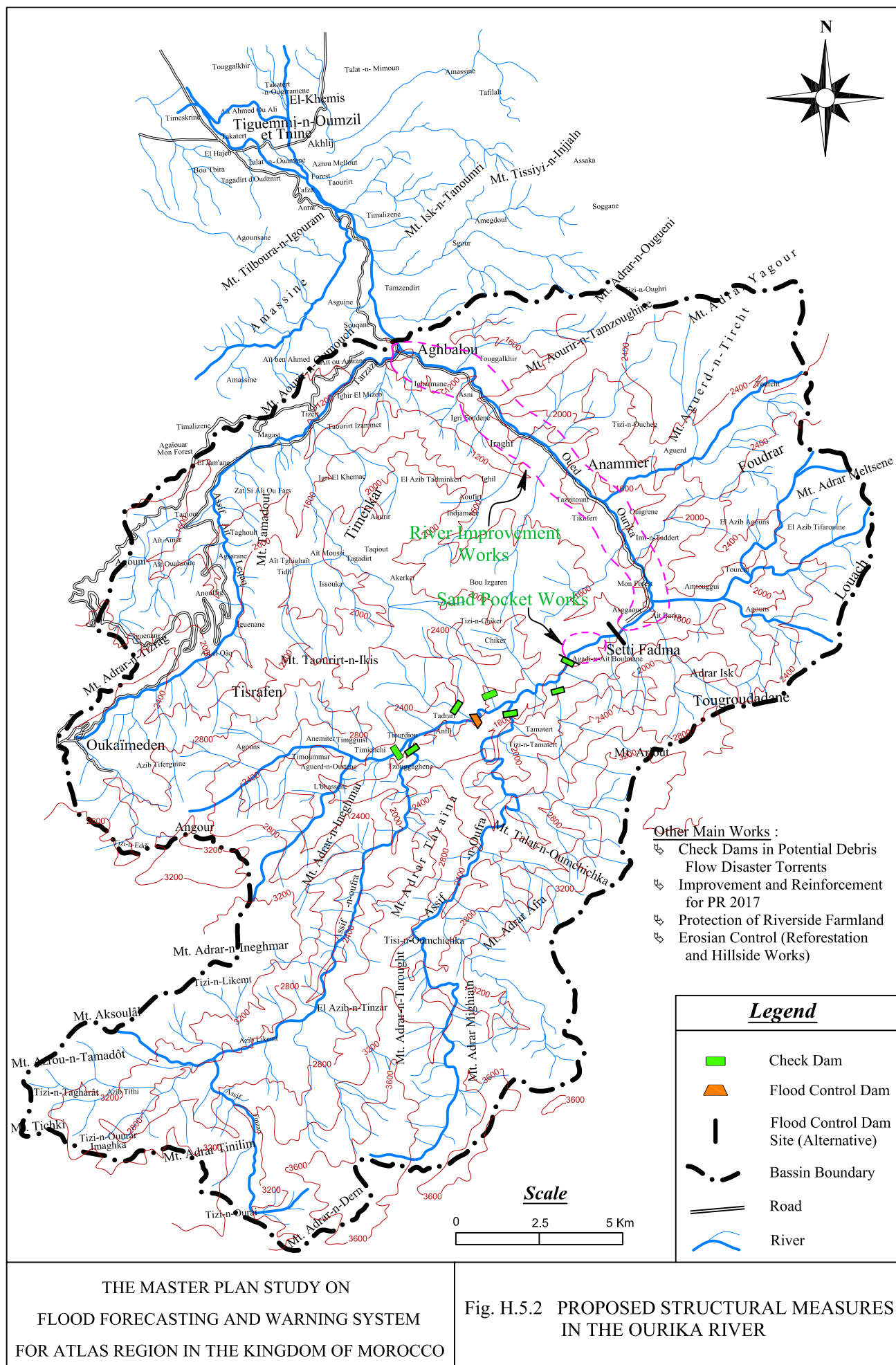
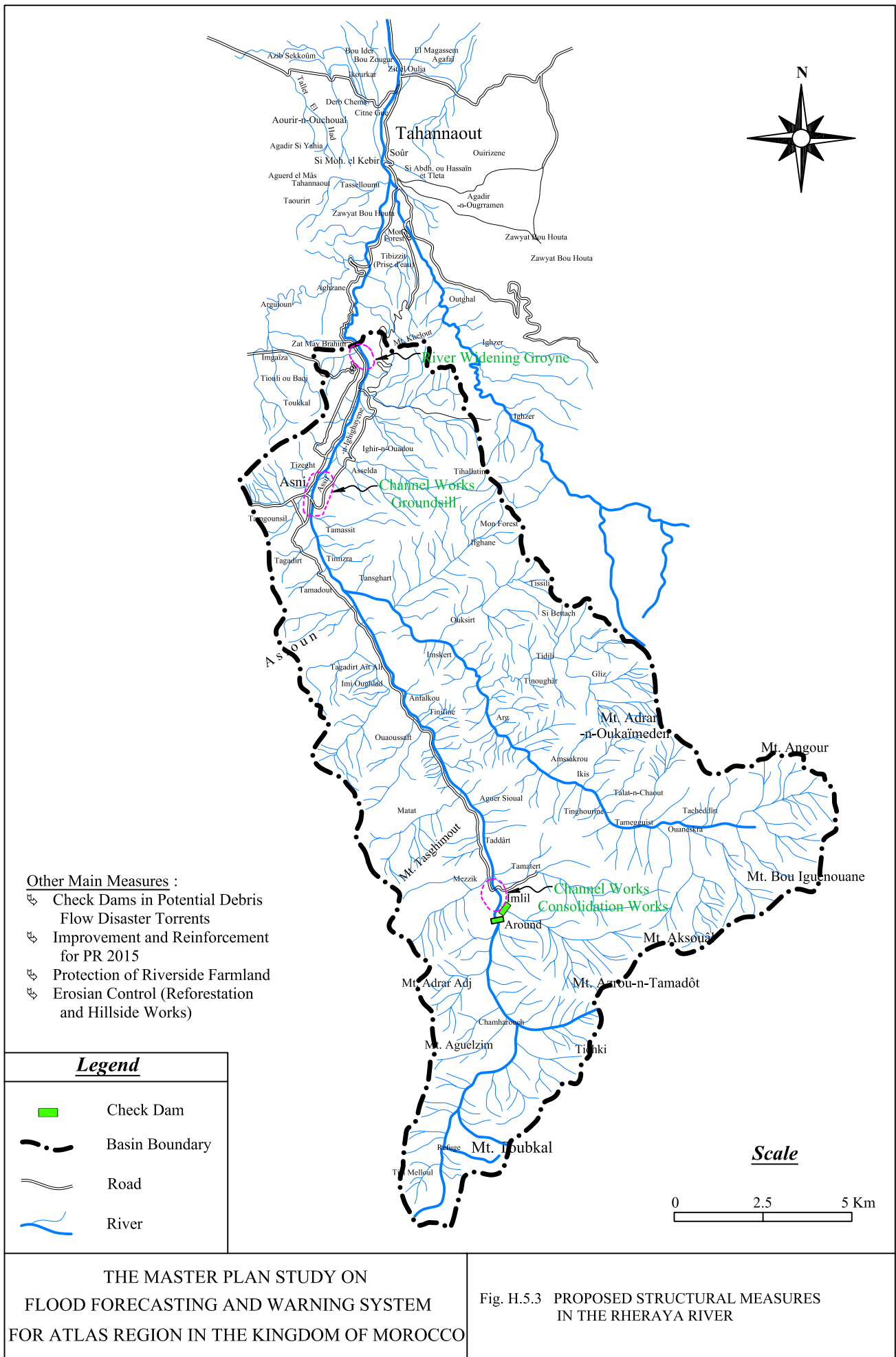






APPENDIX I

TELEMETRY AND WARNING SYSTEM

**THE MASTER PLAN STUDY ON
FLOOD FORECASTING AND WARNING SYSTEM
FOR ATLAS REGION IN THE KINGDOM OF MOROCCO**

APPENDIX I TELEMETRY AND WARNING SYSTEM

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CHAPTER 1. TENDER SPECIFICATIONS FOR THE PILOT PROJECT PHASE-I

1.1 General Requirement

(1) Scope

This specification covers equipment and materials supply and installation at site of the rainfall and water-level observation sub-system, data processing sub-system, data monitoring sub-system and flood warning sub-system for the PILOT SYSTEM of the Flood Forecasting and Warning System for ATLAS region. The supplier shall offers all equipment and materials stipulated in the specifications. The supplier shall also require installation works and commissioning for each sub-system as well as total system.

Fig.I.1.1 shows Location map of Hydrological Station.

(2) Ambient Conditions

The hydrological station of the pilot project locates around 1000m to 2500m above sea level in high mountain area. Supplier shall consider such surrounding conditions. The equipment shall be suitable for permanent operation, and all guaranteed technical data shall be maintained for the following ambient conditions.

