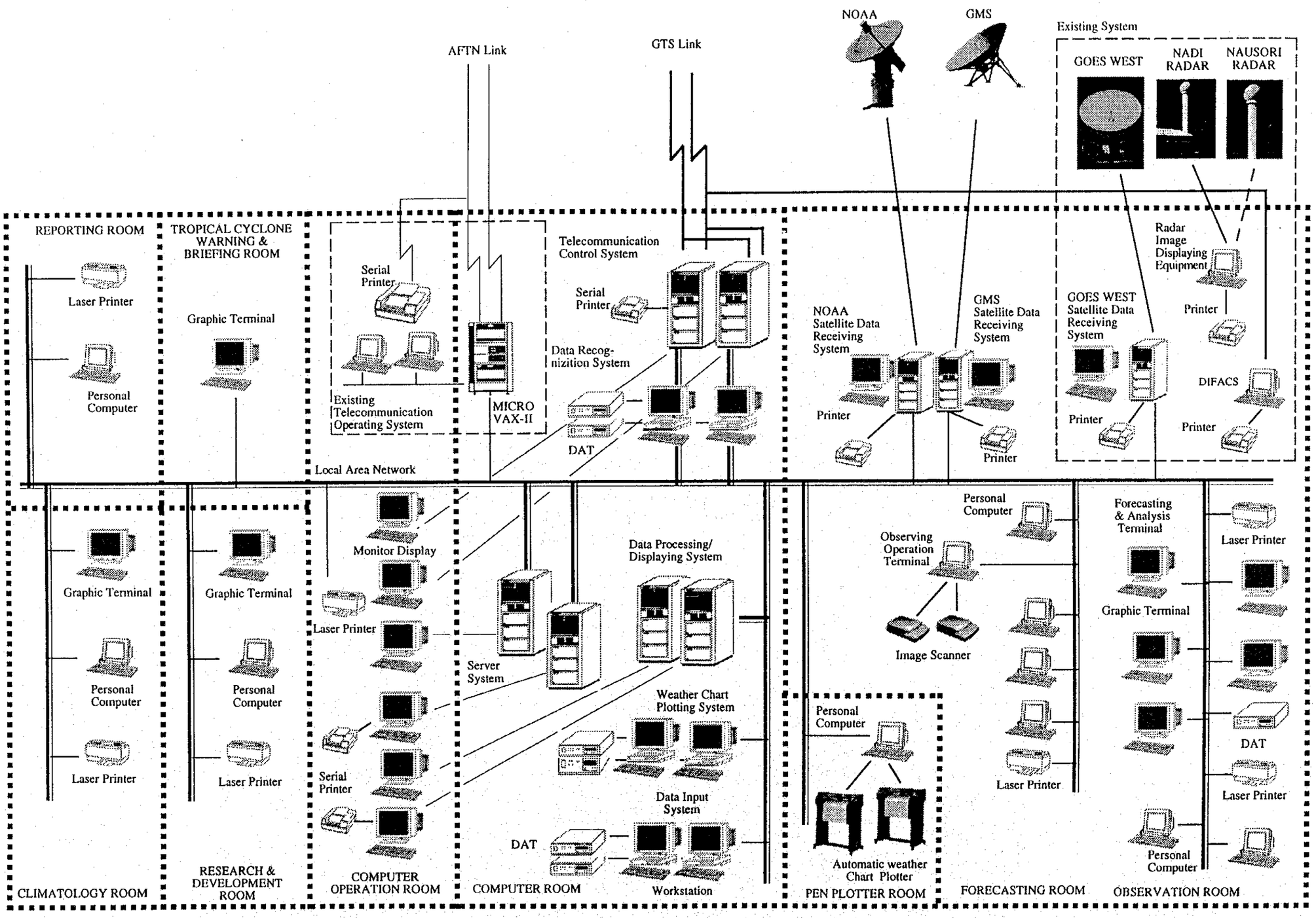
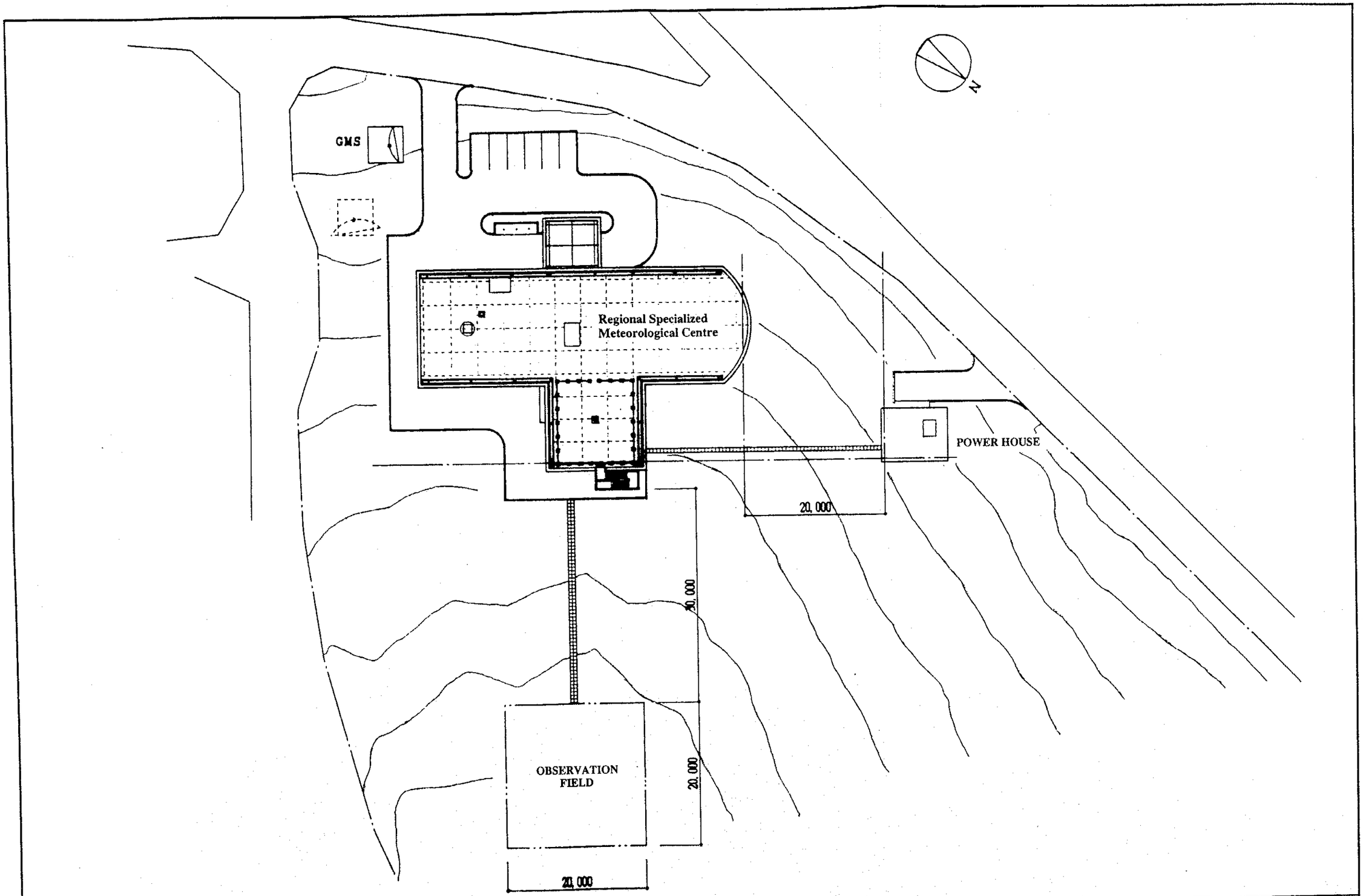


Fig. 3-6 Configuration of Computer System on Basic Design

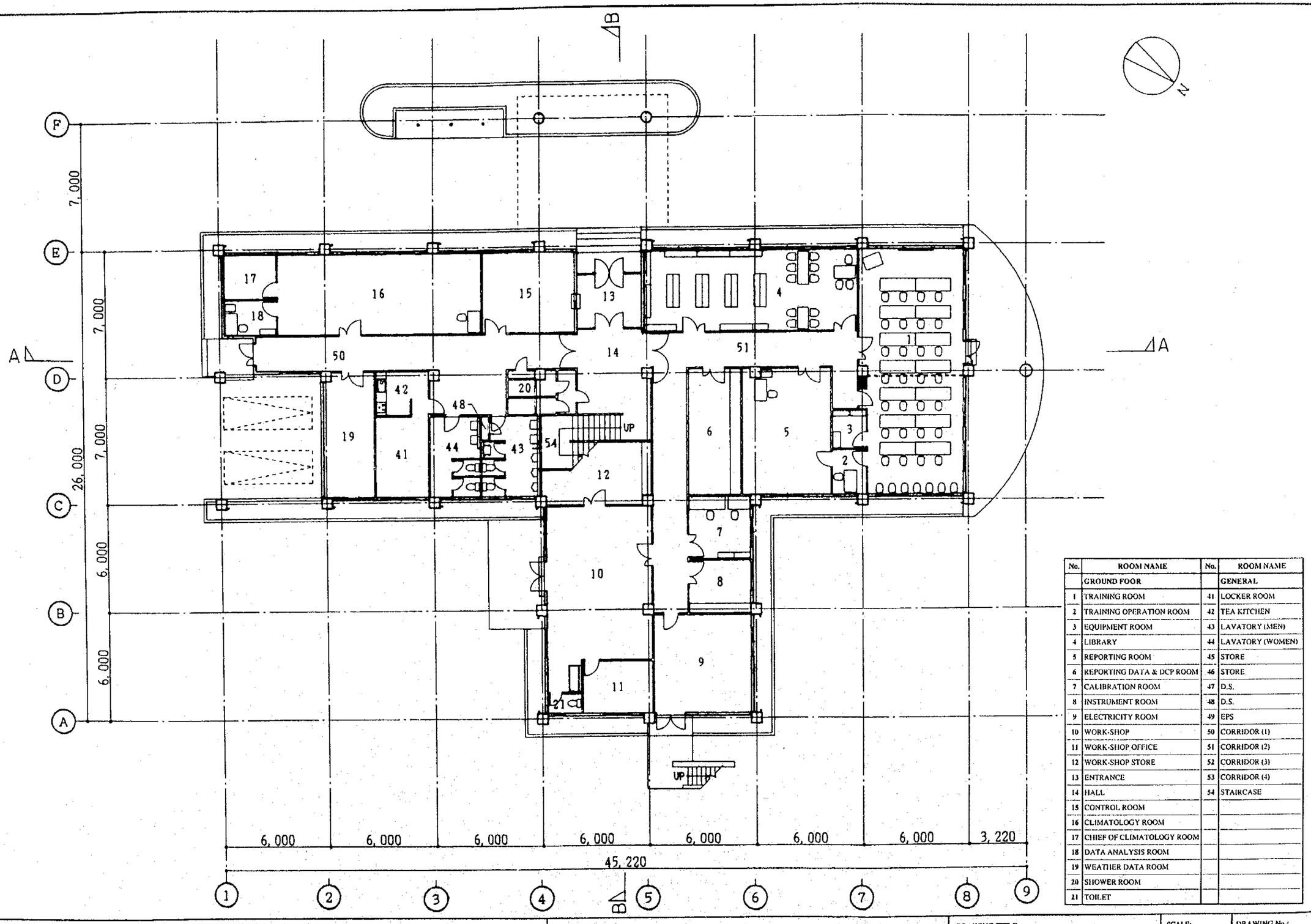
3-3-4 Basic Design Drawing

The basic design drawings are as follows.

SITE PLAN	A - 01
GROUND FLOOR PLAN	A - 02
FIRST FLOOR PLAN	A - 03
ROOF PLAN	A - 04
ELEVATION - 1	A - 05
ELEVATION - 2	A - 06
SECTION	A - 07
POWER HOUSE	A - 08



Japan Weather Association 2-9-2, Kanda Nishikicho, Chiyoda-ku, Tokyo, 101 Japan Tel. +81-3-3295-1525 Fax.+81-3-3295-1097	PROJECT: Regional Specialized Meteorological Centre	DRAWING TITLE: SITE PLAN	SCALE: 1/500	DRAWING No.: A-01



No.	ROOM NAME	No.	ROOM NAME
	GROUND FOOR		GENERAL
1	TRAINING ROOM	41	LOCKER ROOM
2	TRAINING OPERATION ROOM	42	TEA KITCHEN
3	EQUIPMENT ROOM	43	LAVATORY (MEN)
4	LIBRARY	44	LAVATORY (WOMEN)
5	REPORTING ROOM	45	STORE
6	REPORTING DATA & DCP ROOM	46	STORE
7	CALIBRATION ROOM	47	D.S.
8	INSTRUMENT ROOM	48	D.S.
9	ELECTRICITY ROOM	49	EPS
10	WORK-SHOP	50	CORRIDOR (1)
11	WORK-SHOP OFFICE	51	CORRIDOR (2)
12	WORK-SHOP STORE	52	CORRIDOR (3)
13	ENTRANCE	53	CORRIDOR (4)
14	HALL	54	STAIRCASE
15	CONTROL ROOM		
16	CLIMATOLOGY ROOM		
17	CHIEF OF CLIMATOLOGY ROOM		
18	DATA ANALYSIS ROOM		
19	WEATHER DATA ROOM		
20	SHOWER ROOM		
21	TOILET		

