Specifications

# General

*[Write a paragraph about the state, Area and existing Monitoring System, climatic conditions etc.]*

The State Ground & Surface Water Resources Data Centre of Government of Tamilnadu in India is implementing the World Bank aided Hydrology Project-II. The project intends to develop a comprehensive Real-time hydro-meteo data Collection System in Tamilnadu. The data acquisition system so developed would enable hydro meteorological data/ information and subsequent analysis for project planning, water resources monitoring and operational water management system.

 **Tamilnadu State at a Glance**

|  |  |
| --- | --- |
| Parameters  | Value |
| Geographical Area | 1,30,000 Km2 |
| Annual Average Rainfall | 953mm |
| Temperature | 15 to 450 C |
| Humidity | 17 to 100 % |
| Extreme conditions in state | Drought, cyclones |
| General river flow | 1 – 2 months a year |

## Present Status and Need for RTDAS

*[Write about present status, weather the agency have manual of automatic system, what needs to be upgraded and what new stations are required, describe about existing telemetry, existing servers etc.]*

A Hydrological Information System network has been developed during HP-I covering 611 Standard Rain gauges, 56 Autographic Rain gauges, 45 Full Climatic Stations, 812 Piezometers and 112 Gauging stations. Existing data collection system is manual and transmitted from other various field data centers at a monthly frequency. At the State Data Centrer, the data is organized with the help of computerized software (MS access based), Surface Water Data Entry System (SWDES). The state proposes to install hydro-meteorological information system with telemetry in all the river basins in order to acquire reliable data on real-time basis.

The state plans to establish integrated monitoring system at river gauging sites including rainfall, surface water level in the rivers and groundwater levels next to gauging stations (Refer Annexure 1, Figure 1 and 2). Majority of the sites proposed are upstream of weir structures constructed across the rivers that would allow measurement of discharge at more confidence once the discharge coefficients are developed for these structures. In order to understand interaction between surface and groundwater, the piezometers have also been installed next to river gauging sites at 25 locations where integrated surface and groundwater measurements are proposed.

## Objectives

The objective of proposed task is to engage an agency to

* Supply, install, and commission the real time hydro- meteorological data acquisition system (RTDAS) with GSM/GPRS telemetry.
* Supply and Operation of ADCP for Discharge Measurement
* Provide web-based server for data collection and data dissemination
* Integrate RTDAS server with existing telemetric (GSM/GPRS based) database.
* Operate and maintain the RTDAS system for a period of five years.
* Train the Water Resources Department personnel to operate and maintain the system.

The RTDAS is proposed to have following monitoring systems:

* Automated Raingauges (ARG, Tipping Bucket Type) - 49 Nos.
* Automatic Water Level Recorder on Rivers (Shaft Encoder Type – xx, Radar – yy, Bubbler – zz, Ultrasonic – aa ) -25 Nos.
* Automated River Water Level Recorder on Canals / Dams (Shaft Encoder Type – xx, Radar – yy, Bubbler – zz, Ultrasonic – aa) – 49 Nos.
* Automated Weather Station with Rain Gauges (AWS) - 1 No.
* Web-based server for data collection and dissemination – 1 set.

## Scope of Work

The Bidder shall be required to provide all of the following services for implementation of real time data acquisition system for the River basins in the Tamilnadu State of India.

* Supply, Installation, Testing, Training, Commissioning of the real time hydro- meteorological data collection network and establish data communications using GSM/GPRS between the remote stations and the data center.
* Provide web-based server for data collection and dissemination The Bidder should arrange for its own or a reputable third party web/database services to receive, process, store, backup and disseminate tabular, graphical and GIS map data on the web during the installation and commissioning stage itself.

*[This option is based on Data Services from Bidder, should be modified if Agency want to have own software and Servers]*

* Develop water level discharge relationship based on discharge measurement with discharge measurement device such as ADCP or current meter.
* Integrate with existing telemetric data from 56 ARG and 6 AWS.
* Supply a detailed operation and maintenance manual for each appropriate unit of supplied Goods.
* Provide formal and on the job training. This includes operation and maintenance procedures to be carried out at the field stations.
* Provision for operation and Warranty services for 2 (two) years after the final Acceptance Test and Annual Maintenance Services of 3 years after the completion of Warranty period;
* A guarantee by the manufacturer that all equipment being provided will have maintenance support for a minimum of eight years after the commissioning of the equipment;