(a) Out Door Equipment

- Temperature : -20°C to 50°C
- Relative humidity : 90 % or less
- Withstand wind speed : 45m/sec.
- Location : 460m Up to 2500m above sea level

(b) In Door Equipment

- Temperature : 10°C to 40°C
- Relative humidity : 40% to 80% non-condensing
- Location : 460m Up to 2500m above sea level

(c) Data Processing and Monitoring Equipment

- Temperature : 15°C to 35°C
- Relative humidity : 40% to 80% non-condensing
- Location : 460m Up to 1000m above sea level

(3) Power Consumption

All equipment shall be of low power consumption, power-saving type.

(4) Documents

The correspondents and all documents such as Instruction manuals, operation manuals and data sheets shall be written by French. However, English could be used for notes of the table and drawings and technical descriptions.

(5) Non Partial Offer

Since the pilot system composed various kinds of equipment, materials and miscellaneous. Therefore, Supplier is strongly requested to collect all equipment and materials stipulated in these specifications and arrange properly to comply with the specifications. Details interface conditions between the equipment shall be described in the proposal. Installation work for all equipment and materials shall also be conducted by responsibility of the supplier.

Partial offer shall not be accepted.

1.2 System Requirement

1.2.1. General

The Pilot System aims to collect meteo-hydrological data from selected observation stations for analysis and process the collected data to issue flood warning to inhabitants. The Pilot System shall consist of the following four (4) functions:

Fig.I.1.1 shows Location map of station in the Ourika River Basin.

(1) Data Collection

The observation sub-system performs to collect the necessary hydrological data of the Ourika river basin, consisting of one (1) rainfall gauging station at Agouns, and four (4) rainfall and water-level gauging stations at Tazzitount, Tourceht, Tiourdiou, Amenzal. The collected data transmission is made through existing VHF radio network to Flood Forecasting and Warning Center (hereinafter call MASTER INFORMATION CENTER) DRHT in Marrakech. Observation stations shall equip automatic hydrological gauging devices such as tipping bucket rain gauge and ultrasonic water level gauge. Collected hydrological data shall be stored in the Remote Terminal Unit at same time these data shall print out on the thermal printer. In addition to water level gauge, those gauges shall install separately at riverside and observation housing side and short distance radio equipment shall equip between two sides. The pilot system so designs non-real time data collection system. However, the data collection system shall be designed easily upgrade to radio or INMARSAT-C telemetry to cope with further expansion plan.

(2) Data Processing and Information Dissemination

Data processing and information dissemination sub-system shall performs to process hydrological data from hydrological observation stations through existing radio telephone network, to analysis and store the collected data by utilizing data processing server connected with LAN of DRHT, and to transmit the flood information to the computer in the related organizations through the public telephone network. The sub system consists of two sets of PC servers as [data base], two client PC for data analysis and process, a remote access server for data communication between the monitoring stations, NTP server and GPS receiver for system time correction, one client PC for director's office and peripheral equipment. Individual UPS for the server and PC shall provide against sudden interruption of commercial power supply.

(3) Data Monitoring

DRHT processes flood information at MASTER INFORMATION CENTER and processed data shall distribute to DPE Tahanout and related organizations. The Governor of Al Hauz Province has an authority to issue the flood warning and evacuation order. Data monitoring sub-system shall consist of four (4) agencies concerning the flood warning system, namely, DGH Rabat, DPE Tahanaout, Al Hauz provincial office and Caidat office at Ourika. When data monitoring station want to get the latest flood information, the monitoring station dial the telephone number of DRHT MASTER INFORMATION CENTER through V90 MODEM then flood information shall receive as respond from the data processing server of DRHT.

(4) Flood Warning

Flood warning sub-system performs flood warning dissemination to inhabitants of Iraght through the office of the local authority (Caidat) at Agadir Ifagherne. The flood warning post consists of voice amplifier in combination with loud speakers installed beside of houses of inhabitants. The Governor will send instruction to the local authority to disseminate flood warning. Then officer of the local authority shall announce the flood warning and or evacuation order to inhabitants near Iraght warning post. Distance from the office of the local authority to Iraght warning point is about 30km. VHF radiotelephone unit shall install at Iragf warning post through existing province VHF radio network.

1.2.2. System Functions

The main functions of the pilot project are gathering hydrological data, analysis and processing data, display and printing of processed data and transfer of flood notice to concerned organizations. The flood warning announcement also disseminate to inhabitants by flood warning posts. It is notfully automatic system. Existing human interface shall be utilized for Data collection and flood warning announcement. Total system is consisting of four (4) sub-system described below. The total system configuration is shown in the Fig.I.1.2.

(1) Data Collection Sub-system

VHF/FM, 150MHz band radio network has been established by DRHT since 1995 among the Ourika River Basin. It has been utilized effectively until now with some modifications and addition of radiotelephone and gauging devices.

Improvement of data collection shall be made on automatic meteo-hydrological gauging devices. Ultrasonic water level gauge shall install on the bank of the river where the stations apart from station housing. Short distance data transmission device shall be installed to transmit water level data to the Remote Terminal Unit via short distance data receiver. Receiving data shall give necessary process by the remote control unit. The rainfall and water level data shall be outputted to LED display. Then observer transmits readout data verbally to the MASTER INFORMATION CENTER Marrakech through existing VHF radio network. The following gauging stations shall collect data

(a) Rainfall gauging station

- Agouns
- Tournchi

(b) Rainfall and water level gauging station

- Tazzitount
- Tiourdiou
- Amenzal

The number of data in the Pilot System is as follows;

- | | |
|--------------------|-----|
| - Rainfall data | : 5 |
| - Water-level data | : 3 |

Fig.I.1.4 and I.1.5 shows station block diagram for rainfall, and rainfall/water level gauging station.

(2) Data Processing Sub-System

Data processing sub system shall be performs more than two years collected raw data storage (maximum 1440 data per day), statistical process, online process and data output process. After primary processing, secondly process shall be made such as (1) Flood status map (2) Flood status diagram (3) Rainfall graphs both all station and each station (5) Discharge graph both all stations and each station (6) Rainfall table and (7) Water level and discharge table. These data shall be displayed, printed and distributed agencies concern based on Web site. Operation System shall be Windows 98 or 2000. Every client PC can be monitored the data by Web site.

(a) Data Processing

The data processing sub-system shall be a networked computer system consisting of PC file server equipment with CD-R drive, client PC with CRT display, and their peripheral equipment through Ethernet LAN.

The collected hydrological data shall be conducted following processing by the PC server:

- Primary processing (including warning detection)
- Statistical processing

The primary processing items at MASTER INFORMATION CENTER for collected data shall be as follows:

(i) Rainfall

- 10 minutes rainfall (mm)
- 30 minutes rainfall (mm)
- Hourly rainfall (mm)
- 3 hours rainfall (mm)
- 6 hours rainfall (mm)
- 24 hour rainfall (mm)
- Cumulative rainfall
- Rainfall start time
- Maximum hourly rainfall and occurred time
- Maximum 24 hours rainfall and occurred time
- Alarm of rainfall (hourly rainfall and cumulative rainfall)

(ii) Water level

- Water-level conversion
- 15 minutes level difference
- Hourly level difference
- Increasing or decreasing detection
- Alarm detection of water level
- Flow calculation

All the data that were made primary processing shall be stored as follows:

PC server shall store primary processed data the in hard disk equipment.

(b) The PC file server equipment stores the data in the following classifications:

- Data for display
- Data for monthly and annual report
- Data to be stored for reference
- Parameters
- Data of typical floods record

CD-R drive shall be used for download of storage data and to store all the necessary data, which will be utilized for future analysis and flood forecasting process.

The statistical processing items at MASTER INFORMATION CENTER for collected data shall as follows:

(i) Rainfall

- Maximum daily rainfall
- Maximum cumulative rainfall
- Maximum hourly rainfall
- Maximum 3 hours rainfall
- Maximum 24 hours rainfall
- Rainy days
- Monthly rainfall
- Annual rainfall

(ii) Water level

- Mean water level
- Maximum water level
- Minimum water level
- Annual statistics of water level
- Mean flow
- Maximum flow
- Minimum flow
- Total flow

(c) Display and Printing

Processed data shall be displayed and printed as follows:

(i) Display

- CRT display terminal

(ii) Printing

Laser beam printer (LBP)

- Observed hydrological data
- Hourly report
- Daily report
- Monthly report
- Annual report

Color hard copier

- Hard copy of CRT display

Daily report, monthly report and annual report shall be printed on LBP by using the data that were stored in the PC file server equipment.

Daily report will be output at 8 o'clock a.m. automatically every day. Also, designating a date, daily report shall be possible to print by manually operation.

Monthly report and annual report shall be made by manual operation only.

The client PC shall be capable of producing tabulations of daily, weekly, monthly and annual data.

Fig.I.1.3 Shows Station Block Diagram for MASTER INFORMATION CENTER.