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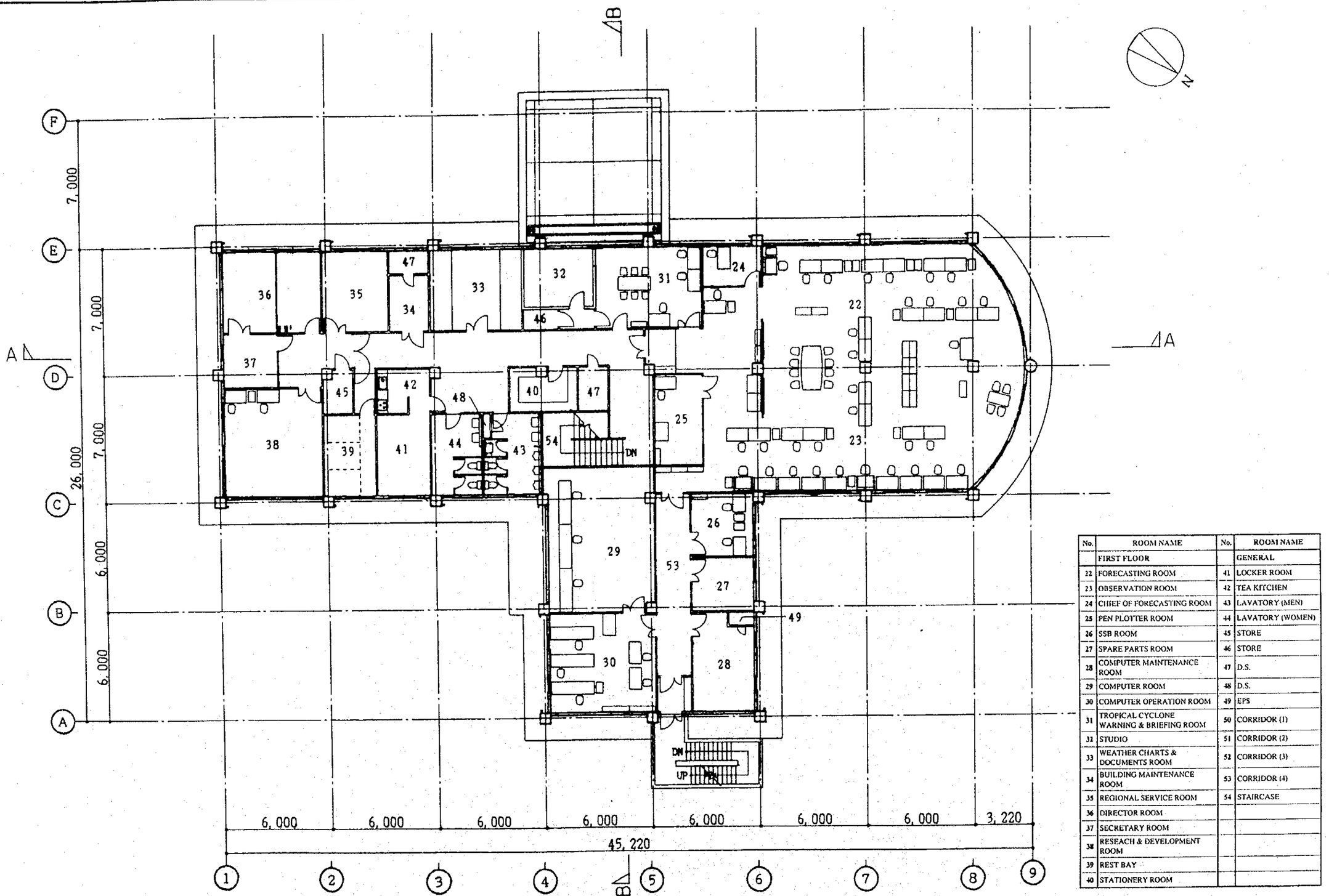
DRAWING TITLE: GROUND FLOOR PLAN

SCALE: 1/200

DRAWING No.: A-02



No.	ROOM NAME	No.	ROOM NAME
	FIRST FLOOR		GENERAL
22	FORECASTING ROOM	41	LOCKER ROOM
23	OBSERVATION ROOM	42	TEA KITCHEN
24	CHIEF OF FORECASTING ROOM	43	LAVATORY (MEN)
25	PEN PLOTTER ROOM	44	LAVATORY (WOMEN)
26	SSB ROOM	45	STORE
27	SPARE PARTS ROOM	46	STORE
28	COMPUTER MAINTENANCE ROOM	47	D.S.
29	COMPUTER ROOM	48	D.S.
30	COMPUTER OPERATION ROOM	49	EPS
31	TROPICAL CYCLONE WARNING & BRIEFING ROOM	50	CORRIDOR (1)
32	STUDIO	51	CORRIDOR (2)
33	WEATHER CHARTS & DOCUMENTS ROOM	52	CORRIDOR (3)
34	BUILDING MAINTENANCE ROOM	53	CORRIDOR (4)
35	REGIONAL SERVICE ROOM	54	STAIRCASE
36	DIRECTOR ROOM		
37	SECRETARY ROOM		
38	RESEACH & DEVELOPMENT ROOM		
39	REST BAY		
40	STATIONERY ROOM		

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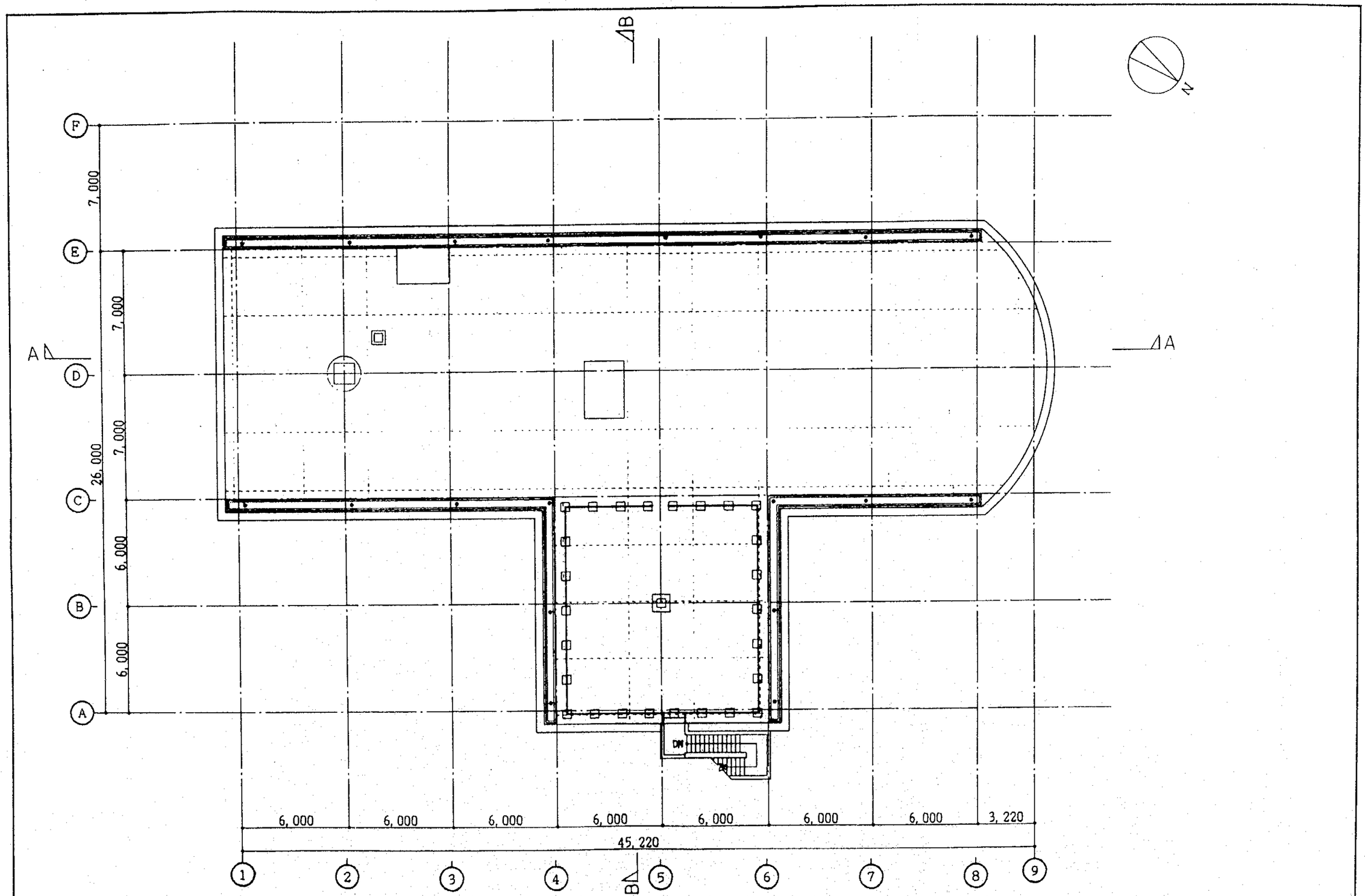
DRAWING TITLE: FIRST FLOOR PLAN

SCALE: 1/200

DRAWING No.: A-03



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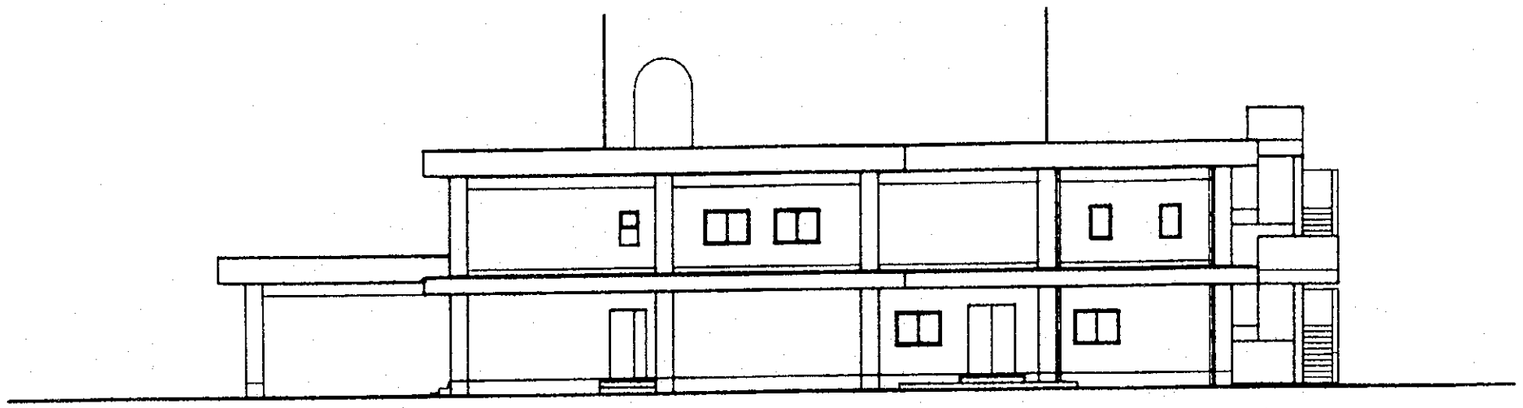
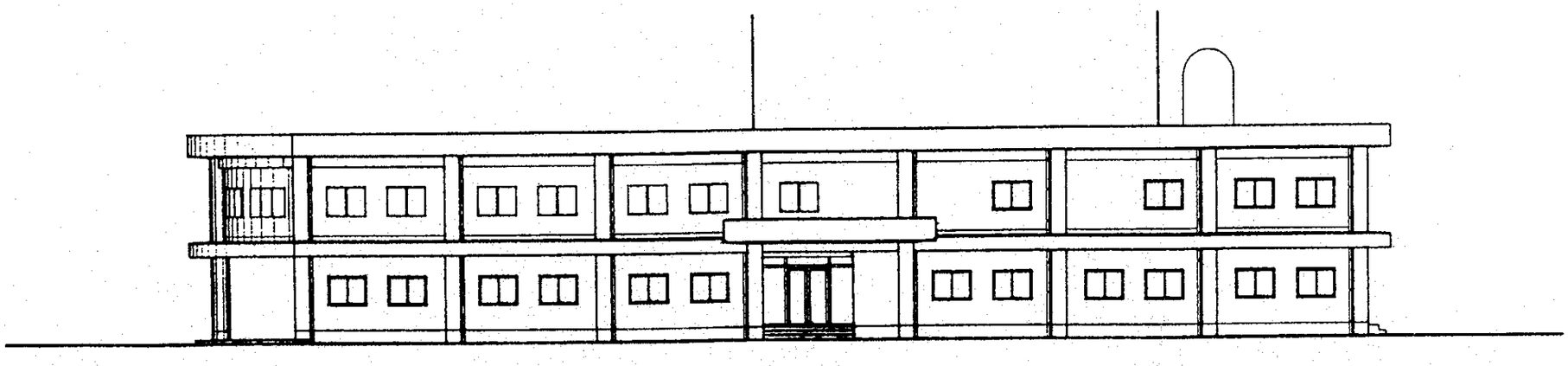


SOUTH ELEVATION



WEST ELEVATION

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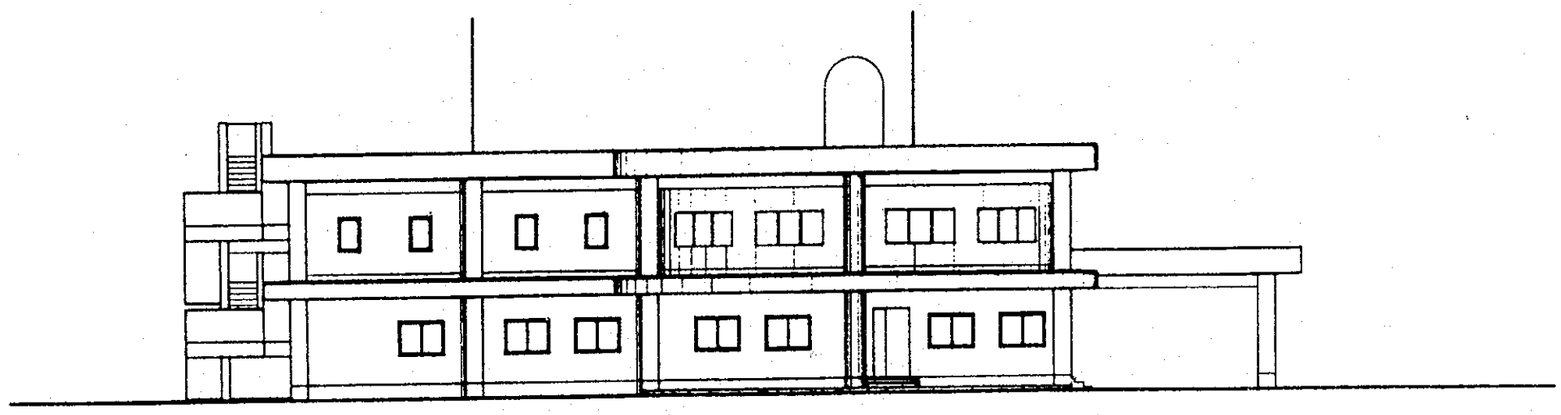
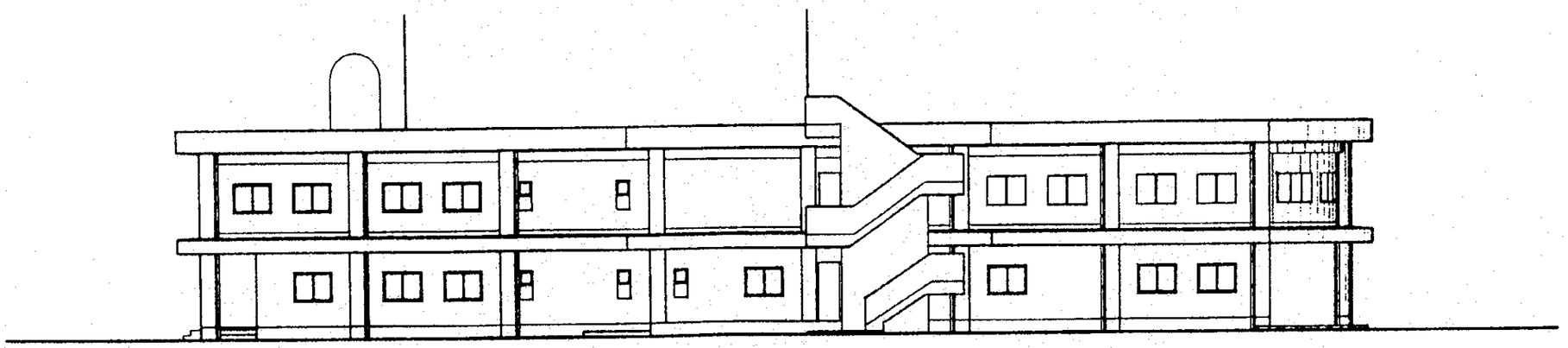
PROJECT:	DRAWING TITLE:	SCALE:	DRAWING No.:
Regional Specialized Meteorological Centre	ELEVATION-1	1/200	A-05