## General Technical Concept

The concept of implementation on which the present technical specifications and special conditions are based intends to acquire the state of art technology available for setting up automated data collection network. Emphasis is provided on a robust and reliable technology. The data acquisition system will comprise of two segments, the data acquisition segment and the data communication segment. Data Acquisition Segment and Data Communication Segment co-operate automatically in an integrated manner to complete the cyclic function of data collection. The data acquisition segment comprises of sensor, data acquisition controller/ data logger and an integrated power controller. The data communication segment comprises of the data communication equipment at site, all intermediate components and the network controller / web server at data processing center. It is preferred that the rechargeable battery used at site gets uninterruptedly recharged by a solar panel attached to the system. Under the project, data transmission has been proposed using GSM /GPRS technology. Accordingly, the sites have been chosen verifying the coverage of telecom network. This methodology has been chosen keeping in view its advantages over the other systems in respect of investment, maintenance and reliability. The bidder shall ensure that the system remains operational even under extreme conditions of weather. The failure of transmission due to temporary disturbances in the network must be taken care of by providing adequate storage in the data logger and ensuring subsequent relay immediately after the network is restored. Two way communication facility and event notification through SMS is highly desirable in the system to be provided by the Bidder. Uninterrupted data recording must be guaranteed for long periods during which regular maintenance visits may not be possible.

## Bidder’s Responsibilities

The real time data acquisition system for the River basins in Tamilnadu described here is considered as a whole and will always include all materials and services required to ensure smooth and sustainable operation, even though they may not be expressly described in the various sections of this document. The Bidder is responsible for offering all works and supplying all accessories to ensure that all network components are complete and ready for operation.

The bidder’s Services will include the following among other elements:

1. Design, configuration, integration and programming of each type of measurement station according to the technical specifications given below.
2. Provision of detailed instructions and standard design drawings like footprints of the equipment required for installation. The main civil works like the Gaugewell and fencing shall be provided by the Purchaser. The Bidder shall carry out the ‘last mile connection civil works’ required for installation.
3. Delivery of spare parts to be ordered by the Purchaser based on a complete list of recommended spare parts to be provided by the Bidder.
4. Testing of all the elements of the real time data acquisition system /network prior to shipping.
5. Supply & Installation of all stations of each type of measuring station, including on-the-job training.
6. Supply and installation of GSM/GPRS communication devices.
7. Commissioning of the entire system/network after installation.
8. Design and implementation of a training programme that is sufficient for installation, configuration, operation and maintenance of all system components. Provide classroom and field trainings to the staff of Water Resources Department (WRD) of Government of Tamilnadu on the data acquisition system. This includes operation and maintenance procedures. Training will also be conducted at the field locations selected by the Purchaser.
9. Supply, installation and configuration of the software required for the configuration and operation of each network component, including hydro-meteorological sensors and data loggers. Training WRD staff on basic statistical, graphical and reporting capabilities for data conversion and data aggregation (e.g. hourly to daily data) should be included.
10. Supply and design web-based server for data collection and dissemination. Provide software to be used in the Data Center at Chennai. The software shall store data collected by the GSM/GPRS receiving stations. A non-proprietary software solution such as Post GreSQL or proprietary software like Oracle, whichever is ideal for maintaining a robust RDBMS is recommended to ensure continuous operation of the system. The software system will include data quality control that shall allow for the flagging and/or removal of data using threshold analysis. Easy to use interface allowing sensor by sensor quality control for threshold and rate of change data screening is required. The software will include the features as specified in Technical Specification Section.
11. All the devices including PDAs and computer shall be provided with anti-virus protection software by the Bidder, during the Contract Period
12. Delivery of full documentation related to all components of the network, including operation and maintenance manuals in English, system integration diagrams and wiring diagrams.
13. Provide country of origin for all major equipment/ materials.
14. Establishment of a service agent in Tamilnadu, India.
15. A guarantee by the manufacturer that all equipments being provided will be supported for a minimum of ten years after the commissioning of the real time data acquisition system.
16. Supply detailed operation and maintenance manual for each component in the system.
17. Providing right and workable telemetry solution that operates in remote low power areas using solar powered technology as per choice of technology and specification given in the Technical specification.
18. Cost of communication to be clearly identified in bid proposal, and bidder shell be responsible for all operational costs like network charges for the Guarantee period and Operation and Maintenance period.
19. Provision for Warranty for two (2) years after Final Acceptance and Annual Maintenance Services for three (3) years after the Warranty period of Real Time Data Acquisition System (RTDAS) and back-up acquisition system with SMS/manual entry including all components at the remote stations as well as all newly acquired equipments in the Data Center.
20. For procured software, all licenses and maintenance agreements should be in the name of Purchaser and should seek full support and updates for such software for the duration of the warranty period of 2 years and Annual Maintenance Services Period of 3years.
21. Integrate the data collection from the existing 56 Telemetric Automated Raingauges (Tipping Bucket Type) and 6 Telemetric Automated Weather Station with the Real Time Data Acquisition System (RTDAS) provided by the Supplier.
22. Provision for expansion of RTDAS, in both hardware (datalogger) and software (such as server)
23. The Real Time Data Acquisition System (RTDAS) software should have the facility to track the non-functional sensors on daily basis and display on the web. It should also display the charges recoverable from the Supplier on monthly basis for the non-functional sensors and data lost in sensor-days at the rates specified in Section-IV SCC Clause 10 (iii).