(3) Monitoring Sub-system

The monitoring sub-system is consisting of client PC with Windows 98 OS and printer. The MASTER INFORMATION CENTER shall provide several kinds of messages and graphics by Web bases. The client PC shall be monitored on Web site. Kinds of data distribution shall be as follows;

- Flood status map
- Flood status diagram
- Rainfall graphs both all station and each station
- Discharge graph both all stations and each station
- Rainfall table and
- Water level and discharge table.
- Flood Information Bulletin

(4) Flood Warning Dissemination Sub-System

One (1) unit of the warning control equipment shall be installed at Ourika Caidat office and one (1) warning posts shall be installed at Iraght.

Flood warning Broadcasting shall be conducted the following manner.

- Artificial sound before announcement
- Voice announcement
- Recorded announcement

Level of warning broadcasting is classified as;

- Pre-warning broadcasting
- Warning broadcasting
- Concretion broadcasting

Each broadcasting messages shall be recorded on IC Cards in advance and each IC Card shall be identified by the color on its label.

Target areas of sound reaches shall be more than 700m radiuses nominal with directional loudspeakers.

Fig.I.1.6. Shows Station Block Diagram for Flood Warning sub system.

1.3 Specifications for Equipment and Materials

1.3.1. Flood Watch Sub-System

(1) Remote Terminal Unit

The remote terminal unit shall collect rainfall and/or water level data and send to the telemetry supervisory equipment in response to the calling signal. This equipment shall also have data logging function, data display and printer output function.

- Type of cabinet : Wall-mounting
- Sensor interface : Rainfall; pulse signal
Water level; BCD 4 digits
- Printer interface : RS-232C
- Data logging function : Selected interval from 15/30/60 minutes
with 1MB or 2MB PC card
- Power source : 12VDC nominal
- Communication interface : Simple radio link
- Transmission line : $600\Omega \pm 20\%$ balanced
- Modulation : FSK

(2) GPS for Time Correction

- Receiver type : Multi-channel (8-channel) all-in-view
- Frequency : $1575.42\text{MHz} \pm 1\text{MHz}$
- Data output : Single output port
NMEA 0183 ver. 1.5 or 2.0 selectable
- Power source : 12VDC nominal

(3) Tipping Bucket Type Rain Gauge

This equipment is utilized to measure rainfall named as Tipping bucket rain gauge installed at roof of the station housing to have high accuracy measuring. The detailed requirements are as follows. For actions against winter season, some anti-freeze protection shall be considered.

- Type of rain gauge : Tipping Bucket type

- Measuring : 1 mm/pulse
- Measuring Accuracy : $\pm 3\%$ or less in case of less than 100mm/h
- Diameter of water inlet : 200 mm rated
- Output of signal : One set of dry contact in pulse

(4) Ultrasonic Water Level Gauge

The water level gauge shall be measured water level without direct contact of water. Ultrasonic water level gauge shall consist of:

- Transducer
- Coder
- Air Temperature Sensor with Electric Ventilator
- Serial/BCD converter

The ultrasonic water level gauge shall perform temperature correction for the sonic speed variation depending on temperature variation by air temperature sensor.

The major specifications are as follows:

(a) Transducer and Coder

- Measuring Method : Aerial ultrasonic reflection
- Frequency : Approx. 24 kHz nominal
- Measuring range : 0 – 13.5 m
- Resolution : ± 1 cm
- Measurement area : Approx. 1m radius from center of ultrasonic beam
- Measurement Frequency : Approx. every 0.2 second
- Height of installation : 15m Max.(Distance from transducer to minimum water level)
- Display : 8-digit LCD
- Output : Format : Serial
 Item : Actual water level data
 20 seconds mean level
 60 seconds mean level
 180 seconds mean level
 600 seconds mean level
- Power supply : 12VDC nominal

(b) Temperature Sensor with Electric Ventilator

- Detection : Platinum resistance thermo detector
- Measurement Range : $-50 \sim 50^{\circ}\text{C}$
- Accuracy : $\pm (0.15+0.002t)^{\circ}\text{C}$ or less
- Type of ventilator : Electric ventilator

- Ventilation speed : Approx. 5 ~ 7m/s
- Power supply : 12VDC nominal
- (c) Serial/BCD converter
 - Input : 1 CH Serial
 - Output : 1 CH BCD 4-digit
 - Accuracy : $\pm 0.1\%$ or less
 - Display : 8-digit LCD
 - Power supply : 12VDC nominal

(5) Short Distance Data Transmitter

The transmitter shall connect with ultrasonic water level gauge through serial/BCD converter and transmit water level data to receiving site within 1km distance.

Major specifications shall be as follows:

- Frequency : 429.2500MHz ~ 429.7375 MHz
- Output power : 10mW
- Type of emission : F2D
- Data input : 1 channel (BCD 4-digit)
- Power supply : 12VDC nominal

(6) Short Distance Data Receiver

The receiver shall connect with the remote terminal unit to receive water level signal from short distance data transmitter. Supplier shall consider the expansion communication distance, in case line of sight condition is not obtained.

Major specifications shall be as follows:

- Frequency : 429.2500MHz ~ 429.7375 MHz
- Type of emission : F2D
- Data output : 1 channel (BCD 4-digit)
- Power supply : 12VDC nominal

(7) Solar Cell Power Supply

The solar cells power supply shall consist of solar cells, power distribution board and sealed lead-acid battery, and shall be able to receive solar energy and to supply it to the equipment and, at the same time, to store it in the sealed lead-acid battery.

The solar cells shall have the following specification:

- Type : Silicon solar cells
- Type of element : Silicon semiconductor
- Type of battery : Lead-acid battery

Capacity of solar cells and Battery

Name of site	Quantity	Capacity of Solar Panel	Capacity of Battery
Rainfall Gauging	2	54.5W	150AH
Water Level River site	2	218W	500AH
Water Level Station site	2	54.5W	150AH

The power supply distribution board shall be of overcharge protection type, and shall include a multi-range DC V-1 meter and a selector switch for the following;

- Operating voltage of solar cells
- Battery voltage
- Output current of solar cells
- Load current

The power distribution board shall be of wall mounting type.

(8) Installation Materials

- (a) Coaxial Cable 10C-2V
- (b) Coaxial Connector MP-10
- (c) Power Supply Cable
- (d) Grounding Materials
- (e) Connecting Materials
- (f) Miscellaneous

1.3.2. Data Processing Sub System

(1) Data Processing Server

(a) PC Server

- (i) CPU : Intel Pentium III 450MHz or higher
- (ii) Second cache memory : 256KB or more
- (iii) Main memory : 64MB or more
- (iv) RAID : RAID Level 5
- (v) RAID component : 8GB or more (Hot plug)
- (vi) RAID controller : Ultra2 or Ultra3 SCSI
- (vii) Storage device : FDD, CD-ROM, CD-R
- (viii) Input device : 101 Key Board (PS/2), Mouse(PS/2)
- (ix) Graphic
 - Resolution : 1,280 x 768 dot or more
 - Color : 256 colors or more
- (x) Network : 10BASE-T/100BASE-TX
- (xi) Power source : AC220V 60Hz
- (xii) OS : Microsoft Windows NT Server
US version 4.0, latest version

(b) CD-R Drive

- (i) Connection method : ATAPI or SCSI

- (ii) Read speed : X 10 or fast
 - (iii) Wright speed : X 4 or fast
- (c) Remote Access Server
 - (i) CPU : Intel Pentium III 450MHz or higher
 - (ii) Second cache memory : 256KB or more
 - (iii) Main memory : 64MB or more
 - (iv) RAID : RAID Level 0
 - (v) RAID component : 8GB or more
 - (vi) RAID controller : Ultra2 or Ultra3 SCSI
 - (vii) Storage device : FDD, CD-ROM, CD-RW
 - (viii) Input device : 101 Key Board (PS/2), Mouse(PS/2)
 - (ix) Graphics
 - Resolution : 1,280 x 768 dot or more
 - Color : 256 Colors or more
 - (x) Network : 10BASE-T/100BASE-TX
 - (xi) Power source : AC220V 60Hz
 - (xii) OS : Microsoft Windows NT Server
US version 4.0, latest version
- (d) NTP Server
 - (i) Time Adjusting method : Network time protocol
(for PC Server, Remote Access Server, Client PC)
 - (ii) Network : 10BASE-T/100BASE-TX
 - (iii) Power source : AC220V 60Hz
- (e) GPS Receiver
 - (i) Antenna type : Helical Antenna
 - (ii) Operating frequency : 1575.42MHz
 - (iii) Gain : Over than 25db (without cable)
 - (iv) Noise figure : Under than 2.0db
 - (v) Extension cable : 10D2V or equivalent
 - (vi) Max. Cable length : 50m
 - (vii) Power source : AC220V 60Hz
- (f) Concentrator
 - (i) Power source : AC220V Single phase
 - (ii) Number of distributions : 6 or more
 - (iii) Conection of Power source: Terminal contact by the screw
- (g) Accommodation Rack
 - Size : 650mm(W) x 2000mm(H) x 1000 mm (D) or
small (19 inch rack)
- (h) UPS
 - (i) Input voltage : AC 220V±10%, single phase