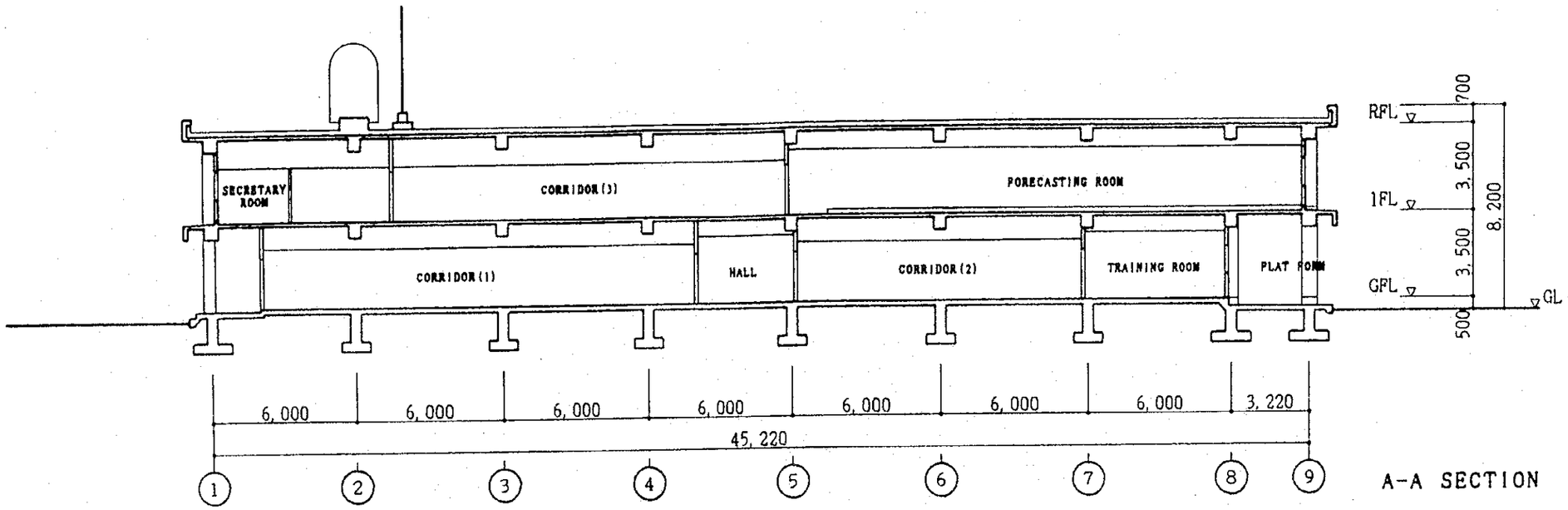


NORTH ELEVATION

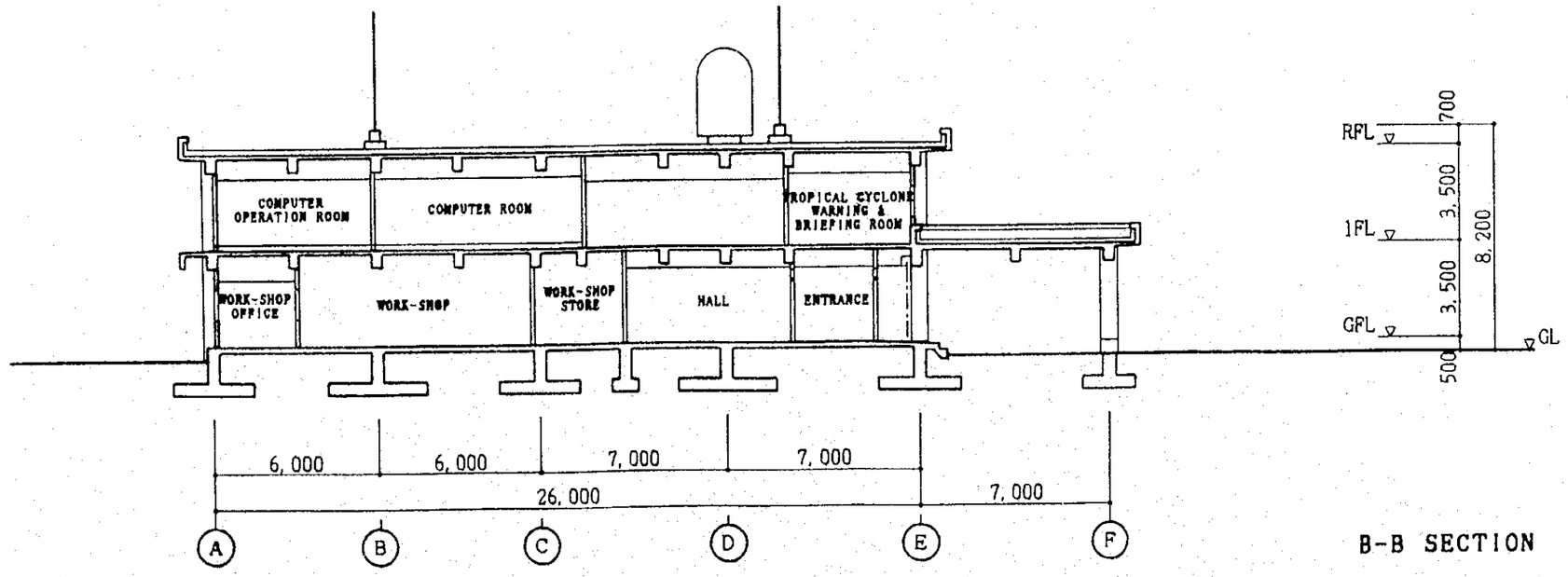


EAST ELEVATION

Japan Weather Association 2-9-2, Kanda Nishikicho, Chiyoda-ku, Tokyo, 101 Japan Tel. +81-3-3295-1525 Fax.+81-3-3295-1097	PROJECT: Regional Specialized Meteorological Centre	DRAWING TITLE: ELEVATION-2	SCALE: 1/200	DRAWING No.: A-06



A-A SECTION



B-B SECTION

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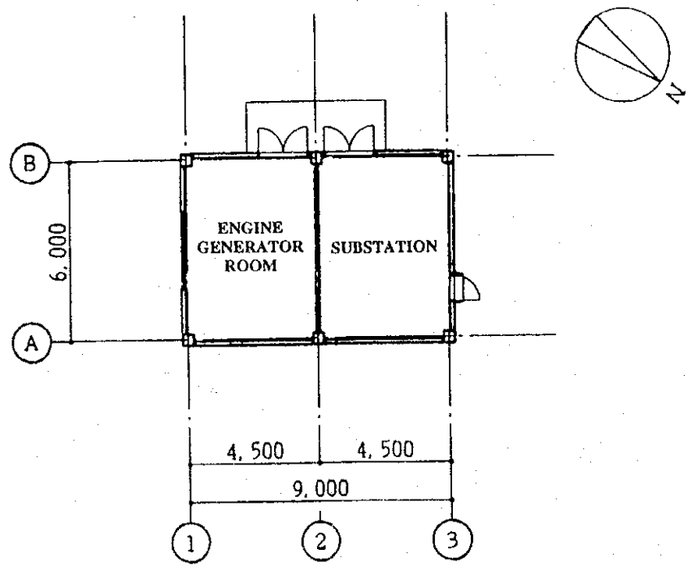
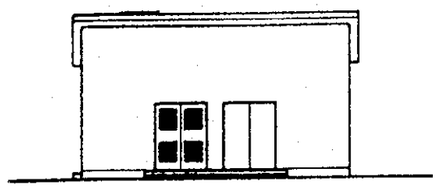
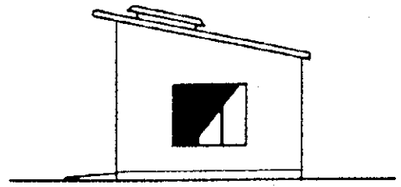
PROJECT:	DRAWING TITLE:	SCALE:	DRAWING No.:
Regional Specialized Meteorological Centre	SECTION	1/200	A-07



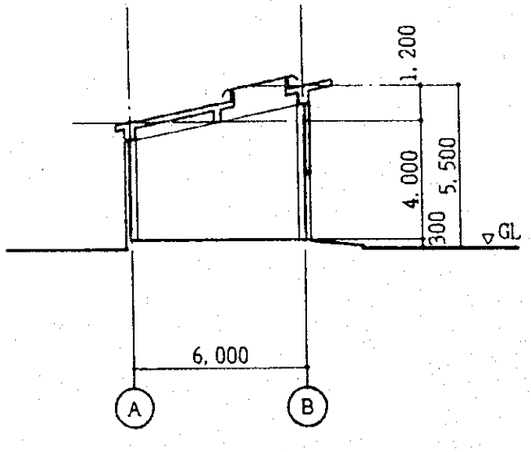
PLAN



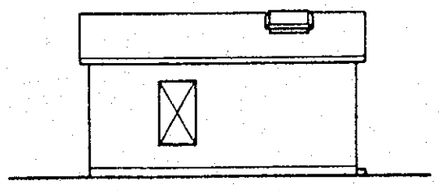
WEST ELEVATION



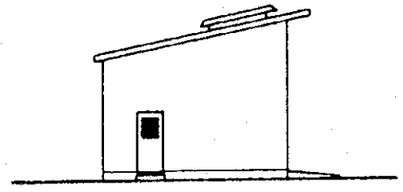
SOUTH ELEVATION



SECTION



EAST ELEVATION



NORTH ELEVATION

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3-4 Implementation Plan

3-4-1 Construction Condition

The coordination among related construction work shall be required, because the Project concerns systematically many engineering fields such as meteorology, architecture, civil work, etc. The installation work of the meteorological equipment includes the manufacturing of the equipment in Japan, shipping to the site, and installation and adjustment.

The Project is to be executed, with the minimum of delay and misunderstanding, in close relation with the organizations in charge, JICA Fiji office and the Government authorities concerned.

1. Executing agency of the Project
The government agency of Fiji responsible for the execution of this Project is FMS, which is supervised by Ministry of Foreign Affairs, Tourism and Civil Aviation. These two organizations are the executing agency in Fiji for Consultant Agreement and Construction Contract.

2. Implementation Plan
As for the implementation plan, it is necessary to discuss in detail and confirm the following points between FMS and the Consultant during the execution period of the detailed design.

1) The arrangement of the Project site to be shouldered by Fiji, securing of the temporary electrical power and telephones, and the water supply for construction work, and official procedures including application to CAAF and PWD, etc., shall have been completed prior to the commencement of the Project.

2) The construction schedule shall be worked out in detail, since the foundation work period may fall within the rainy season from November to the following April.

3) Adequate attention shall be paid to avoid obstruction of the airport services, since the site is located in the international airport area and especially as the site is immediately adjacent to the airport control tower.

4) The equipment and materials shall be procured as far as possible in Fiji. Whereas, the procurement from other countries such as Japan or Australia, New Zealand, etc., entails customs clearance costs payable by Fiji.

5) The confirmation of the budget to be allocated without fail at the time of the detailed design is required for the procurement of furniture and fixtures, bedding, etc., and also external work and removal and setting of existing equipment, and furniture and fixtures to be shouldered by Fiji side.

3-4-2 Implementation Method

1. Construction conditions

1) Local construction firms

In Fiji, there is the Fiji Master Builders' Association Inc. which members include major contractors, subcontractors as well as building material manufacturers. Among the major contractors, there are local corporations of construction contractors in U.S.A., Australia, Mew Zealand and other countries, and many of these companies are large size companies which are engaged in tourist development projects. On the whole, the technical level of construction is quite high compared to other developing countries.

2) Labour condition

Labourers are classified by their skills such as carpenters, masons, steel fitters, etc. and are organized into labour unions, however, there is no standard license or qualification to identify the skill of labourers. Common labourers are not classified into special fields and are employed when necessary. The skills of skilled labourers are much varied and truly skilled labourers are quite few. Today, the average performance of various skilled labourer in Japan is 1.5 times that of Fiji.

3) Quality control and construction schedule

Most of the construction materials is imported from Australia, New Zealand, etc., and therefore the proper quality can be expected.

4) Application for the Project permission

In case of the Grant Aid Project, a permit for design must be applied to PWD and CAAF through the Ministry of Foreign Affairs, Tourism and Civil Aviation, and FMS.

2. Main points of the construction work

The construction work of the Project involves the two-story building above ground, and employs no special construction methods. In addition, the materials are to be procured in Fiji as far as possible. Accordingly, the construction work can be adequately carried out by local construction firms. The materials to be procured from Japan or the other other countries would not pose any substantial problems, providing these materials are appropriate for the construction standards in Fiji.

Computer system and equipment and many precision instruments for the meteorological observation are to be installed in the building. Therefore, it goes without saying that the electrical installation of the building is the heart of the building. In accordance with the construction schedule, the electrical engineer shall be dispatched at the time of the installation, adjustment and wiring construction of the electrical power equipment of the computer related, power failure back-up system and constant frequency and constant voltage systems; and the air-conditioning and plumbing engineers shall be dispatched for adjustment and confirmation of the computer-related rooms' air-conditioning performance at the time of the installation of air-conditioning equipment and plumbing. During the construction period, procurement of the materials and securing of the skilled labourers shall be performed on in accordance with the construction schedule.

As to the procurement and installation of the equipment and materials, an engineer shall be required to be dispatched for the training of handling at site, and maintenance of the equipment, and explanation of handling, in view of specific work and precision of installation work. Maintenance after the installation shall be discussed in full detail.

The dispatch of the engineers to be required during each construction period is as follows.