The Bidder will be responsible for the site installation of all the equipment including the required ‘last mile connection civil works’. Bidder is responsible for providing sufficient and correct documentation on the civil works and installation, including site-specific features such as lightning protection and power supply for purposes of supervision by the Purchaser.

## Purchaser’s Responsibilities

The Purchaser will be responsible for

* Land ownership issues.
* Obtaining government approvals as required.
* Assist in import / customs clearance.
* Direct the bidder in transportation of equipment to the installation sites.
* The Purchaser’s own costs for witnessing tests.
* Costs of travel, transportation and per diem for training of Purchaser’s staff.

## Delivery and Completion Schedules

The delivery and installation schedules are described in Schedule of Requirements. The maximum time period from the date of effectiveness of Contract to Final Acceptance is four (4) months followed by a Warranty period of two (2) years and Annual Maintenance Services Period of three (3) years. The bidder must comply with the milestones indicated in the delivery schedule and schedule for installation and commissioning.

# Bid Related Requirements

## General

All Goods materials to be incorporated in the supply be new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the contract.

Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the goods and materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national or relate to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable.

## Plans and Schedules to be provided

A project execution plan shall be provided after award of Contract, including system design block diagrams, a list of critical engineering activities, a manufacturing and delivery schedule, the proposed training programme, as well as guidelines and standard drawings for civil works.

## Spare Parts

A list of recommended high-usage spare parts for a period of five (5) years of operation must be submitted by the manufacturer along with cost of these spare parts. High-value spare parts, such as entire components, shall not be included in this list. The Bidder shall indicate a number of spare stations to be supplied which are not intended for immediate installation. These spare stations will be available for short-term replacement of damaged or malfunctioning stations, while arrangements are made for repair, warranty or purchasing spare parts.

In addition, the Bidder must submit a complete listing of spare parts for each equipment component (sensors, data loggers, power supply, etc.) with a price list to remain valid for Five (5) years from the date of Final Acceptance. Cost of these spares shall not be included in Contract Price as well as in the Bid Price for evaluation. Spares shall be ordered separately for supply as needed.

***[This section must be edited if Bidder is supposed to maintain the spare parts with own inventory, and the cost of all replacements are included in O&M price.]***

## Shipping and delivery

The Bidder shall be responsible, at his costs, for loading, transporting, shipping and unloading of the equipment to be supplied under the contract from the point of manufacture to the final destination of delivery. The transportation of equipment to field locations for installation after receiving inspection shall also be the responsibility of the Bidder as part of installation requirement.

The Bidder shall provide such packing of the equipment as is required to prevent its damage or deterioration during transit to its final destination.

## Field Visits

For installation and subsequently for maintenance of the stations, the Bidder must have team of technical staff to meet the requirement and equipped for field visit. As back up, the system must be designed in such a way and the training component must be strong enough that equipment installation at remote stations can also be done by the Purchaser’s national staff, if required. Appropriate training courses shall be conducted by the contractor’s experts. All systems must be preassembled and an end-to-end test must be passed prior to installation.

## Civil Works

### Civil Works by Purchaser

The Bidder shall provide the detailed instructions and standard design drawings like footprints of the equipment required for installation. The main civil works like the Gauge well and fencing shall be provided by the Purchaser.

***[This section should be edited if the civil works are to be included in the main contract]***

### Civil Works by Bidder

The civil works related to installation of equipment like erection of concrete block for Bubbler Nozzle, erection of pole for Data Collection Platform, erection of gauge hut for housing the equipment, mounting of the equipment etc are responsibility of the bidder. The Bidder shall carry out the ‘last mile connection civil works’ required for installation.

## Geographical and Ambient Specifications

All materials and equipment supplied under these specifications shall be suitable for being delivered, stored and operated under continental conditions with extreme changes of temperature between winter and summer and between day and night. It is the bidder’s responsibility that the offered equipment / configuration be appropriate for the following locations and climatic conditions:

|  |  |
| --- | --- |
| Latitude | 100 00′to 130 00′North |
| Longitude | 770 00′ and 790 00′East |
| Elevation | 0 to 300 m at plains & 300-1600 m at hills. |
| Temperature range | 5° to +55° C (air temperature) |
| Relative humidity range | 10 to 100% |

## Units

Measurement units of all the equipment / systems to be procured shall be metric.

## Accessories and Tools

All accessories, tools and fixtures required for installation and dismounting/ remounting of the equipment shall be treated as a part of the supply for each type of equipment. Devices and instruments required for sensor re-calibration shall be offered separately.