(ii) Output voltage : AC 220V±2%, single phase

(iii) Power supply duration : 10 minutes

(iv) Capacity of output power:

Purpose	Capacity
For PC Server	1.5KVA
For Client PC	0.7KVA

(v) Automatic operation : Windows correspondence

(i) Laser Beam Printer

Paper size : A4 and A3

Printing system : Laser

Resolution : 1000 dpi or more

Type of tray : two (A4 and A3) type, simultaneously installed

Printing speed : 15 ppm (A3) or more

Power source : 220VAC

(2) Client PC

The data input terminal, data processing, data terminal and server with modem are composed of PC having various peripherals that are VDT, keyboard, modem, LAN-IF, and others. Even though the required peripherals and functions are varied due to purpose of each PC, minimum requirement of PC is as follows:

(a) PC

CPU : Pentium III 667MHz or more

Memory : 128MB or more

Second cache memory: 256KB or more

Hard disk : 15GB or more

CD-ROM : X 48 or fast

Graphics :

Resolution : 1,280 x 768 dot or more

Color : 256 Colors or more

Display monitor : 17-inch flat type CRT

LAN IF : 10BASE-T/100BASE-TX

Keyboard : 109 key French Version

Mouse : Two-button Scroll Mouse

OS : WINDOWS 98, latest version

Case : Desktop model

Power source : AC 220V 60Hz

(b) Modem

Communication speed: Max data 56000bps/V.90

Telephone line interface: Two line public telephone system

Power source : 220VAC

(3) Ink Jet Color Printer

- (a) Paper size : A4
- (b) Printing system : Thermal ink jet
- (c) Resolution : 600 dpi or more
- (d) Color : 160,000 Colors or more
- (e) Printing speed : Monochrome 12ppm
Color/Graphics 10ppm
- (f) Type of tray : A4 type
- (g) Power source : 220VAC

(4) Isolation Transformer

This equipment shall install between commercial power line and data processing sub system equipment to protect damage caused by lightning through commercial power line for increasing of system reliability. The detailed requirements are as follows:

- (a) Input Voltage : 220V single phase
- (b) Output Voltage : 220V single phase
- (c) Frequency : 50/60Hz
- (d) Rated Power : 20 kVA
- (e) Insulation : Class-B (130°C)
- (f) Surge absorber : Semiconductor type should be applied at secondary line.
- (g) Arrester : Silver-colored metal film type should be applied at primary line.
- (h) Rated surge current: 15kA peak current or more, half of peak value in 10us or more
- (i) Insulation voltage : 100Mohm or more at 500VDC

(5) Network Equipment

(a) Switching Hub

- Support Specifications : IEEE802.3
- Data Transfer Speed : 10/100Mbps (CSMA/CD)
- Port : 10BASE-T/100BASE-T X16
- Power Supply : 220VAC

(b) Hub

- Support Specifications : IEEE802.3
- Data Transfer Speed : 10/100Mbps (CSMA/CD)
- Port : 10BASE-T/100BASE-T X8
- Power Supply : 220VAC

- (c) LAN Cable : UTP category 5

(6) Application Software

(a) Main Software

The main software shall process collected data automatically that operator inputted manually into the client PC, such as 10 minutes rainfall, hourly rainfall, cumulative. The software shall also carry out an operation for statistical process.

Collected Data

Data	Number of Data	Collection Frequency	Contents of Data
Rainfall	5	Every one hour in normal condition, can be changeable 15, 30 Minutes in flood condition	•Observation time •Rainfall values from preceding observation values.
Water Level	4	Every one hour in normal condition, can be changeable 15, 30 Minutes in flood condition	•Observation time •Water level values from preceding observation values.

After processed data, statistical data such as daily, monthly and annual reports and operation logs, shall print out by the laser beam printer.

(b) File Server Software

The File Server Software shall manage to store the processed data in the database file. This process shall also be updated automatically when hydrological data is inputted.

Data Base File

Database	Data volume	Cumulated data
Basic	2 years	•Rainfall. Water level •Processed rainfall •Processed water level •Statistical information
Flood forecasting (data exchange)	168 hours (1 week)	•Rainfall •Processed water level •Processed flow

(c) Data Display Software

The Data Display Software shall furnish graphics information base on processed hydrological data and flood forecasting information visually on the CRT display and color printer on real time bases. The information shall provide as Web type that shall connect to DGH Rabat office, Ourika Caibat Office • DPE AI Hauz Tahanabaout Office, Province of AI Hauz Tahanaout Office Client PC through telephone line. The information shall also be transmit to LAN in the DRHT Marrakech office

Display Information

Item	Contents	Disseminate to
Status 1	Current rainfall, water level graphs display on the river basin map	Agencies concern
Status 2	Current rainfall and water level graphs display on the river diagram.	Agencies concern
Graphs 1	Past 48 hours Rainfall, water level and discharge graphs	Agencies concern
Graphs 1	Past 24 hours Rainfall graphs	Agencies concern
Graphs 2	Past 24 hours water level graphs	Agencies concern
Graphs 3	Past 24 hours discharge graphs	Agencies concern
Table 1	Rainfall intensity and accumulated rainfall in last 24 hours	Agencies concern
Table 2	Water level and discharge in last 24 hours	Agencies concern

(d) Online Data Export Software

The Online Data Export Software shall extracts necessary data from processed hydrological data for flood forecasting processing and output to the file.

1.3.3 Data Monitoring Sub System

(1) Client PC

Refer to the item 1.3.2. (2)

(2) Ink Jet Printer

Refer to the item 1.3.2. (3)

1.3.4 Flood Warning Dissemination Sub System

The warning equipment consists of Voice amplifier, tape recorder, monitoring unit and loud speaker which shall accommodate in the rack. Major item of specifications are as follows:

(1) Voice Amplifier

- Rated output : 240W (continuous), 400W (max.)
- Rated load : 42Ω
- Current consumption : Approx. 18A at 24VDC
- Signal-to noise ratio : 60dB or more
- Input level : -6dB 10KΩ (deviation: ±3dB)
- Input impedance : 600 Ω±20%

(2) Loud Speaker

- Rating output power : 70W x 2 sets
- Type : Driver unit with Horn
- Impedance : 200 Ω

(3) Mixer Unit with Tape Player

Mixer unit shall has the following functions,

- Microphone input
- Level check VU meter
- Tone control
- Input selector switch
- Desk top Microphone unit
- Power supply : AC220V
- Output level : 0dBV, Rated. +10dBV, Max.
- Input sensitivity : MIC1 – 3 Approx. -22dBV, 600 Ω
- Auto reverse cassette tape player unit

(4) Monitor Panel

Replay sound from cassette tape and microphone sound shall monitor at monitor speaker and level indicator on monitor panel.

(5) Tape Recorder unit

The double deck tape recorder shall equip in the cabinet. The recorder will use for warning broadcasting message preparation.

(6) Isolation Transformer

This equipment shall install between commercial power line and DC power supply equipment to protect damage caused by lightning through commercial power line for increasing of system reliability. The detailed requirements are as follows:

- (a) Input Voltage : 220V single phase
- (b) Output Voltage : 220V single phase
- (c) Frequency : 50/60Hz
- (d) Rated Power : 2 kVA
- (e) Insulation : Class-B (130°C)
- (f) Surge absorber : Semiconductor type should be applied at secondary line.
- (g) Arrester : Silver-colored metal film type should be applied at primary line.
- (h) Rated surge current : 15kA peak current or more, half of peak value in 10us or more
- (i) Insulation voltage : 100Mohm or more at 500VDC

(7) DC Power Supply Equipment

DC power supply equipment consists of DC regulator, battery charger and DC/DC converter. The equipment shall be supplied at least 40 minutes during commercial power failure.

- (a) Input Voltage : 220V single phase
- (b) Output Voltage : 12V DC, 24V DC

- (c) Frequency : 50/60Hz
- (d) Rated Power : 2 kVA
- (e) Rated Output Current : 12V, 5A, 24V, 20A
- (f) Battery type : Sealed Read Acid type
- (g) Rated Voltage : 12V x 2
- (h) Capacity : 58AH or more

(8) VHF radiotelephone

(a) General

- Frequency : Specified frequency from 150MHz band
- Rating : Repeating of 10-sec. transmission and 3 min. reception.
- Receiving : continuous rating
- Operating voltage : 12VDC nominal
- Operating temperature : -10 ~ +50°C
- Current consumption : 7A or less at 25W transmitting
- Sele-call system : 5-tone function
- Number of channel : 16 channel or more

(b) Transmitter

- Rated output : 25W
- Frequency stability : less than $\pm 5 \times 10^{-6}$
- Modulation system : Variable-reactance frequency modulation
- Type of emission : F2D and F3E
- Maximum frequency deviation : ± 5 kHz or less
- Occupied band width : 16kHz or less
- Antenna impedance : 50 ohms

(c) Receiver

- Receiving system : Double supper-heterodyne system
- Band width : 12 kHz or more at 6dB down
- Spurious response : More than 70dB
- S/N ratio : 30dB or more at 15dB μ input and 1 kHz, 70% modulation
- Receiving sensibility : 0dB μ or less

(9) Antenna system

(a) 3-element Yagi Antenna

- Operating frequency : Specified frequency 150MHz band
- Gain : 8dBi or more
- Impedance : 50 ohms
- Polarization : Vertical
- VSWR : 1.5 or less

(b) Coaxial cable

10D-2C or equivalent 30m with connectors

(10) Cable Protector Panel

The loud speaker cable shall extend two ways around 600m. These cables shall be protected by arrestors and absolvers from lightning surge.