・First phase

<Building construction>

・Electrical engineer: 1 person

・Air-conditioning and plumbing engineer: 1 person

<Equipment installation and adjustment>

a. Upper Air Observation Receiving and Analizing Equipment

・Upper air observation equipment engineer: 2 persons

b. Meteorological Observation Instrument

・Meteorological instrument installation engineer: 1 person

・Second phase

<Equpment installation and adjustment>

a. Computer System

・Computer engineer: 2 persons

・Software engineer: 3 persons

b. Satellite Data Receiving System (High-resolution data receiver for GMS and for NOAA)

・Satellite data receiving system engineer: 2 persons

c. Automatic Meteorological Observation System

・DCP data transmission engineer: 2 persons

・DCP meteorologicalo instrument enginner: 2 persons

3-4-3 Construction Supervision Plan

Construction Supervision Plan

In accordance with the policy of the Grant Aid Program of the Government of Japan, the Consultant will organize a Project team for detailed design and construction supervision based on the basic design, to carry out the smooth execution of the Project.

The Consultant will dispatch one resident engineer to the site for the construction of the Center. The engineer will guide the construction personnel concerned in the construction and have close liaison with FMS, the Ministry of Foreign Affairs, Tourism and Civil Aviation, the Embassy of Japan, JICA office, etc. In addition, the Consultant will dispatch an engineer in charge of structures, facilities, etc., to the site during the required period in accordance with the progress of the construction work to inspect and guide the construction work on site.

As to the installation and adjustment work of the equipment, the Consultant will dispatch the Consultant supervisors (engineer for each system and equipment) to the site timely and in accordance with the construction schedule to inspect and guide the construction work on site. Especially as to the supervisory services of the computer software, many items of services of adjustment, confirmation and inspection are necessary, such as the confirmation of performance of the computer system after performance test in Japan, and installation of software on site, data reception and transmission conditions by GTS Link, etc. For this purpose, the software engineer is expected to stay long enough for full supervisory services at the site.

Furthermore, the meteorological data telecommunications and processing engineer shall be dispatched to the site to confirm the performance and adaptability of the computer software to the meteorological services. In addition, two software and data telecommunications and processing engineers shall be dispatched to Melbourne to confirm data reception and transmission by GTS Link .

1. Principal Policy of Supervision Plan

1) With the aim of completing of the Project without delay and in accordance with the construction schedule, close liaison will be maintained with the organizations of both countries concerned and the personnel in charge.

2) To provide quick and appropriate guidance and advice to the personnel in charge of construction, for the execution of the building construction and equipment installation work in accordance with the relevant design documents.

3) To adopt local construction methods and using as many locally available materials as possible.

4) To produce an efficient as Grant Aid Project, on the basis of transferring technology, with regards to construction methods and engineering.

5) To have the Contractor submit the maintenance manual after completion of the work to FMS, and the Ministry of Foreign Affairs, Tourism and Civil Aviation, and give proper advice and promote efficient operation.

2. Content of Construction Supervision Work

1) Construction supervision

The Consultant will execute, on behalf of the Government of Fiji, the selection of the form of the construction contract, drafting of construction contract, selection and recommendation of the construction contractor to the Government of Fiji, examination of the detailed breakdown of the work, and attendance at the time of the signing of the Construction Contract.

2) Inspection and confirmation of construction drawings, material and equipment

The Consultant will inspect and confirm the construction drawings, manufacturing drawings, system diagrams, materials, samples of finishes, construction materials such as facility materials, to be provided by the Contractor, and confirm performance of the equipment.

3) Construction guidance

After examination of the construction plan and schedule, the Consultant will give instructions to the personnel in charge of construction, and report the progress status of the construction work to FMS, Ministry of Foreign Affairs, Tourism and Civil Aviation, the Embassy of Japan, JICA office, etc.

4) Approval procedure for payment

The Consultant will examine the contents of the notice of approval, the bill, etc., for the construction cost to be paid during the construction period and after completion of the work, and assist the contractor in the approval procedure for payment.

5) Attendance for inspection

The Consultant will inspect, as necessary, respective progress of the work during the construction period. After confirmation of the completion of the construction work and the execution of the Conditions of Contract, the Consultant will attend final transfer of the facility and the equipment and, upon approval of the Client, complete the consultant services. In addition, the Consultant will report the status during the construction work of the Project, payment procedures, and miscellaneous items required for transferring after completion, to the authorities concerned in the Government of Japan.

3. Dispatch of Resident Engineer

A meteorological planning engineer shall be assigned as a resident engineer for supervision of the whole Project.

・First phase

<Building construction>

Although the Centre is a low-story and simple building, it will be required to accurately supervise building quality control and construction schedule due to special function of the building as a meteorological centre in the South Pacific region.

Regarding the building quality control, it will be necessary to express a decision as the Consultant on construction material procurement plan without any delay because quality and construction method of each material differs with the origin of procurement such as Japan or other countries. In case of the absence of the resident engineer of the Consultant, precious time of the construction term will be dissipated.

Regarding the construction schedule, it will be very difficult to keep the schedule for excavating and foundation works due to the commencement of the construction work in a rainy season. Since above reasons, the resident engineer should be assigned for supervision of the construction works for Regional Specialized Meteorological Centre in Nadi. Therefore, Architectural engineer-B will be mobilized as the resident engineer of the Consultant for 11 months of the construction works term.

During the term of First phase, each technical engineer will support on inspection of the construction drawings and construction method and also quality inspection for the building equipment and materials in Japan. Furthermore, necessary technical engineers will be mobilized to Fiji in times of necessity for supervision on installation and adjustment works stage.

a) Architectural engineer-A

b) Structural engineer

c) Electrical engineer

d) Air-conditioning and plumbing engineer

<Equpment installation and adjustment>

It will be not required any resident engineer because the equipment installation and adjustment works on the First phase is not a large scale. Therefore, necessary technical engineers will be mobilized to Fiji in times of necessity for supervision. And also inspection of equipment drawings and quality inspection for the equipment will be executed by each technical engineer in Japan.

a) Upper air observation system engineer

b) Meteorological instrument engineer

・Second phase

<Equpment installation and adjustment>

On the Second phase, equipment installation and adjustment works will be mainly executed and various equipment under the Project differs on the performance and function. These equipment will compose a single integrated system for meteorological services. For total integration for the system and fulfillment of the technical specifications on system quality, performance and function, it will be indispensable to mobilize a system integrator of the Consultant. As the system integrator, a meteorological telecommunication and data processing engineer will be assigned as a resident engineer who will supervise the equipment installation and adjustment works and put himself in FMS's place as one of system users. Working together with the following engineers, the resident engineer will implement the supervising works for giving full scope to the competence of meteorological data communication and processing as Regional Specialized Meteorological Centre in accordance with the technical specifications required for meteorological services.

In addition, necessary technical engineers will be mobilized to Fiji in times of necessity for supervision. And also inspection of equipment drawings and quality inspection for the equipment will be executed by each technical engineer in Japan.

a) Meteorological telecommunication and data processing engineer

b) Meteorological software engineer

c) Computer engineer

d) Satellite data analyzing engineer

e) DCP engineer-A

f) DCP engineer-B

g) Architectural and civil engineer

3-4-4 Procurement Plan

1. Equipment

For the procurement of the equipment and materials for the system, it is necessary to consider the employment of local agents as far as possible for easiness of maintenance and trouble-shooting after the completion. However, a lot of electronic parts are applied in current equipment and systems. As a result, the greater part of equipment are difficult to be procured locally, and it is necessary to procure them from Japan and/or other countries in consideration of quality control of the equipment and the important role to be played as RSMC.

Concerning the computer system including software and peripherals, it is assumed to procure from Japan in order to supervise the factory inspection smoothly after tentative installation and pre-performance test of the whole system. According to a comparison of equipment cost, the procurement from Japan is estimated to be slightly cheaper than from the other countries.

In case of the procurement from other countries, dispatch of the Consultant engineers for the factory test and other inspections in the countries will be necessary, and the procurement of the equipment from Japan is expect as more economical in consideration of these expenses. In addition, the Consultant also need to supervise the manufacturing of equipment at any stage in close contact with the Contractor, since these circumstances, the procurement from Japan will be more favorable.

In regard to the procurement of Automatic observation system, Upper air observation data analyzer, Meteorological instruments, etc., it will be rightfully necessary to do factory test (interim and final test), shipment inspection. For these equipment, tentative installation and pre-performance test will not be required. Therefore, the procurement of these equipment will be possible from whichever Japan or other countries.

The most considerable factors in supplying equipment is maintenance method of the equipment and availability of the necessary parts and consumables in Fiji. Furthermore, as activities of the private sector related to computer system, there are several agents of the computer equipment in Fiji and the maintenance of the computer system belonging to the Government of Fiji is provided by them. They have sufficient engineering skills, experiences and capabilities for maintenance and management on computer equipment. The activities of the private sector will be useful for the computer system introduced under the Project.

Regarding software, the Information Technology and Computing Services Department (ITC) has sufficient engineering skill and technique enough to provide software maintenance services, and the cooperation of ITC is expected to be provided to FMS after completion of the Project.

From the circumstances as described above, the procurement plan for the equipment should be considered as far as possible to standardize the equipment, to secure easy procurement of spare parts in Fiji, to select a familiar system to the Government of Fiji and easy maintenance system for Fiji Governmental organizations and the private sector.

2. Construction materials

The construction materials shall basically be procured locally. Only the materials difficult to obtain in Fiji and those specially required to achieve the quality and level of the facility of the Project shall be procured from Japan and/or the other countries.

Most of the construction materials are available in Fiji. Many of these materials are imported, or produced locally by the firms having capital and technical cooperation with foreign countries (mainly Australia, New Zealand).

In Fiji, the primary products, such as concrete aggregate, cement, timber, are produced locally. Most of the other construction materials are imported. In addition, the market being small, the procurement of the materials is subject to be affected by the other construction projects.

1) Cement

Only one national corporation produces cement with technical cooperation from New Zealand. The limestone, a raw material of cement, is produced from the coral in the sea. Cement is exported to neighboring countries, and its supply is comparatively stable. Cement is mostly of good quality, and the results of quality tests carried out monthly at the inspection office in New Zealand are excellent. The quality, however, being inferior to Japanese products, requires quality testing during construction.

2) Concrete aggregate

The Public Works Department (PWD) is the largest producer of concrete aggregate. The direct production of the aggregate by PWD is to prevent unwanted development and stabilize the price, which is under Government control. The coarse aggregate is mostly produced from crushed rock. Both quality and quantity are sufficiently stable for the current demands.

3) Concrete products

The concrete materials are locally produced with the exception of the reinforcing bars. So it is possible to manufacture the concrete secondary products such as concrete blocks, etc. in Fiji. Ready-mixed concrete is also available.

4) Reinforcement bars

The reinforcing bars for the production of the reinforced concrete are imported. Like cement, the reinforcing bars as well, are subject to official price fixing. The reliable strength of the reinforcing bars could be confirmed from the mill sheet obtained of the reinforcing bars.

5) Timber and plywood

Timber production in Fiji is extensive. Many plywood factories and sawmills are to be found in Vanua Levu Island, the Viti Levu Island. The products from these factories are exported to Japan, too. The plywood is used for various purposes, interior and exterior finishes, concrete forms, etc. A wide variety of products are available in large quantities, and the price is stable. Plywood is one of the most readily available materials in Fiji.

6) Aluminum products

The jalousie windows are mainly produced from aluminum. The jalousie windows with wide opening are popular in Fiji due to the high temperature and humidity of the tropical climate, and are used in many buildings. The windows are produced by knock-down method, assembled in Fiji by importing draw-form materials from New Zealand and Australia. The jalousie windows (louvered windows) made in Fiji, however, have poor airtightness, and also allow ingress of the rain due to the strong winds of the tropical cyclones. The Centre to be built by the Project is to be provided with precision equipment such as computers, satellite data receiving systems and related facilities. For this purpose, an opening with high airtightness is required.

The various aluminum sashes ordered based on the draw-form materials are produced, and employed in Fiji, too. Having no substantial problems in airtightness, locally made aluminum sashes are to be used in the Project.

7) Painting materials

Oil based paints have been used for a long time as painting materials for ships, especially for small marine traffic, and are locally produced by firms financed with foreign capital. The paints are available in a wide variety of colors and in quantity.

The major building materials except those mentioned above may be regarded as being imported. Especially, the installation (electricity, water supply and drain, air conditioning, ventilation) related materials and equipment are to be imported, with the exception of thin vinyl chloride pipes of diameter less than 150 mm, and a portion of the electric wire covered with vinyl. The equipment being imported as required, however, it is difficult to set the timing of procurement and the price of equipment. Therefore, for general construction work in Fiji, the Client himself usually procures the installation materials and equipment, and supplies to the Contractor.

As stated above, general construction materials are available and their quality poses no substantial problems. However, the construction of the Centre requires special finishing materials for the installation of the observation equipment, computers, etc., and the equipment for specific power systems and related materials and equipment, which shall be procured from Japan and/or the other countries.

3. Transportation route of materials

The main trade ports in Fiji are Suva in the capital, and Lautoka in Nadi side. The materials to be transported to Fiji by sea from Japan are to be unloaded at Suva or Lautoka, from where these materials are to be carried to the Project site by land. The road to the Project site is paved with asphalt, and the transportation of the materials presents no foreseeable problems.

The materials and equipment are generally to be transported by sea (or by air) in containers.