## Documentation

The bidder must submit full documentation, including user’s manuals and guidelines for operation and maintenance in English, for all equipment and software components supplied. In addition a project-specific system operation manual has to be prepared, including

* Specific equipment layout;
* A procedural handbook;
* System block diagrams (logical connections);
* Wiring diagrams;
* Interface specifications, including communication protocols and configuration modes; and
* Software licenses.

The documents will also be transformed in to web-based helpline. The manual shall be provided both as hardcopy (10 copies) and on CD-ROM.

# Training Component

## Training Program

The Bidder is required to provide an extensive training programme for the system. The training set forth in the following paragraphs is a minimum requirement and the bidder should propose any additional training that he considers critical for long term success of the system operations.

The Bidder is expected to provide an outline or table indicating the contents of each of the required courses. The table shall describe the specific topics to be covered for each day of the training period.

The Bidder is responsible for the salaries of the training instructors and all training materials. The costs of travel, transportation and per diem for the trainees shall be borne by the Purchaser.

## Training in General Operation

Training shall be provided by the bidder in several phases. The training shall include both classroom and field trainings and will be continued during all five years. The bidder is required to have hydro-meteorological equipment specialists. The training shall include:

|  |  |  |  |
| --- | --- | --- | --- |
| S. No. | Description | Numbers of training sessions/Year | Number of Participants per session |
| 1 | User Training Course for senior management. | 2 | 20 |
| 2 | User Training Course for working staff. | 2 | 20 |
| 3 | Operation and Maintenance course (two weeks). Course topics will include sensor calibration, data logger configuration, data downloading, data retrieval, collection, compilation, processing, maintenance requirements, and procedures for equipment configuration, installation, site testing and commissioning. | 3 | 20 |
| 4 | Design, operation and maintenance of the database at Central Data Centre at Chennai including back-up, recovery and web-services. | 2 | 5 |
| 5 | Specialized Training for Maintenance Technicians on O&M  | 2 | 20 |
| 6 | Theory and practice of discharge measurements, and development of rating curves. | 2 | 20 |

The training course will take place at *Chennai, Madurai or Trichy as decided by the Purchaser*. In case of formal training, the Purchaser will provide classroom and other logistics. The Bidder will facilitate the professional and the training materiel. On-the-job training will be provided by the Bidder in conjunction with the installation of hydro-meteorological stations and during the course of maintenance as required.

The Bidder shall prepare a training course plan and include the same in the Bid Document. These trainings will be repeated every year during warranty and annual maintenance periods for refreshing the trained staff and training additional staff.

The classroom training, hands on experience and troubleshooting will be prepared as video for easy access and will be posted on the web. All training modules will be also provided as a media file (Windows Media Player Compatible) on a USB Drive. Five copies on five separate media shall be required.

# Installation Requirements

## Data Collection Platform

The station should be installed so that sensitive equipment such as the data logger, batteries, telemetry radios, and antennas are located well above expected high water to ensure that sensitive instruments are not submerged.

At stations using the satellites for data telemetry, the antenna should be installed and oriented towards the appropriate satellite with considerations made to avoid obstructions in the line-of-site between the antenna and the satellite.

### Lightning Protection

Each station shall employ a grounding system that will protect the electronic equipment from electrical surge caused by lightening. The system will consist of a single point grounding system which will tie all grounding wires to a copper grounding plate. The plate will then be connected with a copper grounding strap to a grounding rod. Antenna cables will utilize polyphasers to protect the data collection platform and radios from lightning damage. The Bidder will provide all parts for this installation and properly install the Single Point Grounding System at each station.

### Enclosure and Wiring Specifications

Enclosures are required inside the gauge houses. The enclosure will be used to hold the DCP, transmitter, battery and solar regulator. Gauge houses will be used at all AWLS sites. In the case of AWS and ARG, the installation will consist of a tamper proof enclosure that will be installed outdoors. All enclosures must come equipped with a keyed lock where no other tool can be used to open the enclosure other than using the correct key. The enclosure must be sealed and secured in a NEMA type 4 enclosures as to prevent water and insects from entering the enclosure. Wires leading in and out of the enclosure must be properly secured and protected from sharp edges. Electrical or any other kind of tape to protect wires leading in and out of the enclosure will not be acceptable.

Instruments should be secured in an orderly fashion inside of the instrument shelter and all wiring and cables should be well organized and clearly labelled and secured (see figure below).



### Power Supply and Charging

The power supply and management system will be supplied with each system and will utilize solar panels charge batteries and uses a charge regulator in order to maintain charge of the battery and extend the life of the battery by not overcharging it.

Solar panels should be oriented to maximize daily sunlight absorption. Due to the variations in sun angle between winter and summer months, the panel should be installed so that it receives sufficient solar radiation to charge the system batteries during the winter months.

The power supply system must meet the requirements mentioned in the table below.