(11) Installation Materials

(a) Panzer mast (7m high) for speaker cable hanging (21 pcs.)

(b) Fixing Materials for Speaker

(c) Power Cable

(d) Signal Cable

(e) Speaker cable with messenger wire (600M)

(f) Connecting Materials

(g) Fixing Materials for Equipment

(h) Miscellaneous

1.3.5. Installation Work

The installation work shall be contracted separately. The contractor shall requests to dispatch installation supervisor for guidance of the equipment installation of them.

1.3.6. Station Housing

Supplier shall construct the following housing for the purpose of observation equipment installation.

Name of station	Equipment accommodation	Water level equipment accommodation
Amenzal	-	2 x 2 x 3 m
Tidordour	-	2 x 2 x 3 m

1.4 Equipment Composition List

1.4.1. Equipment Composition List for MASTER INFORMATION CENTER

No.	Item	Units	Remarks
1	Data Processing Server	1	Hot standby
-1	PC Server	1	
-2	Remote Access Server	1	
-3	NTP Server	1	
-4	GPS Receiver	1	
-5	Concentrator	1	
-6	UPS	2	
-7	Accommodation Rack	1	
2	Laser Beam Printer	1	
3	Isolation Transformer	1	
4	Network Equipment	1	
-1	Switching Hub	1	Install into the Data Processing Server.
-2	Hub	1	
5	Ink jet printer	1	
6	Maintenance PC	1	

1.4.2. Equipment Composition List for Monitoring Station

No.	Item	Units	Remarks
1	Client PC	4	
-1	PC	4	
-2	Modem	4	
-3	Ink Jet Color Printer	4	
-4	UPS	4	0.7KVA, 220V

1.4.3. Equipment Composition List for Rainfall Gauging Station

No.	Item	Units	Remarks
1	Remote Terminal Unit	2	
3	Rain Gauge	2	
8	Solar Panel	2	12V/54.5W
9	Power distribution board	2	
10	Storage Battery	2	12V/150Ah

1.4.4. Equipment Composition List for Rainfall and Water level Gauging Station

No.	Item	Units	Remarks
1	Remote Terminal Unit	3	
3	Rain Gauge	3	
4	Ultrasonic Water Level Gauge	3	
-1	Ultrasonic Transceiver	3	
-2	Coder	3	
-3	Air Temperature Sensor	3	
-4	SIO/BCD Converter	3	
5	Solar Panel	3	12V/54.5W
6	Solar Panel	2	12V/218W
7	Power Distribution Board	6	
8	Storage Battery	2	12V/150Ah
9	Storage Battery	2	12V/500Ah
10	Storage Battery	1	12V/600Ah
11	Short Distance Data Transmitter	2	
12	Short Distance Data Receiver	2	

1.4.5. Equipment Composition List for Flood Warning Post

No.	Item	Units	Remarks
1	Warning equipment	1	
-1	Tape Recorder	1	
-2	Voice Amplifier	1	100W
-3	Mixer unit with cassette tape player	1	
-4	Monitor unit	1	
3	Loud Speaker	4	with Speaker Junction Box
4	Cable Protector	1	
5	DC Power Supply Unit	1	
6	Storage Battery	1	24V/56Ah
7	Indoor Cabinet	1	
8	VHF Radio Unit	1	10W 150MHz
9	3 element Yagi Antenna	1	
10	Isolation Transformer	1	2KVA,220V
11	Cable mast	21	Panzer mast R216

CHAPTER 2. TENDER SPECIFICATIONS FOR PILOT PROJECT (PHASE-II)

2.1 General Requirement

(1) Scope

The specifications cover equipment and materials supply and installation of the pilot project of Atlas Region Flood Forecasting and Warning System Phase-II. The Pilot Project Phase-I completed on the end of December 2001. This is continuation work of Phase-I project. The phase-II project aims to establish real-time hydrological data collection from all flood watch stations by radio telemetry system through repeater stations. The system is consisting of the telemetry supervisory and control station, rainfall and water-level gauging stations, and flood warning radio network. The supplier shall propose all equipment and materials stipulated in the specifications. The supplier shall also require the supervision of installation works and commissioning for each sub-system as well as total system.

(2) Ambient Conditions

The flood watch stations of the pilot project locate around 1000m to 2500m above sea level in high mountain area. Supplier shall consider such surrounding conditions. The equipment shall be suitable for permanent operation, and all guaranteed technical data shall be maintained for the following ambient conditions.

-1. Out Door Equipment

- Temperature : -15°C to 50°C
- Relative humidity : 90 % or less
- Withstand wind speed : 50m/sec.
- Location : 460m Up to 3200m above sea level

-2. In Door Equipment

- Temperature : 10°C to 40°C
- Relative humidity : 20% to 80% non-condensing
- Location : 460m Up to 3200m above sea level

-3. Data Processing Equipment

- Temperature : 15°C to 35°C
- Relative humidity : 20% to 80% non-condensing
- Location : 460m above sea level

(3) Power Consumption

All equipment shall be of low power consumption, power-saving type. The supplier shall consider capacity of the existing power supply equipment.

(4) Documents and correspondents

The correspondents and all documents such as Instruction manuals, operation manuals and data sheets shall be written by French. However, English could be used for notes of the table and drawings and technical descriptions.

(5) Non Partial Offer

Since the pilot project composed various kinds of equipment, materials and miscellaneous. Therefore, Supplier is strongly requested to collect all equipment and materials stipulated in these specifications and arrange properly to comply with the specifications. Details interface conditions between the equipment shall be described in the proposal. Therefore, Partial offer shall not be accepted.

(6) VHF Radio Frequency Assignment

Frequency band 68-75MHz radio telemetry system for data collection is employed. Specified operation frequencies within that frequency band shall be informed to successful supplier later.

(7) Equipment Construction

A plug-in type printed circuit board shall be employed as much as practicable for easy assembling and disassembling.

Inspections and adjustments shall be able to be performed from the front of each unit. Bay dimensions should be submitted to the Purchaser.

(8) Type Approval of Radio Equipment

The supplier shall supply the type approved radio equipment authorized by ANRT. If supplier will supply non-type approved equipment, application of the type approval of radio equipment shall be carried out prior to the delivery of the equipment. The supplier shall shoulder the type approval fee and other expenses for the process of the application.

(9) Spare parts and supply

The supplier shall deliver the spare parts and consumables for minimum two years operation. Number of spare parts shall be proposed based on supplier's opinion.

(10) Installation Materials

Details installation materials are not stipulated in the specifications. The supplier shall deliver the installation materials even not stipulate in the specifications if it is necessary.

2.2 System Requirement

2.2.1. General

The Pilot Project aims to collect hydrological data from selected observation stations by means of VHF Radio telemetry system for analysis and process the collected data to issue flood warning to inhabitants. The Pilot Project phase-II shall consist of the following four (4) functions:

-1. Data Collection

The data collection sub-system performs to collect the necessary hydrological data of the Ourika river basin, consisting of two (2) rainfall gauging stations at Tourcht and Agouns, and three (3) rainfall and water-level gauging stations at Tazzitount, Tiourdiou and Amenzal. The collected data transmission is made through new VHF radio network via repeater stations to Master Information Center (hereinafter call MIC) ABHT in Marrakech. The flood watch stations have had installed automatic hydrological gauging devices such as tipping bucket rain gauge and ultrasonic water level gauge to be connected to Remote Terminal Unit.

-2. Data Processing

Data processing and information dissemination sub-system has been completed by phase-I. However, data input was made by manual. Automatic real-time hydrological data from hydrological observation stations through telemetry supervisory and control equipment is realized by phase-II. It performs to process to display and store the collected data by utilizing data processing server connected with LAN of ABHT, and to disseminate the flood information to the computer in the related organizations through the public telephone network on WEB bases.