Implementation Schedule

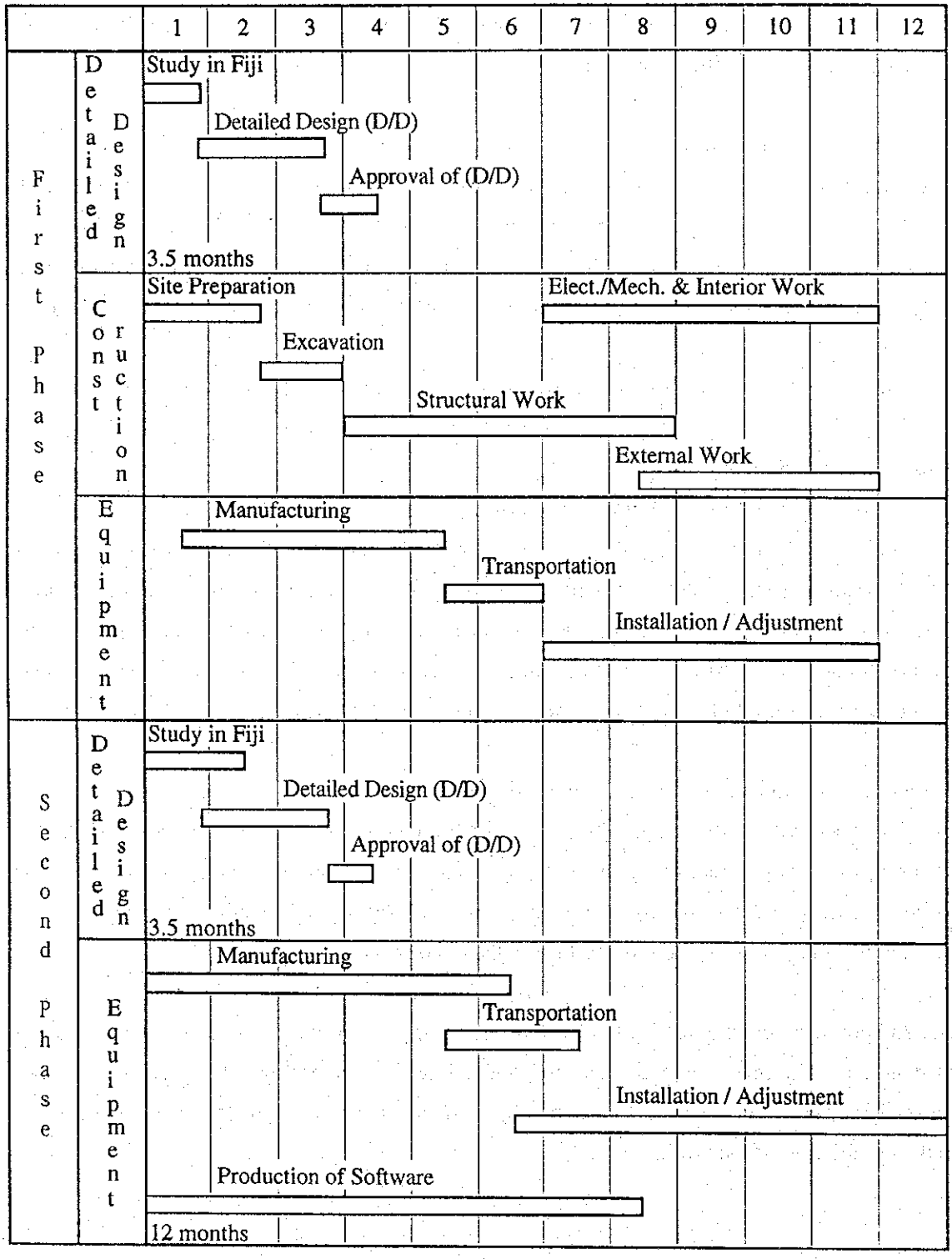
The Project consists of the construction work of the Centre of about 1,450 m^2, and the installation work of the equipment of the computer systems (including software), satellite image reception systems, automatic meteorological observation systems, upper air observation data analyzer and meteorological observation instrument. According to the study of the overall construction period, it will take about 23 months to complete the Project. The Project is to be divided into 2 phases for construction and installation work.

・Content of the construction and installation work

The 1st phase covers the construction work of the Centre and the installation work of the upper air observation data analyzer, meteorological observation instrument, etc. The work is to be commenced after signing of the Exchange of Notes, the Consultant Agreement, the detailed design, etc., and will require 11 months to complete.

The 2nd phase covers the installation work of the equipment of the computer system (including software) satellite image reception systems and automatic meteorological observation system. Through the same procedures as the 1st phase, 12 months are required from the commencement to the completion of the work.

3-4-5 Implementation Schedule



3-4-6 Scope of Work

Cost estimation for the major undertaking to be borne by Fiji side (Capital Budget)

At the time of execution of the Project under Japan's Grant Aid Assistance, the estimated cost for the major undertaking of the Government of Fiji will be necessary as described in the following table.

Item	Phase I	Phase II	Total
External & planting work cost	F$6,000.-	F$0.-	F$6,000.-
Power supply intake cost	F$120,000.-	F$0.-	F$110,000.-
Water supply intake cost	F$7,000.-	F$0.-	F$7,000.-
Telephone line intake cost	F$17,000.-	F$0.-	F$17,000.-
Cabling cost	F$0.-	F$25,000.-	F$25,000.-
Furniture cost	F$20,000.-	F$0.-	F$20,000.-
Transportation cost	F$6,500.-	F$15,000.-	F$21,500.-
Total	F$176,500.-	F$40,000.-	F$216,500.-

Chapter 4. Project Evaluation and Conclusion

Chapter 4 Project Evaluation and Conclusion

4-1 Benefit and Effect

Meteorological phenomena are behaviors of the global atmosphere, which exceed the sphere of every single country. Accordingly, international exchange of meteorological data is indispensable and essential for the worldwide meteorological services. Actually, such cooperation is realized by exchanging observation data and numerical weather prediction through GTS line all over the world with great success. The meteorological data transmitted from all over the world enables the numerical weather prediction in Japan. In turn, the numerical weather prediction products provided by Japan together with the satellite image from Japanese geostationary meteorological satellite "GMS" contributeto the mitigation of meteorological disasters in the Asian Pacific countries. This is surely an ideal posture of international cooperation.

The Project is expected to produce the considerable benefits as mentioned above. The Project will substantially contribute to the development of the socio-economic activities of the people of the Republic of Fiji and the South Pacific countries. Therefore, the realization of the Project is considered to be truly significant. Furthermore, for the operation and administration of the Project, there is no substantial problem in respect to personnel or funds of the organizations of the Republic of Fiji.

After the implementation of the Project, it will be possible as the concrete benefits and effects of the Project;

- to meet the function and responsibility of RSMC as the centre of meteorological services in the South Pacific and to provide more authentic weather forecast and cyclone information & advisories to the nations of Fiji and neighboring island countries such as the whole population (1.54 million) of Fiji, Kiribati, Tuvalu, Vanuatu, Tonga, Western Samoa, Tokerau, Niue, New Caledonia, American Samoa, French Polynesia, Wallis Islands and Cook Islands.

- to watch the whole responsible area of RSMC by the establishment of GMS and NOAA satellite receiving systems for preparation of weather forecast.

- to forecast behavior and development of cyclones ahead of 48 hours with cyclone development model and sea surface temperature data to be caliculated by NOAA satellite receiving system.

- to disseminate the forecasts and warnings to the nations of Fiji and the neighboring island countries more promptly and accurately by minimization and rationalization of meteorological routine works using the computer system and automatic weather chart plotter.

- to exchange a large volume of meteorological information and data with other meteorological centers in the world through GTS link and to store and analize these useful meteorological information and data by the computer systems for improvement of accuracy of weather forecast and cyclone warning.

- to prepare meteorological data and information for forecasting as the same level as the developed countries through receiving them from GTS link and data analysis by the computer system.

- to contribute improvement of accuracy on numerical weather prediction of the developed countries due to prompt dissemination of accurate meteorological data from Fiji through GTS link.

- to execute training for meteorological staff of Fiji itself and the neighboring island countries at Regional Specialized Meteorological Centre in Nadi to be constructed under the Project for the development of manpower in the South Pacific region.

4-2 Verification of Appropriateness

In consequence of the implementation of the Project, meteorological observation and forecasting systems will be modernized and upgraded, and also accuracy of meteorological information and progression of forecasting works will be improved. Therefore, Regional Specialized Meteorological Centre in Fiji will be possible to disseminate more speedily and to provide more accurate & enriching meteorological information and warnings of cyclone through GTS link and AFTN link. The benefits and effects due to the Project as mentioned above will be distributed to the whole population (1.54 million) of Fiji and the neighboring island countries in the South Pacific.

In addition, there is no apprehension and solicitude on technical level and operation & maintenance structure of the Government of Fiji and FMS has the improvement plan on personnel and organization to be corresponded to operation & maintenance methods of the Project, as described "Chapter 3" in this report. Furthermore, the additional maintenance cost after completion of the Project, it will be approximately 7% of the sum of budget for 1994.

As a result of the study, it is not expected any problem for proper operation & maintenance and also there is no doubt of Fiji's competence for the actualization of the Project.

Since above reason, the implementation of the Project under Japan's Grant Aid Assistance is an appropriate step in fulfilling the international cooperation offered by the Government of Japan.

4-3 Conclusion

The Project is expected to produce the considerable benefits as mentioned above. The Project would substantially contribute to the development of the basic human needs in the people of the Republic of Fiji and the South Pacific region. Therefore, the implementation of the Project is inferred to be truly significant.

In addition, by expediting and improving the following circumstances, the effects of the Project will efficiently and appropriately be increased and contributed further to the neighboring countries.

- In order to exhibit the effects and profit of the Project efficiently, it will be required to establish a computer section in FMS, to ensure engineers and to upgrade their technical skills on operation & maintenance for the computer hardware & soft ware to be introduced under the Project.

- In the consideration of the localization of FMS personnel within next 3 years, it is desirable to continually cultivate the forecasters and engineers in FMS for mitigation of the technical level down.

- It will be useful to establish a section or a post to be specially assigned for observation, analysis and forecast of tropical cyclones for contributing the prevention of tropical cyclone disasters in the South Pacific.

- At the present, the neighboring island countries of Fiji are only receiving meteorological information from FMS through AFTN link. In a case of GTS link to be established among the neighboring island countries, they will be able to receive large volume and high quality of meteorological information from FMS, therefore, it will contribute to upgrade the accuracy of weather forecasting in the South Pacific.

- After completion of the Project, the training facilities will be improved. training for meteorological personnel in the South Pacific will be able to execute at the training room of Regional Specialized Meteorological Centre for contribution of expanding the effects of the Project to the whole region.

- For further increasing the effects of the Project, it will be useful to apply the results of the technical cooperation being executed by Australia and New Zealand for the operation of the system to be introduced under the Project.

Appendices

Appendix 1. Member List of Survey Team

(1) Basic Design Survey Team

Mr. Toshinobu KATO	Leader / Coordinator Second Basic Design Study Division, Grant Aid Study & Design Department, Japan International Cooperation Agency (JICA)
Mr. Kiyoshi SUMITA	Grant Aid Planner Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs,
Mr. Koji KUROIWA	Technical Adviser Forecast Division, Japan Meteorological Agency (JMA)
Mr. Seiichi SHINOKI	Meteorological Information & Forecast Planner (Chief Consultant) Japan Weather Association (JWA)
Mr. Ryo MASUTOMO	Meteorological Satellite Data Receiving Planner Japan Weather Association (JWA)
Mr. Kazuhiko OKUYAMA	Meteorological Data Transmission & Processing Planner Japan Weather Association (JWA)
Mr. Yoshihisa UCHIDA	Facility Planner Japan Weather Association (JWA)
Mr. Masaharu IDO	Equipment Planner Japan Weather Association (JWA)

(2) Expalanation of Draft Report

Mr. Toshinobu KATO	Leader / Coordinator Second Basic Design Study Division, Grant Aid Study & Design Department, Japan International Cooperation Agency (JICA)
Mr. Koji KUROIWA	Technical Adviser Forecast Division, Japan Meteorological Agency (JMA)
Mr. Seiichi SHINOKI	Meteorological Information & Forecast Planner (Chief Consultant) Japan Weather Association (JWA)
Mr. Kazuhiko OKUYAMA	Meteorological Data Transmission & Processing Planner Japan Weather Association (JWA)
Mr. Yoshihisa UCHIDA	Facility Planner Japan Weather Association (JWA)

Appendix 2. Survey Schedule

(1) Basic Design Study

Jan. 4 - 28, 1995

	1995		Study Schedule							
			Governmental Member			Consultant Member				
			Mr. Kiyoshi SUMITA	Mr. Toshinobu KATO	Mr. Koji KUROIWA	Mr. Seiichi SHINOKI	Mr. Yoshihisa UCHIDA	Mr. Kazuhiko OKUYAMA	Mr. Ryo MASUTOMO	Mr. Masaharu IDO
			Grant Aid Planner	Leader/Project Coordinator	Technical Adviser	Chief Consultant/ Meteorological Information & Forecast Planner	Facility Planner	Meteorological Data Transmission & Processing Planner	Meteorological Satellite Data Receiving Planner	Equipment Planner
1	4. January	Wed		Tokyo⇒Nadi (NZ24)						
2	5. January	Thu		Arrival at Nadi (moving to Suva) Courtesy call on Embassy of Japan, JICA office						
3	6. January	Fri	Toyko⇒Sydeny⇒Nadi (JL771&QF291)	Courtesy call on the Ministry of Transport and Civil Aviation and other concerning organizations, and meeting with them Courtesy call on development assistance organizations, and meeting with them						
4	7. January	Sat	(Arrival of Mr. SUMITA)	(moving to Nadi) Meeting with Fiji Meteorological Service						
5	8. January	Sun	Inner meeting							
6	9. January	Mon	Meeting with Fiji Meteorological Service						Tokyo⇒Nadi (FJ303)	
7	10. January	Tue	Meeting with Fiji Meteorological Service						Arrival at Nadi, Meeting with Fiji Meteorological Service	
8	11. January	Wed	Discussion with Fiji Meteorological Service on the Minutes of Discussions for the Project						(moving to Suva) Data Collection for preparation of a report and a cost estimation	
9	12. January	Thu	Meeting with the Ministry of Transport and Civil Aviation and other concerning organizations (moving to Suva)						Data Collection for preparation of a report and a cost estimation	
10	13. January	Fri	Signing of the Minutes of Discussions, reporting to Embassy of Japan and JICA office (moving to Nadi)						Data Collection for preparation of a report and a cost estimation(moving to Nadi)	
11	14. January	Sat	Departure Nadi⇒Sydeny (QF292)			Meeting with FMS, Data Collection for preparation of a report and a cost estimation			Data Collection for preparation of a report and a cost estimation	
12	15. January	Sun	Sydeny⇒Tokyo(NH914)			Inner meeting				
13	16. January	Mon				Meeting wiht Fiji Meteorological Service and concerning organizations, Site survey			Data Collection for preparation of a report and a cost estimation(Lautoka)	
14	17. January	Tue				Meeting wiht Fiji Meteorological Service and concerning organizations, Site survey			Data Collection for preparation of a report and a cost estimation(Lautoka)	
15	18. January	Wed				Meeting with FPTL & FINTEL and study of local conditions on transportation			(moving to Suva) Data Collection for preparation of a report and a cost estimation	
16	19. January	Thu				Meeting wiht Fiji Meteorological Service and concerning organizations			Data Collection for preparation of a report and a cost estimation	
17	20. January	Fri				Meeting and preparation of a basic design with FMS			(moving to Lautoka)Data Collection for preparation of a report and a cost estimation	
18	21. January	Sat				Meeting and preparation of a basic design with FMS, Data Collection for preparation of a report and a cost estimation				
19	22. January	Sun				Inner meeting				
20	23. January	Mon				(moving to Suva)Reporting to Embassy of Japan and JICA Meeting with ITC and EU			(moving to Suva) Data Collection for preparation of a report and a cost estimation	
21	24. January	Tue				(moving to Nadi)Meeting with CAAF, FMS			Data Collection for preparation of a report and a cost estimation	