**Power Supply & Management Specifications**

| **Power Supply & Management** |
| --- |
| **No.** | **Item** | **Technical Specification** |
| 1 | Charging System | * 12 V Solar Panel(s) sufficient to keep the battery system charged to full capacity during a consecutive cloudy days
 |
| 2 | Accessories | * Charge regulator properly sized for the selected solar panel and battery
 |
| 3 | Battery | * 12 V DC Battery
* Sized to provide autonomy for 21 days of operation
 |

### Measurement and Storage of Data

The DCPs will allow programmable measurement times and data collection intervals in addition to producing transmissions. The measured data will be stored on the DCP, and utilize data storage that will drop off the oldest data as new data is stored, though the DCP is required to store a minimum of 12 months of data before any data drops off. The table below provides a guideline to how often data should be measured and logged. *[This measurement and transmission interval would also depend on type of telemetry method use, so might need to be modified accordingly.]*

|  |
| --- |
| **Measurement and Logging Interval** |
| **Sensor** | **Units** | **Logging Interval** | **Transmit Interval** |
| **Automatic Weather and Water Level Station (AWS with Water Level)** |
| Temperature | C | 15 minutes | Hourly |
| Humidity | % | 15 minutes | Hourly |
| Wind Speed | ms-1 | 15 Minutes | Hourly |
| Wind Direction | Deg True | 15 minutes | Hourly |
| Accumulated Rainfall | mm | Each tip event | Each Tip Event or multiple of tip events as programmed by user and Hourly |
| Water Level | m | 1 minute measurements, logged every 15 minutes | Based on user selectable threshold and/or rate of change of the 1 minute measurements and hourly |
| Battery Voltage | V | 1 hour | Hourly |
| Solar Charging Volts | V | 1 hour | Hourly |

### Fencing

If the location of the gauging station isn’t in a secured location, measures should be taken to prevent unauthorized access. This might include fencing with barbed-wire, locks on instrument shelters with protective covers, or camouflaging the installation. The picture below shows one of fencing to protect equipment.



## Automatic Rain Gauge

### Specifications for Installation

ARG stations will require a hardened enclosure on a structure (pipes, mast, and tower) to make the enclosure stable. The enclosure will be mounted 1.5 m above the ground. The rain gauge will be placed away from objects such that the rain gauge orifice is no closer than the 2 times the difference in height (top of the rain gauge to the top of the nearby objects) to other objects.

### Specifications for Civil Works

#### ARG Enclosure

Area of the ARG enclosure should be ideally 7 m x 5 m. If a rare condition demands then even lesser area (5 m x 4 m) can be demarcated in consultation with officials at respective Regional office. The approach to the site should be made free of obstacles like bushes; trees etc and a suitable cement path must be laid to approach the platform.

#### Fencing for the ARG site

* The height of the fencing for the ARG site enclosure must be 2 meters from the ground level.
* The fencing must be made over a cement enclosure which is nine inches above ground level.
* Fencing angle should be of size 50mm x 50mm x 6mm and pre coated with red-oxide.
* The total length of the fencing angle should be 2.8 meters i.e. (2.0m above ground level + 0.8 m below ground level)
* Two MS angles must be used diagonally at each of the four corner angles of the site. The angles can be attached (with welding or the other appropriate means) from the middle of the existing corner angle to the ground. The depth of the support will remain the same as of main angle.
* The dimensions of the fencing angle foundation should be 1.0 ft x 1.0 ft (length X width) and at a depth of 3 feet. The foundation should be square shaped. Distance between each fencing angle should be 1 meter.

#### Chainlink

* Dimensions of GI Chainlink : 3 inches x 3 inches and of Gauge :10 ( 3 mm diameter).
* GI chainlink mesh must be stretched and welded/fixed properly on the fencing angles.
* A pipe or angle must be fixed on the upper part of the fencing to have a neat finishing and at the same time to avoid loosening of the fencing over a period of time.
* The chainlink fencing should be fastened with the help of screws fitted on the fencing angles. Alternately it may be welded neatly at four equidistant positions of 0.5 mt each.

#### Gate

* Dimensions: 2 m X 1 m x 6 mm (Length x Width) with locking facility
* The gate must be fabricated by MS Angle whose dimensions should be minimum 40mm x 40mm x 6mm
* Suitable locking facility with 3 keys for safety purposes is mandatory. Standard locks should be used.
* Gate and MS Angle must be well painted with white / silver colour.
* Gate should have proper support of MS angles with additional support of crossed MS angles. Alternately gate should be fixed with the support of RCC pillars.

#### Tower

* Foundation Dimensions: 3 ft x 3 ft (length x width) and 5 ft deep. The raised platform of the foundation must be 2.0 ft. above the ground level.
* The height of the tower should be 2.5 metres above raised platform.