-3. Flood Warning

Flood warning sub-system performs flood warning dissemination to inhabitants of Iraght through the office of the local authority (Ourika Caidat) at Timerkrine. The flood warning post is already operational. In addition, Warning radiotelephone shall install at Al Hauz Provincial Office and Ourika Caidat for reinforcement of the network. When the Governor sends instruction to Ourika Caidat to disseminate flood warning and or evacuation order through VHF radiotelephone, officer of Ourika Caidat shall relay the instruction to the guadian of Iraght warning post through new VHF radiotelephone. The guadian shall broadcast the flood warning and or evacuation order to inhabitants near Iraght warning post by voice or tape recorder. One set of VHF radiotelephone set shall be installed at the provincial office and Ourika Caidat for communication between Iraght warning post.

2.2.2. System Function

The main functions of the pilot project are gathering hydrological data, analysis and processing data, display and printing of processed data and transfer of flood information to concerned organizations. Data collection sub system shall be operated as fully automatic system.

Fig. I.1.2 shows Conceptual System Block Diagram for Pilot Project. Fig.I.2.1 shows VHF Radio Network Diagram.

(1) Data Collection Sub-system

Improvement of data collection shall be made on fully automatic by means of VHF radio telemetry system. The following flood watch stations shall collect hydrological data;

-1. Number of station

(a) Rainfall gauging station

- Tourcht
- Agouns
- (b) Rainfall and water level gauging station
 - Tiourdiou
 - Amenzal
 - Tazzitount

-2. Number of Data

The number of data in the Pilot Project is as follows;

- Rainfall data : 5
- Water-level data : 3

-3. General function of telemetry system

Telemetry supervisory and control station shall collect rainfall and water level data from the flood watch stations.

The flood watch stations shall automatically send back the hydrological data from the hydro-sensors when calling signal from supervisory and control station received.

The system functions are as follows.

(a) Calling method

- Automatic calling mode

Automatic calling mode shall start automatically by the system timer and general calling for all flood watch stations shall be made. Time interval of calling shall be 10, 30 and 60 minutes. Automatic calling mode shall be prior the other calling mode.

- Manual calling mode

Manual calling mode shall start by manual selection of all station calling and or selected station calling. In case all station calling, general calling shall be prior to select station calling and individual station calling shall be followed.

- Re-calling made

In case there is no response and or wrong data received from flood watch station, re-calling shall be made one time only.

Re-calling under the general calling mode shall be started only respective station after finish general calling mode. Re-calling under individual calling shall be re-calling for respective station contentiously.

(b) Event-reporting function

The flood watch stations shall have the event- reporting function to report the occurrence of event automatically to the telemetry supervisory and control station on the following events:

- * Detection of rainfall (1 mm rainfall tip of rain gauge)
- * Detection of preliminary alert water level (by water-level gauge)

Receiving the event-reporting signal from the flood watch station, Telemetry supervisory and control station shall call all the flood watch stations automatically.

(c) Response method

The flood watch station that call from the telemetry supervisory and control station shall be sent back the digital converted data to the supervisory station. The transmitting timing shall be

sent back immediately in case of individual calling and shall wait until their timing to send back in case of automatic calling.

(d) Telemetry Radio Network

Five (5) flood watch stations shall be networked by VHF radio network. Two (2) repeater stations shall be installed to keep stable communication quality.

The radio propagation test results are attached as Table I-3.1 for reference.

(2) Data Processing Sub-System

The telemetry observed data from telemetry supervisory and control equipment should input to existing PC server automatically through the Communication Control Unit.

Daily report, monthly report and annual report shall be printed on the printer by using the data that were stored in the data server equipment.

Daily report will be output at 9 o'clock a.m. automatically every day. Also, designating a date, daily report shall be possible to print by manual operation.

Monthly report and annual report shall be made by manual operation only.

The client PC shall be capable of producing tabulations of daily, monthly and annual data.

Block diagram for Telemetry Supervisory and Control and Data Processing Equipment is attached as Fig. I.1.3. Fig. I.1.4 and I.1.5 shows Block Diagram for Rain fall and water level Gauging Station. Also, Block Diagram for Repeater Stations is attached as Fig. I.2.2 and I.2.3.

(3) Warning sub-system

The radiotelephone unit has been installed at Iragfh warning post and communication between Ourika Caidat and Iragfh warning post is operational using the VHF radio network of province.

New radiotelephone unit shall install at Provincial office and Ourika Caidat instead of existing radiotelephone on Phase-II. The radiotelephone shall be communicated with the provincial office and Ourika Caidat to Iragfh warning post. In case warning instruction is disseminated the calling station shall transmit 5-tone type selective calling signal to identify the Iragfh station before voice communication. When Iragfh station receives the selective calling signal, siren shall be blow to draw attention of guardian of Iragfh. The siren interface unit to connect with radiotelephone shall be supplied.

Block Diagram for Warning Radio Stations is attached as Fig.I.1.6.

2.3 Specifications for Equipment and Materials

2.3.1. Master Information Center

(1) Telemetry supervisory and control equipment

The telemetry supervisory and control equipment shall provide telemetry data acquisition function by sending calling signal to the gauging stations. This equipment is utilized together with the personal computer type-operating console.

Telemetry supervisory and control equipment also has the event calling function. When gauging station detect a tip of rain drop and or reach warning water level, gauging station send signal to telemetry supervision and control station requesting of event call. Telemetry supervisory and control station shall send automatic calling.

- Type of cabinet : Wall hanging cabinet
- Interface with operating console : RS-232C
- Gauging station capacity : Basic 60 datas/30 stations, expandable to 120 datas/60 stations
- Methods of gauge station calling : All station calling: 10min., 30min., or 1 hour
 : Manual calling: Batch call of all stations or individual call of a selected gauge station(s)
 : Re-call: One time or more
 : Event call: 10 min
 : Reset of non-rain: 12 hour or 24 hour
- Repeater station data collection : Automatic collection: same interval of gauging station
 : Manual collection: individual and all station calling
- Repeater station control : Exchange of transmitter No.1, No.2
 : Disconnect of receiver No.1 or No.2
- Data transmission method : Type of transmission: semi-duplex
 : Code method: NRZI equal code
 : Synchronization: non-synchronized
 : Modulation: Frequency modulation
 : Transmission speed: 1200bps
 : Deviation of speed: $\pm 5 \times 10^{-5}$ or less
 : Center frequency (f0): 1700Hz
 : Frequency sift (Δf): $f0 \pm 400\text{Hz}$
 : Direction of frequency sift: mark:(f0- Δf), space:(f0+ Δf)
 : Frequency accuracy: $\pm 10\text{Hz}$ or less
 : Error detection method: 16bits cyclic code method
 : Code structure: Correspond to JISX5203
- Power source : 220VAC, 50Hz

(2) Telemetry Operating PC

The operating PC shall have a control and a data acquisition function of the telemetry supervisory equipment. Collected data shall be output to the CCU (Communication Control Unit) for connection of LAN of the server system. This operating PC shall be of personal computer type, and shall have the following specifications.

The operating PC shall have the following operational functions and condition status indications:

- Operation

- Station selection
- Control item selection
- Control start
- Control reset
- Other necessary operations

- Indication

- Date and time
- Observation data
- Other necessary indications including the repeater station status

- PC specifications

- CPU : Pentium III 450MHz or more
- Memory : 128MB or more
- Second cache memory : 256kB or more
- Hard disk : 8GB or more
- Graphics : Resolution 1,280 x 768 dot or more
- Color : 256 Colors or more
- Display monitor : 17-inch CRT
- Input device : keyboard, mouse
- Serial port : 2 channel (RS-232C)
- OS : Windows NT4.0 Workstation
- Case : Desktop model
 - Power source : 220VAC, 50Hz

(3) Display and control software

The software shall install on the telemetry operating PC to function as telemetry display and operating console. The display and print shall be the French.

- Function

- Time indication (System clock display)
- Operation status (Observation, repeater start, receive error, observation data lacking)
- Observation time interval setting and display (10 min., 30min., and 1 hour)
- Gauging station calling operation (All station call, individual call)
- Observation data display (Rain fall and water level)
- Repeater station calling operation
- Repeater station status display (Power down, Battery voltage, door

open)

- Repeater station control operation (Start, Stop, TX exchange)
- Print

(4) UPS

Back-up for the operating console

- Input voltage : 220VAC $\pm$ 10%, single phase
- Output voltage : 220VAC $\pm$ 2%, single phase
- Power supply duration : 10 minutes
- Capacity of output power : 0.7KVA

(5) DC Power Supply Equipment

Back-up for telemetry supervisory and control equipment

- Input voltage : 220VAC $\pm$ 10%, single phase
- Output voltage : DC13.4V $\pm$ 2%
- Battery capacity : 50AH
- Power supply duration : 60 minutes

(6) VHF Radio Equipment

VHF radio equipment shall accommodate in the cabinet of the telemetry supervisory and control equipment. The specifications of VHF radio equipment are as follows:

-1. General

- Frequency : Specified frequency from 69 -73MHz
- Rating : Repeating of 10-sec. transmission and
3 min. reception
- Receiving : continuous rating
- Operating voltage : 12VDC nominal
- Operating temperature : -10 ~ +50°C
- Current consumption : 4A or less at 10W transmitting