			Mr. Seiichi SHINOKI	Mr. Kazuhiko OKUYAMA	Mr. Yoshihisa UCHIDA	Mr. Ryo MASUTOMO	Mr. Masaharu IDO
22	25. January	Wed	Nadi⇒Melbourne (FJ914&AN27)		Meeting with CAAF	(moving to Lautoka)Data Collection for preparation of a report and a cost estimation	
23	26. January	Thu	Meeting with Bureau of Meteorology in Melbourne		Meeting with FMS	Site Survey	
24	27. January	Fri	Meeting with Bureau of Meteorology, (evening) Melbourne		Nadi⇒Brisbane (FJ950)		
25	28. January	Sat	⇒Tokyo (QF21)		Brisbane⇒Tokyo (JL776)		

(2) Explanation of Draft Report

Mar 22 - Apr 2, 1995

			Schedule				
			Governmental Member		Consultant Member		
			T. Kato	K. Kuroiwa	S. Shinoki	Y. Uchida	K. Okuyama
1	22-Mar	Wed	Tokyo⇒				
2	23-Mar	Thu	⇒Sydney (NH913) , ⇒Melbourne (QF407)				
			Meeting at Bureau of Meteorology (in Melbourne)			Tokyo⇒	
3	24-Mar	Fri	Meeting at Bureau of Meteorology (in Melbourne)			⇒Nadi (FJ303)	
			Melbourne⇒ Nadi (QF295)			Explanation of Draft Report to FMS	
4	25-Mar	Sat	Explanation of Draft Report to FMS				
5	26-Mar	Sun	Inner meeting				
6	27-Mar	Mon	Meeting with FMS				Nadi⇒Suva(PC136)
7	28-Mar	Tue	Meeting with JICA Office, Embassy of Japan, Ministry of Foreign Affairs,				
			Ministry of Tourism and Civil Aviation				
8	29-Mar	Wed	Meeting with Central Planning Office, MInistry of Finance and Economic				
			Development, New Zealand Embassy, NZ, AIDAB				
9	30-Mar	Thu	Meeting with EU, Central Planning Office, UNDHA,				
			New Zealand Embassy, NZ, Ministry of Tourism and Civil Aviation				
10	31-Mar	Fri	Meeting with Ministry of Finance and Economic Development, Signing of the Minutes				
			of Discussions, reporting to Embassy of Japan and JICA office				Suva ⇒ Nadi (FJ443)
11	1-Apr	Sat	Nadi ⇒ Sydney (QF292)				
12	2-Apr	Sun	Sydney ⇒ Narita (NH914)				

Appendix 3. Name of Discussants
(1) Fiji

Fiji Meteorological Service (FMS)

Mr. Rajendra Prasad	: Director
Ms. S. Pandaram	: Principal Scientific Officer (Services & Development)
Mr. E.V. Puamau	: Principal Technical Officer (Reporting & Facilities)
Mr. S. K. Mani	: Senior Technical Officer (Climatology)
Mr. J. Pahalad	: Senior Scientific Officer (Climatology)
Mr. J. Vaivao	: Senior Technical Officer (Forecasting)
Mr. M. Rokoduru	: Senior Technical Officer (Outstation)
Mr. M. Singh	: Senior Technical Officer (Training & Investigation)
Ms. M. B. Brown	: Executive Officer (Administration)
Mr. M. Chand	: Technical Officer II (Instruments)

Ministry of Foreign Affairs, Tourism and Civil Aviation

Mr. Luke Rokovada	: Permanent Secretary (Tourism and Civil Aviation)
Mr. Gyani Nand	: Acting Permanent Secretary (Political)

Civil Aviation Authority of Fiji (CAAF)

Mr. N. G. Singh	: Chief, Communication Services
Mr. Lepani Lovodua	: Chief, electrical Mechanical Services
Mr. Mohammed Nasser Khan	: Planning Engineer Telecommunications
Mr. Jared Morris	: Engineering Officer

Ministry of Finance & Economic Development

Ms. Vuki Vakatawa	: Head of Aid Unit

Central Planning Office

Ms. G. K. Rup	: Director
Mr. Charley Yuen	: Senior Planning Officer

Information Technology & Computing Services Department (ITC)

Mr. Sai Taganesia	: Manager
Mr. Josese Ravuvu	: Asst. Manager

United Nation

Mr. Joseph Chung	: Chief Technical Adviser, DHA-SPPO
Mr. Atunaisa Kaloumaria	: Mitigation Adviser, DHA-SPPO
Mr. Ian Rector	: Disaster Management Advisor, DHA-SPPO

AusAID

Mr. Chris Wheeler	: First Secretary
Mr. Derek Rooken-Smith	: Counselor

New Zealand Embassy

Ms. Ngawini Keelan	: Second Secretary, Aid

Meteorological Service of New Zealand Limited

Mr. David Roberts	: Pacific Manager

USAID

Ms. Clare Lobendahn	: USAID Liaison Advisor

Delegation of the European Commissions for the Pacific, EU

Mr. Michael Garvey	: Technical Adviser, Acting Head of Mission
Mr. Roberto Rensi	: Economic Adviser

Fiji Post & Telecommunication Ltd.

Mr. Savenaca Tabilai	: Technical Services Manager (Western Division)
Mr. Firoz Nisar Ali	: Corporate Engineer Transmission Network Engineering Western

Fiji Electricity Authority

Mr. Om Dutt Sharma	: Design Engineer Planning

Public Works Department, Lautoka

Mr. Temo Veitokiyaki	: Divisional Engineer, Western

Embassy of Japan

Mr. Yasunori Kikuchi	: Ambassador
Mr. Hiroyuki Onishi	: First Secretary
Mr. Yasuhiro Tojo	: Second Secretary
Mr. Tadahiko Yamaguchi	: Second Secretary

JICA Fiji Office

Mr. Shiro Kinouchi	: Resident Representative
Mr. Hajime Watanabe	: Asst. Resident Representative

(2) Australia

Bureau of Meteorology

Mr. Robert R. Brook	: Assistant Director (Observation and Engineering)
Mr. Mike Hassett	: Communications Manager
Mr. Tim Kiddle	: Supervisor Communications
Dr. Venantius K. Tsui	: Superintending, International and Public Affairs
Mr. Graeme Brough	: Superintending Engineer (Instrument Engineering Section)
Mr. Bruce Neal	: Superintendent (Satellite Section)
Mr. John Beard	: Supervising Engineer (Satellite Section)
Mr. Ram Krishna	: Supervising Meteorologist (International Affairs)
Ms. Dawn Thistlethwaite	: Executive Officer (Observation & Engineering)
Mr. Terry Hart	: National Meteorological Center
Mr. Robert Wright	: National Manager, Special Services Unit

Appendix 4. Minutes of Discussions

(1) Basic Design Study

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY ON THE PROJECT FOR UPGRADING OF METEOROLOGICAL OBSERVATION AND FORECASTING SYSTEM IN THE REPUBLIC OF FIJI

In response to a request from the Government of the Republic of Fiji, the Government of Japan decided to conduct a Basic Design Study on the Project for Upgrading of Meteorological Observation and Forecasting System (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Fiji a study team (hereinafter referred to as "the Team"), which is headed by Mr. Toshinobu KATO, Second Basic Design Study Division, Grant Aid Study & Design Department, JICA, and is scheduled to stay in the country from January 5 to 27, 1995.

The team held discussions with the officials concerned of the Government of Fiji and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed, in principle, the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study report.

Suva, January 13, 1995

Mr. Toshinobu KATO
Leader
Basic Design Study Team
JICA

Mr. Luke ROKOVADA
Permanent Secretary
Ministry of Tourism and Civil Aviation

ATTACHMENT

1. Objective

The objective of the Project is to upgrade the observation and forecasting capabilities so as to improve meteorological services for Fiji itself and neighboring countries which receive information from the regional meteorological centre in Fiji.

2. Project sites

The Project sites are as follows:

for construction of the regional meteorological centre : Civil Aviation Authority of Fiji premises, Nadi Airport as described in Annex I-a.

for automatic observation systems : as described in Annex I-b in order of the priority of necessity.

3. Executing agency

Ministry of Tourism and Civil Aviation is responsible for the administration and execution of the Project.

4. Items requested by the Government of Fiji

After discussions with the Basic Design Study Team, the following items were finally requested by the Fijian side.

(1) Facility

Construction of the regional meteorological centre.

The regional meteorological centre has mainly following rooms.

Observation Room, Communication Room, Forecast Room, Tropical Cyclone Warning Room, Studio, Data Storage Room, Barometer Room, Rest-bay, Instrument Room, Work-shop, Library, Training Room, Conference Room, Office Area, Machine Room, Electricity Room, Other Common Areas and Engine Generator Shed.

(2) Meteorological Observation & Forecasting System

1) Computer System with Automatic Weather Chart Plotter

2) Satellite Data Receiving System for GMS and NOAA

3) Automatic Observation Equipment

4) Meteorological Instrument including Upper Air Observation Data Analyzer

5) HF Facsimile Transmitter

6) Two pick-up vehicles for maintenance and emergency use

and spare parts.

Location of Automatic Observation Equipment is described in order of the priority in Annex I-b.

However, the final components of the Project will be decided after further studies.

5. Japan's Grant Aid system

(1) The Government of Fiji has understood the system of Japanese Grant Aid explained by the Team. (Annex II)

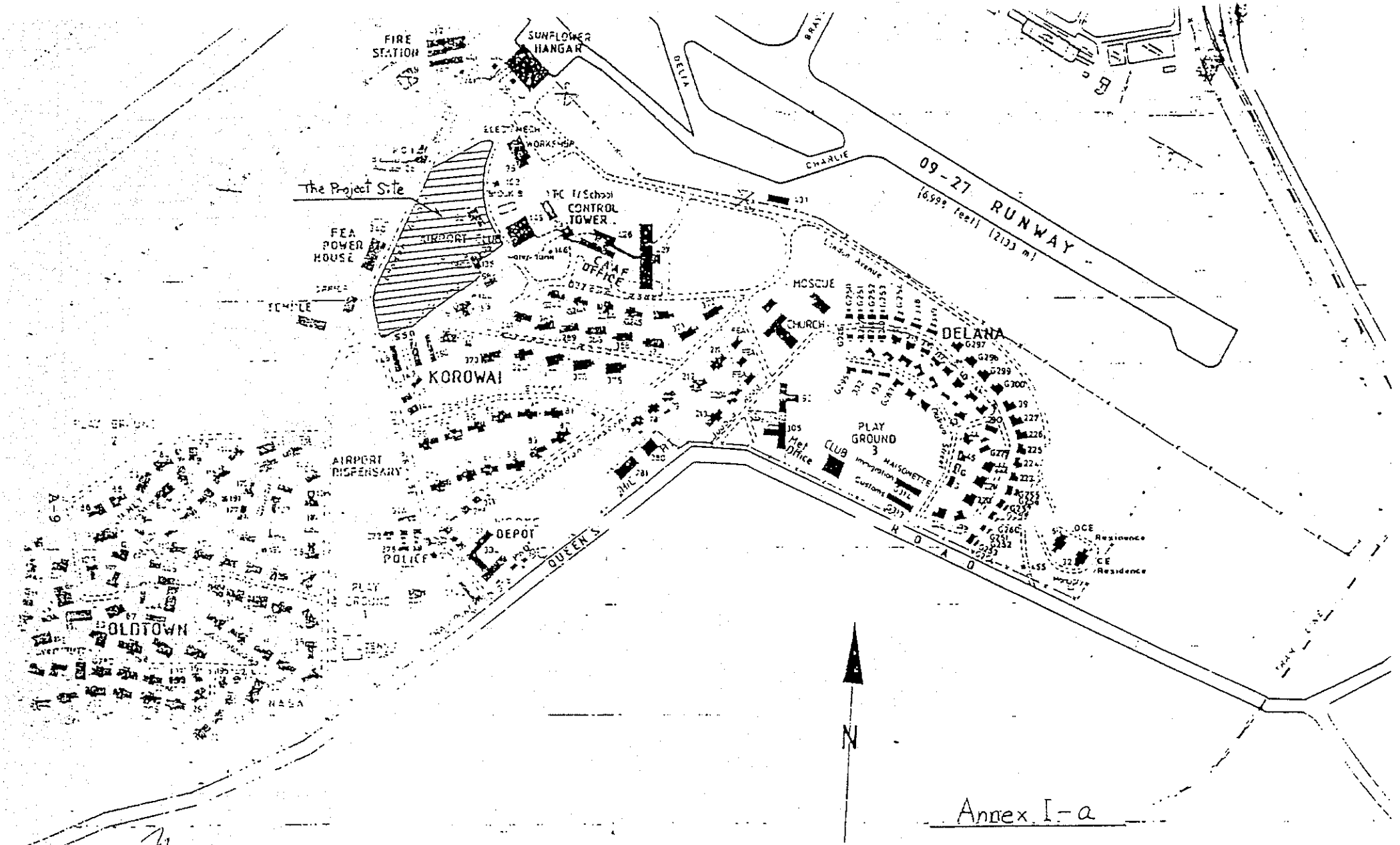
(2) The Government of Fiji will take necessary measures, described in Annex III for smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

(1) The consultant will proceed to further studies in Fiji until January 27.