#### Rain Gauge foundation

* Rain gauge foundation must be of dimensions 1ft x 1 ft (length x width) and 3 ft deep.
* The rain gauge may be located so that it is at a minimum distance of 2 metres away from obstructions on all four sides.
* The raised platform should be six inches above the ground level.
* The base plate of rain gauge should be 1 ft. above ground level.
* In the case of flood prone areas the base plate on which the rain gauge is mounted should be placed 1.0 metre above ground level. The location must be decided after discussion with Field Officer.

#### Proportions for concrete foundations

* Concrete pillar foundations for the ARG tower, fencing angle should be made in the volumetric mixing proportions as follows:
* Concrete foundation : 1 (Cement) : 2 (Sand) : 4 (Metal)
* Fine plastering : 4(Cement) : 1 (Sand)
* Concrete Pillar must be cemented to achieve smooth finish above the ground level.
* After 8 hours, these foundations should be cured with water at least 3 times a day for four days.

#### Local Earthing

* Material required: Salt: 20 Kg; Charcoal: 20 Kg; Sand 100 Kg
* The lightning arrestor rod is made of copper which is mounted on the top most part of the ARG tower.
* It should be of thickness 12 mm and of one meter length with a connected copper wire of dimensions 3.5 Meter length and 6mm thickness (gauge). At the other end of copper wire is the Earthing rod of dimensions 15mm thickness and 1.8 meter length, which is buried into the ground.
* On the bottom of Earthing rod, one copper plate of dimensions 1’ x 1’ should be connected. ARG datalogger enclosure should also be grounded with local earthing.
* A pit of 4-5 feet depth, 2’ X 2’ wide at bottom (like a cone shaped pit) has to be dug.
* After leveling the bottom of the pit, uniform layer in the sequence of 6 inches of Salt + 6 inches Charcoal + 6 inches Sand is filled. Such sequence is repeated 3 times till the earth pit is filled to the top. The copper earthing rod is placed in the center of the pit. The pit is closed and leveled.

#### Painting

* The tower, fencing angles, chain-link fencing and gate should be properly painted to avoid rusting.
* All concrete foundations shall be painted using white cement.

## Automatic Weather Station

### Specifications for Installation

AWS stations will be placed in open fields and away from any obstructions which may disturb the measurements. WMO guidelines will be followed during the installation and precise site selection. The AWS stations will require a 3 m tower. The hardened enclosure will be attached to the tower at 1.5 m about the ground. Then temperature/relative humidity will be mounted at 2 m above the ground and sufficiently away from any objects that may produce long wave radiation. The wind speed/direction sensor will be place that the top of the 3 m tower. The rain gauge will be placed away from the tower, at least 3 m from the tower, and no closer than the 2 times the difference in height (top of the rain gauge to the top of the nearby objects) to other objects. At the combined AWS-AWLS sites a gauge house will be used to store the DCP.

### Specifications for Civil Works

#### AWS Enclosure

Area of the AWS enclosure should be ideally 7 m x 5 m. If a rare condition demands then even lesser area (5 m x 4 m) can be demarcated in consultation with officials at respective Regional office. The approach to the site should be made free of obstacles like bushes; trees etc and a suitable cement path must be laid to approach the platform.

#### Fencing for the ARG site

* The height of the fencing for the ARG site enclosure must be 2 meters from the ground level.
* The fencing must be made over a cement enclosure which is nine inches above ground level.
* Fencing angle should be of size 50mm x 50mm x 6mm and pre coated with red-oxide.
* The total length of the fencing angle should be 2.8 meters i.e. (2.0m above ground level + 0.8 m below ground level)
* Two MS angles must be used diagonally at each of the four corner angles of the site. The angles can be attached (with welding or the other appropriate means) from the middle of the existing corner angle to the ground. The depth of the support will remain the same as of main angle.
* The dimensions of the fencing angle foundation should be 1.0 ft x 1.0 ft (length X width) and at a depth of 3 feet. The foundation should be square shaped. Distance between each fencing angle should be 1 meter.

#### Chainlink

* Dimensions of GI Chainlink : 3 inches x 3 inches and of Gauge :10 ( 3 mm diameter).
* GI chainlink mesh must be stretched and welded/fixed properly on the fencing angles.
* A pipe or angle must be fixed on the upper part of the fencing to have a neat finishing and at the same time to avoid loosening of the fencing over a period of time.
* The chainlink fencing should be fastened with the help of screws fitted on the fencing angles. Alternately it may be welded neatly at four equidistant positions of 0.5 mt each.

#### Gate

* Dimensions: 2 m X 1 m x 6 mm (Length x Width) with locking facility
* The gate must be fabricated by MS Angle whose dimensions should be minimum 40mm x 40mm x 6mm
* Suitable locking facility with 3 keys for safety purposes is mandatory. Standard locks should be used.
* Gate and MS Angle must be well painted with white / silver colour.
* Gate should have proper support of MS angles with additional support of crossed MS angles. Alternately gate should be fixed with the support of RCC pillars.