-2. Transmitter and Power Amplifier

- Rated output : 10W
- Frequency stability : less than $\pm 5 \times 10^{-6}$
- Modulation system : Variable-reactance frequency
modulation
- Type of emission : F2D and F3E
- Maximum frequency deviation : ± 5 kHz or less
- Occupied band width : 16 kHz or less
- Antenna impedance : 50 ohms

-3. Receiver

- Receiving system : Double supper-heterodyne system
- Band width : 12 kHz or more at 6dB down
- Spurious response : More than 70dB
- S/N ratio : 30dB or more at 15dB μ input and 1 kHz,

- Receiving sensibility : 70% modulation
: 0dBμ or less
- (7) Antenna system

The antenna equipment for the telemetry supervisory and control equipment shall satisfy the following specifications:

 - 1. 3-element Yagi antenna.
 - Operating frequency : Specified frequency from 68 to 75 MHz
 - Gain : 4.5dBi or more (for broad type)
6 dBi or more (for folded type)
 - Impedance : 50ohms
 - Polarization : Vertical
 - VSWR : 1.5 or less
 - 2. Coaxial Cable
 - Cable type : 10D-2E or equivalent with connectors
 - Length : 30m
 - 3. Coaxial Arrestor
 - Operating frequency : Specified frequency from 68 to 75MHz
 - Insertion loss : 1.0dB or less
 - V.S.W.R. : 1.2 or less
- (8) Data Processing Sub System
 - 1. Communication Control Unit
 - Interface : RS-232C
 - Input Speed : 1200bps ~ 19.2kbps
 - Synchronous method : Asynchronous
 - Communication control : Subject to Telemetry external output
 - Network : 10BASE-T/100BASE-TX
 - Number of data output : Two-TCP/IP Port
 - Power source : AC220V 50Hz
 - 2. Accommodation Rack

The communication control unit shall be accommodated in the rack of Process server equipment.

2.3.2. Flood Watch Station

(1) VHF Radio equipment for Remote Terminal Unit

The existing Remote Terminal Unit collects rainfall and/or water level data and sends to the telemetry supervisory equipment in response to the calling signal through newly equipped radio equipment. The existing Remote Terminal Unit automatically send request for calling to the telemetry supervisory station when detects a tip of raindrop and or reaches alert water level. The interface condition between RTU and VHF radio equipment is as follows;

The specification of the VHF radio equipment is as follows:

-1. General

- Frequency : Specified frequency from 69 -73MHz
- Rating : Repeating of 10-sec. transmission and 3 min. reception
- Receiving : continuous rating
- Operating voltage : 12VDC nominal
- Operating temperature : -10 ~ +50°C
- Current consumption : 4A or less at 10W transmitting
- 2. Transmitter and Power Amplifier
 - Rated output : 10W
 - Frequency stability : less than $\pm 5 \times 10^{-6}$
 - Modulation system : Variable-reactance frequency modulation
 - Type of emission : F2D and F3E
 - Maximum frequency deviation : $\pm 5\text{kHz}$ or less
 - Occupied band width : 16kHz or less
 - Antenna impedance : 50 ohms
- 3. Receiver
 - Receiving system : Double super-heterodyne system
 - Band width : 12kHz or more at 6dB down
 - Spurious response : More than 70dB
 - S/N ratio : 30dB or more at 15dB μ input and 1kHz, 70% modulation
 - Receiving sensibility : 0dB μ or less

(2) Antenna System

The antenna equipment for telemetry gauging station shall satisfy the following specifications:

- 1. Antenna
 - 2-element Yagi antenna (for observation station and Master Information Center)
 - Operating frequency : 68 to 75 MHz
 - Gain : 4.5dBi or more (for broad type)
6 dBi or more (for folded type)
 - Impedance : 50ohms
 - Polarization : Vertical
 - VSWR : 1.5 or less
- 2. Coaxial Arrester
 - Impedance : 50 ohms
 - Insertion loss : 0.5dB or less
 - Standing wave ratio : 1.2 or less at the specified Frequency
- 3. Coaxial Cable
 - 10D-2E or equivalent coaxial cable shall be used for the antenna system. Length of the cable will be 30m for each station.

2.3.3. Repeater Station

The repeating equipment shall be used for a repeater station of a telemetry system. In addition, the antenna filter shall be mounted in the same frame. VHF-VHF repeater station shall be employed

(1) Repeating Equipment

- Relay scheme : Simplex VHF-VHF repeater
- Type of cabinet : Stationary-type enclosed frame
- Operation scheme : Transmitter No.1/No.2 selection and receiver parallel operation
- Input/output conditions : Setting range -30 dBm to 0 dBm
- Input/output impedance : $600\Omega \pm 20\%$ balanced
- Power source : 12VDC nominal

(2) Filter

- Type : Band elimination or band pass filter
- Nominal impedance : 50 ohms
- V.S.W.R. : 1.5 or less
- Insertion loss : 1.0 dB or less
- Attenuation : 40dB or more

(3) VHF Radio Equipment

This radio equipment shall be installed at repeater station to relay radio wave from MIC and flood watch stations

-1. General

- Frequency : Specified frequency from 68 to 75MHz
- Rating : Repeating of 10-sec. transmission and 3 min. reception
- Receiving : continuous rating
- Operating voltage : 12VDC nominal
- Operating temperature : $-10 \sim +50^{\circ}\text{C}$
- Current consumption : 4A or less at 10W transmitting

-2. Transmitter and Power Amplifier

- Rated output : 10W
- Frequency stability : less than $\pm 5 \times 10^{-6}$
- Modulation system : Variable-reactance frequency modulation
- Type of emission : F2D and F3E
- Maximum frequency deviation : $\pm 5\text{kHz}$ or less
- Occupied band width : 16kHz or less
- Antenna impedance : 50 ohms

-3. Receiver

- Receiving system : Double super-heterodyne system
- Band width : 12kHz or more at 6dB down
- Spurious response : More than 70dB

- S/N ratio : 30dB or more at 15dB μ input and 1kHz, 70% modulation
- Receiving sensibility : 0dB μ or less

(4) Antenna System

The antenna equipment shall satisfy the following specifications:

- Sleeve antenna (Non-directional)
 - Operating frequency : Specified frequency from 68 to 75 MHz
 - Gain : 2dBi or more
 - Impedance : 50 ohms
 - Polarization : Vertical
 - VSWR : 1.5 or less
 - Coaxial Arrester
 - Impedance : 50 ohms
 - Insertion loss : 1dB or less
 - Standing wave ratio : 1.2 or less at the specified Frequency
 - Coaxial Cable
 - 10D-2E or equivalent coaxial cable shall be used for the antenna system. Length of the cable will be 30m for each station.

(5) Solar Cell Power Supply

The solar cells power supply shall consist of solar cells, power distribution board and sealed lead-acid battery, and shall be able to receive solar energy and to supply it to the equipment and, at the same time, to store it in the sealed lead-acid battery.

The solar cells shall have the following specification:

-1. Solar cells

- Type : Silicon solar cells
- Type of element : Silicon semiconductor
- Capacity : 109W/12V
- Insulation resistance : 100M ohms or more at 1kV DC
- Withstand voltage : 2,000V AC for 1 minute
- Bird shielding rod : Provided

-2. Battery

- Type of battery : Lead-acid battery
- Nominal voltage : 12VDC / set
- Capacity : 200AH

-3. Power distribution board

The power distribution board shall be of overcharge protection type, and shall include a multi-range DC Voltage-Current meter and a selector switch for the following;

- Operating voltage of solar cells
- Battery voltage
- Output current of solar cells
- Load current

The power distribution board shall be of wall mounting type.

2.3.4. Warning Post Equipment

The below mentioned equipment shall be supplied by the supplier.

(1) Iragfh warning post.

-1. ICOM made 5-tone selective calling unit shall supply and connects with existing ICOM VHF radio transceiver.