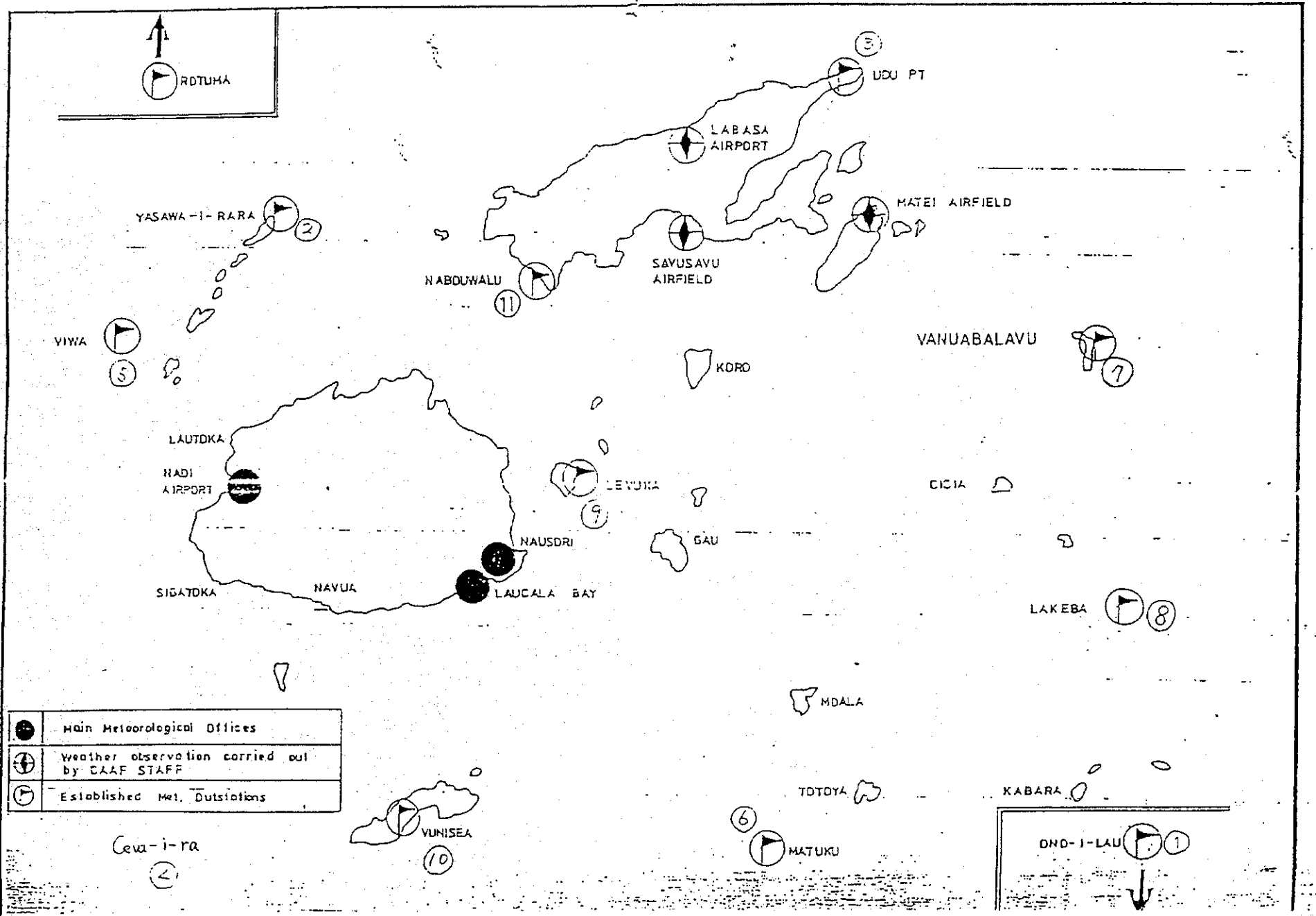
(2) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents in March 1995.

(3) In case that the contents of the report is accepted in principle by the Government of Fiji, JICA will complete the final report and send it to the Government of Fiji by May 1995.


FIRE STATION
SUNFLOWER HANGAR
DELTA
BRAVO
CHARLIE
09 - 27 RUNWAY
(6,999 feet) (2133 m)
ELECTRICAL WORKSHOP
The Project Site
AIRPORT CLUB
FEA POWER HOUSE
PC T/School
CONTROL TOWER
CAAF OFFICE
MOSQUE
CHURCH
DELANA
KOROWAI
PLAY GROUND 3
Met Office
CLUB
Immigration
Customs
MAISONETTE
AIRPORT DISPENSARY
DEPOT
POLICE
QUEEN'S
ROAD
OLDTOWN
NASA
N
AREA - 175
PERIMETER FENCE - 5 Km
SECURITY FENCE - Km
Annex I-a

FIJI METEOROLOGICAL SERVICE
DISTRIBUTION OF METEOROLOGICAL STATION 198

Annex I-b



Annex II

Japan's Grant Aid Scheme

1. Grant Aid procedures

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Government of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. *Basic Design Study*

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
d) Preparation of a basic design of the Project
e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid Project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry (ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order

to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

3. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.
When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

(1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.

(2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

(3) To secure buildings prior to the procurement in case the installation of the equipment.

(4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.

(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

(6) 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 recipient country and stay therein for the performance of their work.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

9) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payment will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex III

Necessary measures to be taken by the Government of Fiji in case Japan's Grant Aid is executed

1. To secure the site for the Project.
2. To clear, level and reclaim the site prior to commencement of the construction.
3. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.
4. To construct the access road to the site prior to commencement of the construction.
5. To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage and other incidental facilities to the Project site.
   1) Electricity distributing line to the site
   2) City water distribution main to the site
   3) Drainage city main to the site
   4) Telephone trunk line and the main distribution panel of building
   5) General furniture such as carpets, curtains, tables, chairs and others
6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon Banking Arrangement.
7. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the project at the port of disembarkation.
8. To accord Japanese nationals whose services may require in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into Fiji and stay therein for the performance of their work.
9. To maintain and use properly and effectively that the facilities constructed and equipment purchased under the Grant.
10. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and the installation of the equipment.
11. To secure GTS link between Melbourne and Fiji.
12. To have the necessary permission from Japan Meteorological Agency to use Global Meteorological Satellite (GMS) for transmission of acquired weather data by automatic weather stations.

(2) Expalanation of Draft Report

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT FOR UPGRADING OF METEOROLOGICAL OBSERVATION AND FORECASTING SYSTEM IN THE REPUBLIC OF FIJI
(CONSULTATION ON DRAFT REPORT)

In January 1995, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Upgrading of Meteorological Observation and Forecasting System (hereinafter referred to as "the Project") to the Republic of Fiji, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Fiji side on the components of the draft report, JICA sent to Fiji a study team, which is headed by Mr. Toshinobu KATO, Second Basic Design Study Division, Grant Aid Study & Design Department, JICA, and is scheduled to stay in the country from March 24 to 31, 1995.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Suva, March 31, 1995

Mr. Toshinobu KATO
Leader
Draft Report Explanation Team
JICA

Mr. Luke ROKOVADA
Permanent Secretary
for Tourism and Civil Aviation
Ministry of Foreign Affairs, Tourism and Civil Aviation

ATTACHMENT

1. Components of Draft Report

The Government of Fiji has agreed and accepted in principle the components of the Draft Report proposed by the team.

2. Japan's Grant Aid system

(1) The Government of Fiji has understood the system of Japanese Grant Aid explained by the team as attached Annex I.
(2) The Government of Fiji will take the necessary measures, described in Annex II, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

3. Further schedule

The team will make the Final report in accordance with the confirmed items, and send it to Government of Fiji within May 1995.

Annex I

Japan's Grant Aid Scheme

1. Grant Aid procedures

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b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
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d) Preparation of a basic design of the Project
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The consulting firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

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However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

(1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
(2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
(3) To secure buildings prior to the procurement in case the installation of the equipment.
(4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
(6) 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 recipient country and stay therein for the performance of their work.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

9) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payment will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex II

Necessary measures to be taken by the Government of Fiji in case Japan's Grant Aid is executed

1. To secure the site for the Project.

2. To clear, level and reclaim the site prior to commencement of the construction.

3. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.

4. To construct the access road to the site prior to commencement of the construction.

5. To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage and other incidental facilities to the Project site.
   1) Electricity distributing line to the site
   2) City water distribution main to the site
   3) Drainage city main to the site
   4) Telephone trunk line and the main distribution panel of building
   5) General furniture such as carpets, curtains, tables, chairs and others

6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon Banking Arrangement.

7. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the project at the port of disembarkation.

8. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

9. To accord Japanese nationals whose services may require in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into Fiji and stay therein for the performance of their work.

10. To maintain and use properly and effectively that the facilities constructed and equipment purchased under the Grant.

11. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and the installation of the equipment.

12. To secure GTS link between Melbourne and Fiji.

13. To have the necessary permission from Japan Meteorological Agency to use Geostationary Meteorological Satellite (GMS) for transmission of acquired weather data by automatic weather stations.

14. To secure necessary software for GTS & AFTN communication, forecast support and weather chart plotting. (It is agreed that GTS software of Bureau of Meteorology in Australia be utilized because of its suitability considering that the GTS link will be established between Nadi and Melbourne.)
    To assure providing these software to the Contractor for suitable and appropriate modification for the computer system under the Project.

Appendix 5. Meteorological Disasters in Last 30 Years (1965 - 1994)

METEOROLOGICAL DISASTERS IN LAST 30 YEARS (65 - 94)

TYPE	PERIOD	AREA AFFECTED	FACTORS	DEGREE OF DISASTERS
Hurricane	6-9 February 1965	Southwestward north of Vanua Levu and southward west of Viti Levu	Heavy rain Widespread flooding Hurricane or roar-hurricane force winds	Severe 1000s of trees, houses and vegetation damaged 11 Dead.
Tropical Cyclone	9-10 April 1967	Southward over Vanua Levu and just east of	hurricane or near-hurricane force wind	Houses and foodcrops suffered considerable damage.
Hurricane "Bebe"	23-29 October 1972	Whole of Fiji	Storm-Hurricane Force Winds Flooding	Severe flooding in Viti Levu Severe damage to infrastructre and root crops.
Hurricane "Lottie"	9-10 December 1973	Southern parts of Fiji	Hurricane force winds	2 vessels sank 70 people died.
Hurricane "Val"	31 Jan-2 Feb 1975	Southern parts of Fiji, southern Viti Levu	Hurricane force winds	Severe. Extensive damage in Lau Group Matuku and Kadavu. One death.
Hurricane "Betty"	5-6 April 1975	Southern parts of Fiji south west of Viti Levu	Up to hurricane force winds Small tornado	Extensive damage in Kadavu
Hurricane "Bob	4-5 January 1978	Parts of Viti Levu, islands on the west of Viti Levu	Storm force winds isolated squall	One death demolished several houses on the main land.
Storm "Fay"	29-30 December 1978	Eastern parts of Fiji	Storm force winds Flooding Storm surge of heavy surf	Major flooding over eastern Vanual Levu and Taveuni Coastal damage in Lau Groups

2/..

TYPE	PERIOD	AREA AFFECTED	FACTORS	DEGREE OF DISASTERS
Hurricane "Meli"	26-28 March 1980	Southern island of Fiji, southern and southeastern Viti Levu	Hurricane force winds Storm surge Landslides Heavy storm surge Heavy floodings in Viti Levu	52 dead About 11 vessels either lost, damaged, sunk or ground
Storm "Tia"	24 March 1980	Vanual Levu northern and central Lau	Storm force winds Flooding Storm surge Landslides.	4 deaths Extensive damage to dwellings.
Gale "Wally"	3-5 April 1980	Small coastal and inland area of Southern Viti Levu including islands on the south of Viti Levu	Gale force winds severe flooding Landslides	Flooding in all coastal river of Viti Levu from Korolevu to Nausori. Several fatal landslides 14 dead, 2 missing Extensive damage to the main highway Several loss of livestock, pasture, crops in the flooded areas.
Hurricane "Arthur"	13-16 January 1981	Southwest and south of Fiji Western one third of Viti Levu	Upto hurricane force moderate Floodings	Considerable damage to buildings and structures Disruption to communication in some parts.
Hurricane "Oscar"	26 Feb-2 Mar 1983	South and west of Fiji, Viti Levu	Prolonged hurricane force winds Severe storm surge Severe flooding	9 dead Flood damage in towns in in Western Viti Levu, Widespread damage to buildings crops, vegetation, livestock, roading, water supply, power supply and wharfs.

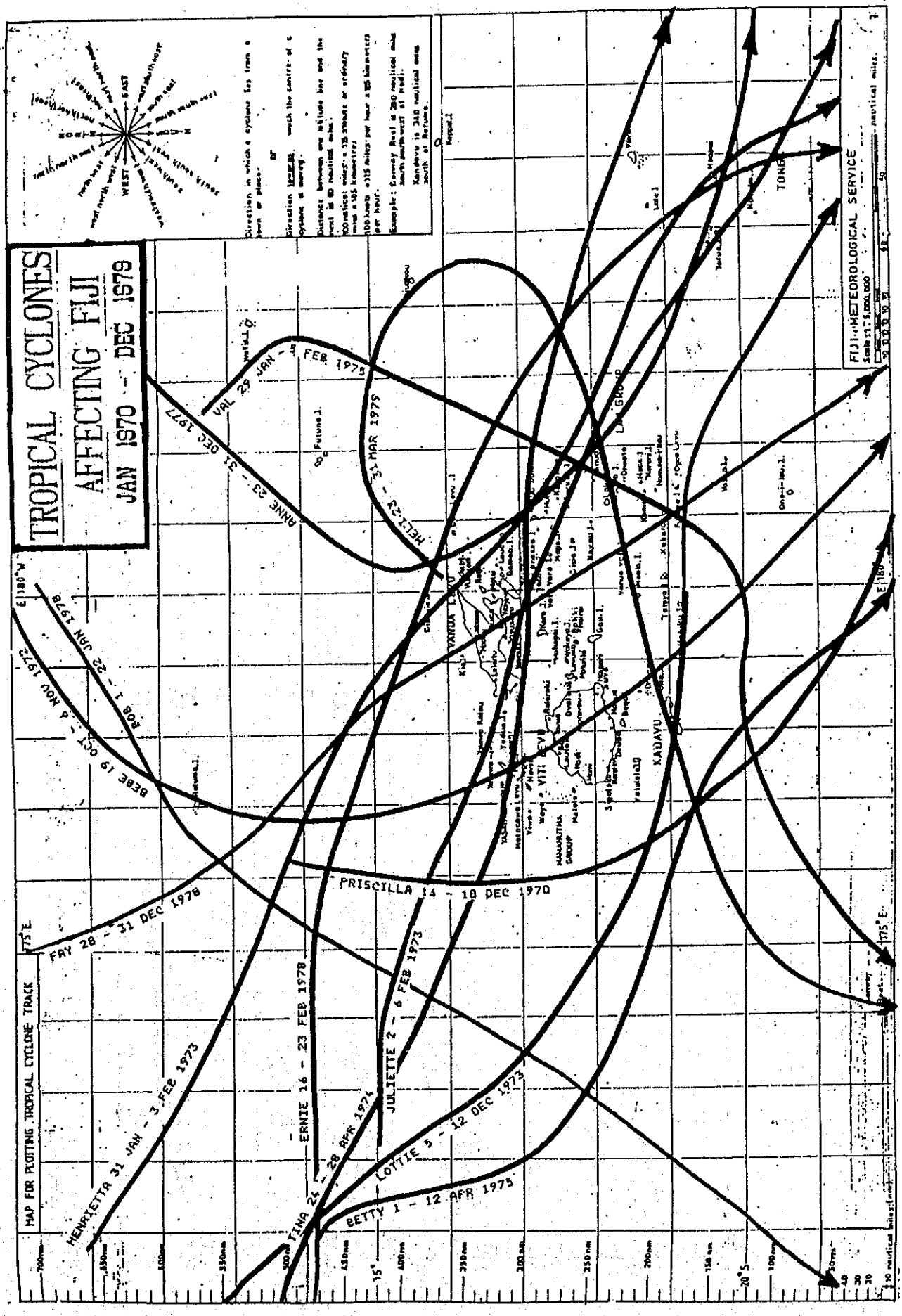
3/...