#### Tower

* Foundation Dimensions: 3 ft x 3 ft (length x width) and 5 ft deep. The raised platform of the foundation must be 2.0 ft. above the ground level.
* The height of the tower should be 3 metres above raised platform.

#### Rain Gauge foundation

* Rain gauge foundation must be of dimensions 1ft x 1 ft (length x width) and 3 ft deep.
* The rain gauge may be located so that it is at a minimum distance of 2 metres away from obstructions on all four sides.
* The raised platform should be six inches above the ground level.
* The base plate of rain gauge should be 1 ft. above ground level.
* In the case of flood prone areas the base plate on which the rain gauge is mounted should be placed 1.0 metre above ground level. The location must be decided after discussion with Field Officer.

#### Proportions for concrete foundations

* Concrete pillar foundations for the ARG tower, fencing angle should be made in the volumetric mixing proportions as follows:
* Concrete foundation : 1 (Cement) : 2 (Sand) : 4 (Metal)
* Fine plastering : 4(Cement) : 1 (Sand)
* Concrete Pillar must be cemented to achieve smooth finish above the ground level.
* After 8 hours, these foundations should be cured with water at least 3 times a day for four days.

#### Local Earthing

* Material required: Salt: 20 Kg; Charcoal: 20 Kg; Sand 100 Kg
* The lightning arrestor rod is made of copper which is mounted on the top most part of the ARG tower.
* It should be of thickness 12 mm and of one meter length with a connected copper wire of dimensions 3.5 Meter length and 6mm thickness (gauge). At the other end of copper wire is the Earthing rod of dimensions 15mm thickness and 1.8 meter length, which is buried into the ground.
* On the bottom of Earthing rod, one copper plate of dimensions 1’ x 1’ should be connected. ARG datalogger enclosure should also be grounded with local earthing.
* A pit of 4-5 feet depth, 2’ X 2’ wide at bottom (like a cone shaped pit) has to be dug.
* After leveling the bottom of the pit, uniform layer in the sequence of 6 inches of Salt + 6 inches Charcoal + 6 inches Sand is filled. Such sequence is repeated 3 times till the earth pit is filled to the top. The copper earthing rod is placed in the center of the pit. The pit is closed and leveled.

#### Painting

* The tower, fencing angles, chain-link fencing and gate should be properly painted to avoid rusting.
* All concrete foundations shall be painted using white cement.

## Water Level Monitoring

### Specifications for Installation

The AWLS stations will require a gauge house to be constructed at each site. The two figures shown below show examples of good gauge house construction and serve as examples of what is expected in terms of protecting the equipment in the gauge house.

A small gauge building will be constructed by the bidder of no less than 2m x 2m (internal dimension). The minimum height of the building will be 3 m, high enough to discourage people from gaining access to the roof. The building will be lockable and the hasp and lock area will be protected from vandalism.

 

In case of where land is not available for gauge hut or security of equipment is a problem, a pillar should be erected to protect the equipment from theft and vandalism. A picture below shows an example of a 20 feet high pillar to house the equipment.



#### Staff Gauges and Benchmarks

The Bidder is required perform surveys at all 17 water level sites and establish benchmarks that will be used to install a staff gauge, except in the case of barrages, where there may already be a staff gauge in place. The Bidder will be responsible for installing staff gauges and maintaining the staff gauges through the period of the contract. The datum used for the benchmark will be provided by Agency engineers.

Datum should be established at each gauging station by surveying from an existing benchmark or establishing a new benchmark using DGPS or RTKGPS equipment. The benchmark will serve as the future basis for the gauging station’s datum and rating curves and thus should be stable and not subject to movement. Installation in bedrock, a concrete bridge abutment, or other stationary objects is preferred.

A reference gauge such as a staff gauge should be established at each gauging station and the elevation of this reference gauge should be surveyed into gauge datum to a precision of 1 cm. This reference gauge is used during site visits to calibrate the water-level sensor and data-logger.

Staff gauges should be securely attached to an existing structure such as a bridge abutment or pier that will be stationary throughout the expected life of the gauging station. If no existing structure is available for attaching the staff gauge it can be attached to a steel or wooden post that is securely fastened to the streambed near the edge of water. This can be accomplished by driving steel rods into the streambed to a depth of at least four feet or by setting a steel or wooden post into a concrete pier. The pier should be constructed by excavating a hole at least two feet deep by 6 inches or more in diameter at an appropriate location on the streambed near the edge of water.



Staff gauges should be installed so that their lower end is submerged in water at the minimum water level and their upper end can be accessed to provide a water level reading at high flows. The staff gauge should be installed close enough to the sensor or bubbler tube so that the same water level is monitored by both devices. It is sometimes necessary to install more than one staff gauge to provide access to a reference water-level reading over the expected range of flows.