-2. Siren unit

- Siren unit with DC12V operation
- Interface with 5-tone unit of VHF radiotelephone

(2) Ourika Caidat warning radio station

-1. VHF radiotelephone

(a) General

- Frequency : Specified frequency from 150MHz band
- Rating : Repeating of 10-sec. transmission and 3 min. reception.
- Receiving : continuous rating
- Operating voltage : 12VDC nominal
- Operating temperature : -10 ~ +50°C
- Current consumption : 7A or less at 25W transmitting
- Sele-call system : 5-tone function
- Number of channel : 16 channel or more

(b) Transmitter

- Rated output : 25W
- Frequency stability : less than $\pm 5 \times 10^{-6}$
- Modulation system : Variable-reactance frequency modulation
- Type of emission : F2D and F3E
- Maximum frequency deviation : ± 5 kHz or less
- Occupied band width : 16kHz or less
- Antenna impedance : 50 ohms

(c) Receiver

- Receiving system : Double supper-heterodyne system
- Band width : 12kHz or more at 6dB down
- Spurious response : More than 70dB
- S/N ratio : 30dB or more at 15dB μ input and 1kHz, 70% modulation
- Receiving sensibility : 0dB μ or less

-2. Siren unit

- Siren unit with DC12V operation
- Interface with 5-tone unit of VHF radiotelephone

-3. Antenna system

(a) 3-element Yagi Antenna

- Operating frequency : Specified frequency 150MHz band
- Gain : 8dBi or more
- Impedance : 50 ohms
- Polarization : Vertical
- VSWR : 1.5 or less

(b) Coaxial cable

10D-2V or equivalent 30m with connectors

(c) Coaxial arrester

- Impedance : 75 ohms
- Insertion loss : 1dB or less
- Standing wave ratio : 1.2 or less at the specified Frequency

(d) Power supply unit

- Battery
 - Type : Lead Acid battery
 - Rating voltage : DC12V nominal
 - Capacity : 100AH
- Battery charger
 - Input voltage : AC 220V single phase
 - Output : DC12V, 10A

(3) Provincial office warning radio station

-1. VHF radiotelephone

(a) General

- Frequency : Specified frequency from 150MHz band
- Rating : Repeating of 10-sec. transmission and 3 min. reception.
- Receiving : continuous rating
- Operating voltage : 12VDC nominal
- Operating temperature : -10 ~ +50°C
- Current consumption : 7A or less at 25W transmitting
- Sele-call system : 5-tone function
- Number of channel : 16 channel or more

(b) Transmitter

- Rated output : 25W
- Frequency stability : less than $\pm 5 \times 10^{-6}$
- Modulation system : Variable-reactance frequency modulation
- Type of emission : F2D and F3E
- Maximum frequency deviation : ± 5 kHz or less

- Occupied band width : 16kHz or less
- Antenna impedance : 50 ohms
- (c) Receiver
 - Receiving system : Double supper-heterodyne system
 - Band width : 12kHz or more at 6dB down
 - Spurious response : More than 70dB
 - S/N ratio : 30dB or more at 15dB μ input and 1kHz, 70% modulation
 - Receiving sensibility : 0dB μ or less

-2. Siren unit

- Siren unit with DC12V operation
- Interface with 5-tone unit of VHF radiotelephone

-3. Antenna system

(a) 3-element Yagi Antenna

- Operating frequency : Specified frequency 150MHz band
- Gain : 8dBi or more
- Impedance : 50 ohms
- Polarization : Vertical
- VSWR : 1.5 or less

(b) Coaxial cable

10D-2C or equivalent 30m with connectors

(c) Coaxial arrester

- Impedance : 75 ohms
- Insertion loss : 1dB or less
- Standing wave ratio : 1.2 or less at the specified Frequency

(d) AC Power supply unit

- Input voltage : AC 220V single phase
- Output : DC12V, 10A

2.3.5. Antenna Mast

Phase-II system requires 12 peaces of antenna masts.

Supplier shall supply Total 5 sets of new Panzer masts, i.e. 3 sets of R26, one set of R212 and one set of R218. Total 6 sets of R26 panzer mast shall five the supplier at site. VHF antenna shall install on the existing antenna mast at the provincial office. Details information for antenna mast is given below.

Station	Type	Model	Height from ground	Quantity	Remarks
ABHT MIC	Panzer Mast	R212	15m	1	New supply
Tazzitount	Panzer Mast	R26	7.4m	1	New supply
Tourcht	Panzer Mast	R26	7.4m	1	New supply

Amenzal	Panzer Mast	R26	7.4m	1	New supply
Tiourdiou	Panzer Mast	R26	7.4m	1	Site supply
Agouns	Panzer Mast	R26	7.4m	1	Site supply
Aloulouss Repeater	Panzer Mast	R26	7.4m	2	Site supply
Adrar Tazaina Repeater	Panzer Mast	R26	7.4m	2	Site supply
Ourika Caidat	Panzer Mast	R218	18m	1	New supply
Provincial Office	Triangular	Local made	10m on roof	1	Existing tower

2.3.6. Installation Materials

Support hardware for ultrasonic water level gauge sensor.

The sensor unit of water level gauge shall install right overhead of main river current which shall be spread out 5m – 7m from river bank. The supplier shall propose design of the support hardware for the engineer's approval.

- Antenna mast
- Coaxial Cable
- Coaxial Connector
- Power Supply Cable
- Grounding Materials
- Signaling Cable
- Connecting Materials
- Miscellaneous

The supplier shall arrange necessary installation materials even not described herein.

2.3.7. Station Housing and grounding system

The following station housing will build by the other contractor for the purpose of accommodation of the repeater equipment. The supplier shall install the grounding system for lightning arrester and the equipment.

Name of station	Equipment housing	Grounding system
Aoulouss	3 x 3 x 2 m	About 200m radial grounding with grounding resistance decrease materials
Adrar Tazalna	3 x 3 x 2 m	About 400m radial grounding with grounding resistance decrease materials

Since repeater station site is composed by rock, It is impossible to obtain low earth resistance by normal installation. Therefore, the grounding resistance decrease materials shall be used. Target earth resistance at all stations is 15Ω or less.

2.4 Equipment Composition List

(1) Equipment Composition List for MIC, Marrakech

No.	Item	Unit	Specifications
1	Telemetry supervisory and control equipment	1	
2	DC power supply for above	1	
3	Telemetry operation PC	1	
4	UPS for above	1	
5	Radio Equipment	1	70MHz band, 10W
6	Communication control unit	1	
7	Telemetry control and display software	1	
8	Antenna	1	3-element Yagi, Broad band type
9	Coaxial Arrester	1	
10	Coaxial cable with Connectors	1	
11	Panzer mast	1	
12	Installation materials	1	

(2) Equipment Composition List for Agouns and Tourncht Rainfall Gauging Station

No.	Item	Unit	Specifications
1	Radio Equipment	2	70MHz band, 10W
	Radio telemetry software	2	
2	Antenna	2	2-Element Yagi, Broad band
3	Coaxial Arrester	2	
4	Coaxial Cable with Connector	2	
5	Grounding materials		
6	Installation materials		

(3) Equipment Composition List for Tazzitount, Tiourdiou and Amenzal Rainfall and Water level Gauging Station

No.	Item	Unit	Specifications
1	Radio Equipment	3	70MHz band, 20W
2	Radio telemetry software	3	
3	Antenna	3	2-Element Yagi, Broad band
4	Coaxial Arrester	3	
5	Coaxial Cable with Connector	3	10D-2E 30m
6	Grounding materials	3	
7	Installation materials	3	

(4) Equipment Composition List for Aoulouss and Adrar Tazaina Repeater Station

No.	Item	Unit	Specifications
1	Repeater Equipment (V-V repeater)	2	
2	Radio Equipment	4	70MHz band, 10W
3	Antenna	4	Sleeve type 70MHz band
4	Transmitter/Receiver filter	2	
5	Coaxial Arrester	4	
6	Coaxial Cable with Connector	4	10D-2E
7	Solar Panel	2	12V/109W
8	Power distribution board	2	
9	Storage Battery	2	12V/200Ah
10	Lightning rod	2	
12	Grounding materials	2	
13	Installation materials	2	

(5) Equipment Composition List for Iragh Flood Warning Post

No.	Item	Unit	Specifications
2	Selective calling unit	1	5-tone type ICOM
3	Siren system	1	
4	Installation materials	1	

(6) Equipment Composition List for Al Hauz Provincial Office Warning Radio Station

No.	Item	Unit	Specifications
1	VHF radiotelephone with 5-tone unit	1	150MHz band 25W ICOM
2	Siren system	1	
3	AC power supply unit	1	AC220V in DC12V out
4	Antenna	1	3-element Yagi antenna
5	Coaxial arrester	1	
6	Coaxial cable	1	10D-2E 50m with connectors
7	Installation materials	1	

(7) Equipment Composition List for Ourika Caidat Warning Radio Station

No.	Item	Unit	Specifications
1	VHF radiotelephone with 5-tone unit	1	150MHz band 25W ICOM
2	Siren system	1	
3	AC power supply unit	1	AC220V in DC12V out
4	Antenna	1	3-element Yagi antenna
5	Coaxial arrester	1	
6	Coaxial cable	1	10D-2E 40m with connectors
7	Installation materials	1	
8	Antenna mast	1	Panzer R218, 18m high

(8) Spare Parts

No.	Item	Unit	Specifications
1	Telemetry Radio unit	2	1 for each frequency band
2	Telemetry supervisory and control equipment	1	1 unit for all kinds
3	Repeater Equipment	1	1 unit for all kinds
4	Solar panel	1	For 300W
5	3-element Yagi Antenna	1	For warning radio 150MHz band
6	LAN cable	1	

(9) Test Instruments

No.	Item	Unit	Specifications
1	Power meter	1	50~500MHz, 0~30W, 50Ω
2	Level meter	1	200H~10KHz, -60dBm~+20dBm
3	Telemetry Checker	1	
4	Analog Tester	1	
5	Digital Tester	1	
6	Maintenance tool	1	