TYPE	PERIOD	AREA AFFECTED	FACTORS	DEGREE OF DISASTERS
Hurricane "Sarah"	25-28 March 1985	Some of the islands on the southern Fiji	Hurricane force winds	Widepsread damaged to crops, vegetation, buildings in Lau Groups.
Hurricane "Eric"	14-19 January 1985	Western Fiji, Viti Levu and southern Lau	Hurricane force winds	25 dead several hundred injured Very severe wind caused destructions to buildings and vegetation in north western Viti Levu Disruption to power supplies and aviation services.
Hurricane "Nigel"	16-20 January 1985	Northwest of Fiji, northern half of Viti Levu Eastern Fiji	Hurricane force winds Storm surge Some flooding	Damage to buildings, coastal installation and agriculture
Hurricane "Gavin"	3-8 March 1985	Western Fiji, eastern Vanua Levu, Viti Levu Southern Fiji	Prolonged gales Flooding	3 deaths Flooding in Nadi, Ba and Lautoka towns. Crops damage and loss of livestock.
Hurricane "Hina"	10-18 March 1985	Western Fiji, Viti Levu	Hurricane force winds	Damage to buildings and other structures, installation and crops. Widepsread flooding.
Storm "Martin"	10-13 April 1986	Northeastern Vanua Levu Northern Lau	Storm wind force Severe flooding Storm surge	extensive damage to buildings, crops and trees 3 deaths
Hurricane "Raja"	22 Dec-1 Jan 1987	Vanua Levu, Lau Groups	Hurricane force winds	1 dead Damage to buildings and crops.

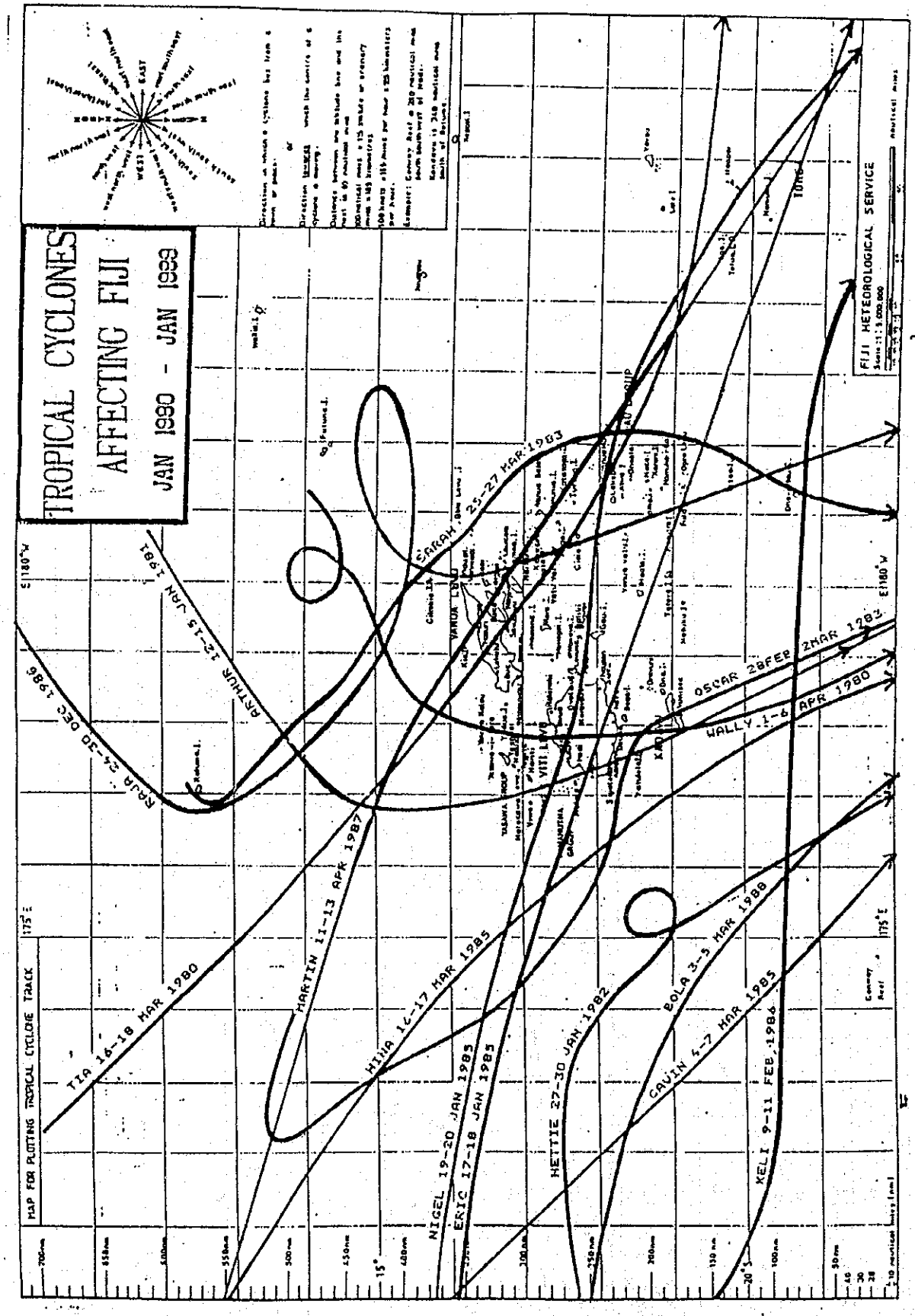
4/...

TYPE	PERIOD	AREA AFFECTED	FACTORS	DEGREE OF DISASTERS
Hurricane "Bola"	25 Feb- 4 Mar 1988	Western Fiji, Southwest Viti Levu	Hurricane wind force	Six presumed drown.
Storm "Rae"	16-25 March 1990	Whole of Fiji	Gustly winds Torrential rain	Extensive flash floodings Nadi and Ba suffered major floodings. Landslides caused temporary closure of roads and bridges. 3 deaths. Minor damages to buildings and crops.
Hurricane "Sina"	24-30 November 1990	Southern Viti Levu, southern islands of Fiji	Hurricane force winds, Heavy rain	Extensive damages to crops, buildings, electrical poles.
Tropical Cyclone "Joni"	6-13 December 1992	Southern Fiji and whole of Viti Levu	Upto Hurricane wind force, Heavy rainfall	1 dead Major damage to crops and vegetation.
Hurricane "Kina"	26 Dec-5 Jan 1993	Whole of Fiji	Hurricane force winds Heavy rainfall Flash floodings Landslides.	Breakage of two minor bridges in Ba and Sigatoka. Disruption to transportation between Eastern and Western Divisions. Extensive damages to crops, buildings. Loss of livestock. 23 dead. Cost of damage of $F170 million.

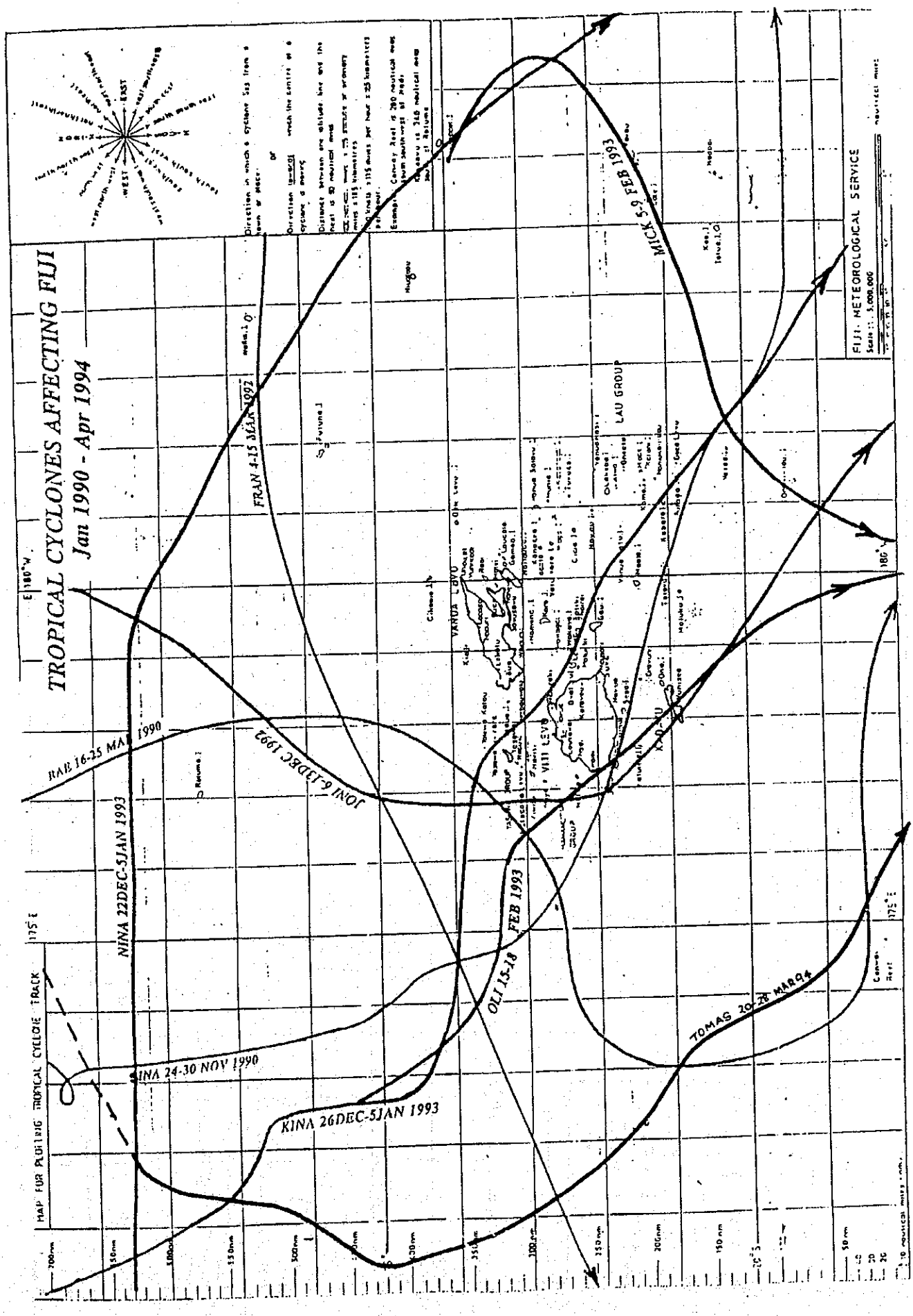
Appendix 6(1). Tropical Cyclones Affecting Fiji (1970 - 1979)



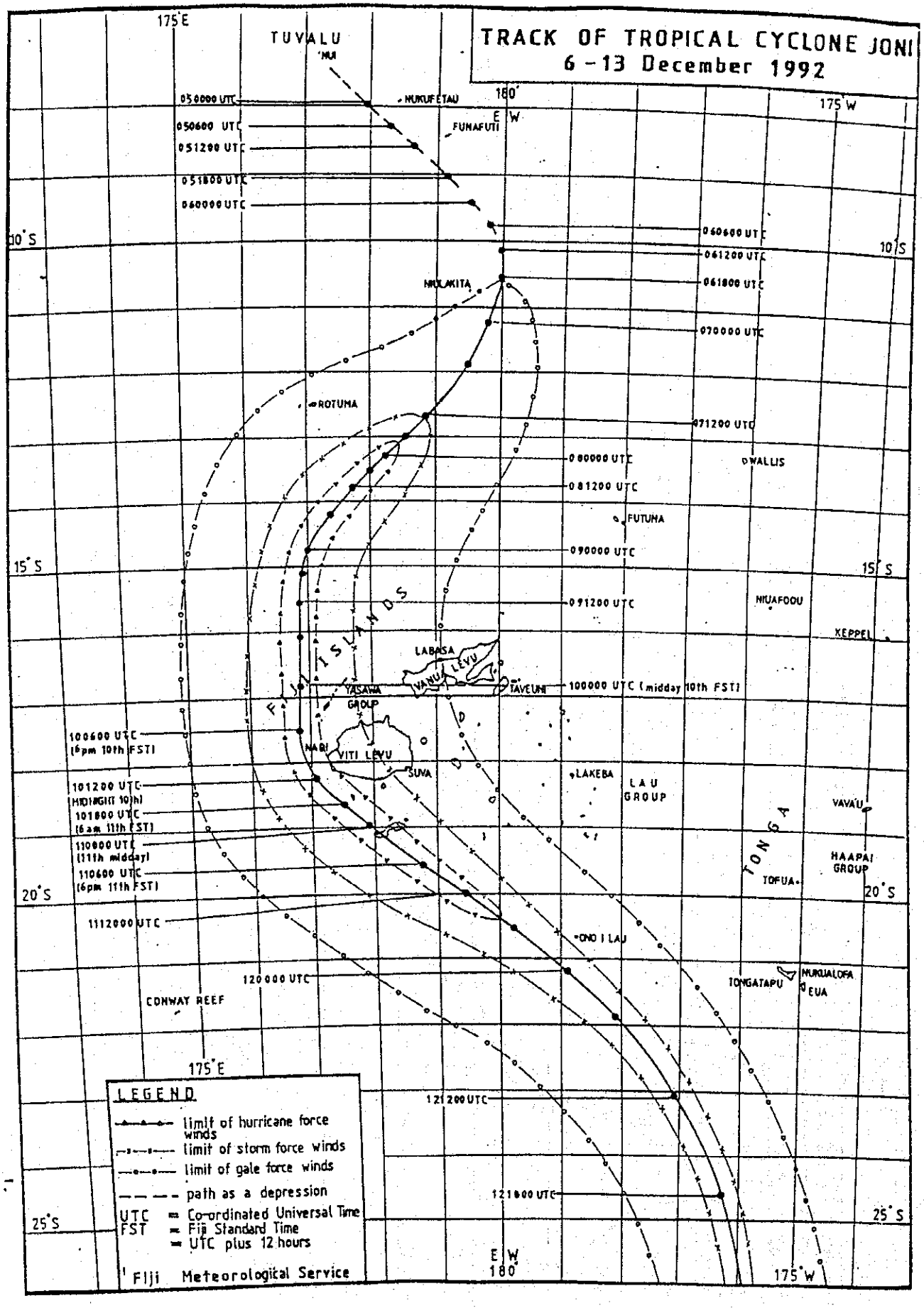
Appendix 6(2). Tropical Cyclones Affecting Fiji (1980 - 1989)



Appendix 6(3). Tropical Cyclones Affecting Fiji (1990 - 1994)



Appendix 7(1). Track of Tropical Cyclone Joni (6 - 13 December1992)



Appendix 7(2). Track of Tropical Cyclone Kina (26 December1992 - 5 January 1993)