Staff gauges should be installed in such a manner as to avoid pileup or drawdown of the water surface in the vicinity of the staff plate, thus affecting the accuracy of the reading. Pileup can occur on the upstream side of an obstruction in the flow whereas drawdown can occur on the downstream side of an obstruction.

### Bubbler

Bubbler orifice tubes or pressure transducers are securely fixed to the streambed such that they remain submerged during low flows and are not moved or lost during high flows.

 The last 6-10 inches of the bubbler tube should be installed with a slight downward slope towards the stream to avoid water coming into the tube in between bubble cycles. The pressure required to evacuate this water during the bubble cycle will result in an apparent but incorrect surging of the recorded water level.

Orifice tubing or instrument cables should be buried in an appropriate conduit for the site conditions. A 1-2” flexible poly pipe can be easily installed and will hold up for many years in most environmental conditions.

A 2” galvanized steel pipe should be used whenever the conduit will be exposed due to site conditions. This is often the case when the bank is protected by large rip-rap or concrete making it difficult or impossible to bury the conduit.

### Radar or Ultrasonic Sensor

Radar or ultrasonic sensors should be mounted such that they have a direct vertical shot to the water surface with no obstruction of their beams. Beam spread must be determined based on manufacturer’s specification and the maximum expected distance to be measured at low flows. Consideration should be made in designing the mounting structure to allow for easy access to the instrument for maintenance.



## Sediment or Turbidity Monitoring Stations

The sensors are securely fixed to the streambed or rigid structure in the stream such that they remain submerged during low flows and are not moved or lost during high flows.

The mounting structures are designed such that the sensors can be removed for cleaning, servicing, or replacement at all flow conditions.

Provisions should be made for safe and easy access to the instrument shelter during all weather and stream flow conditions. Ladders, ramps, fencing, and handrails should be provided as needed and installed in a secure manner to ensure the safety of field personnel.

## Water Quality Monitoring Stations

The water-quality sondes and sensors are securely fixed to the streambed or rigid structure in the stream such that they remain submerged during low flows and are not moved or lost during high flows.



The mounting structures are designed such that the sensors can be removed for cleaning, servicing, or replacement at all flow conditions.

Provisions should be made for safe and easy access to the instrument shelter during all weather and stream flow conditions. Ladders, ramps, fencing, and handrails should be provided as needed and installed in a secure manner to ensure the safety of field personnel.

## Data Centre

The bidder will be required to install all computer systems, software and ancillary devices that are supplied as part of this tender. The purchaser will provide space to install equipment at offices in Central Location.

### Information Technology (IT) Infrastructure

#### Computer Servers

There will be two computer servers required, and will be placed at Central Location Data Center The computer servers are expected to operate the DAS software as well as all software required on the project. The computer servers will be managed by the Bidder up and through the AMC period of operation. The specifications for the server are given in Table below.

| **Data Centre Computer Server** |
| --- |
| **No.** | **Item** | **Technical Specification** |
| 1 | Form Factor | * Rack Mount Server
 |
| 2 | Processor | * Intel XEON ES-2440 or better
 |
| 3 | DIMM Memory | * Speed: 1600MT/s RDIMMS or better
* 8GB RDIMM, 1600MT/s, Low Volt, Dual Rank or similar
 |
| 4 | Hard Drive | * RAID 5 Software or Hardware Controller
* 5 - 1TB 7.2K RPM Near-Line SAS 6Gbps 2.5in Hot-plug Hard Drive or similar
 |
| 5 | Network Adapter | * 1 Gb
 |
| 6 | Power Supply | * Dual, Hot-plug, Redundant Power Supply, 350W or similar
 |
| 6 | Electrical Supply | * 220V A/C
 |
| 7 | Devices | * Keyboard,
* Mouse,
* 22” monitor minimum
 |
| 8 | Software | * Windows Server 2012R2
 |
| 9 | Accessories | * Power Cord
* Rack Rail with cable management system
* Power Points as needed
 |

#### Computer Rack and related parts

The Bidder is required to procure two full height computer racks that will hold the computer servers and UPS system being acquired by the project.

#### UPS

An Uninterruptable Power Supply (UPS) will be required at both the Gorakhpur and Lucknow Data Center. The UPS must be capable of operating the computer server(s) for a minimum of 30 minutes.

#### Ancillary Equipment

The Bidder will be required to provide ancillary equipment to the Data Centers. This equipment will include:

* 2 - Full height computer racks to hold rack mount computers
* 2 - 16-port computer switches,
* 2 – Rail mounting system for server
* Cables and power points as needed

### Software

#### Data Acquisition Software (DAS)

There is a requirement for two Telemetry Based DAS software package to be installed by the Bidder at Central Location. The DAS must be capable to providing the following:

1. Collection of Telemetry data from the Telemetry receiver (to be supplied by the bidder as part of the bid)
2. Telemetry DAS software will come free of annual licensing charges, such that it can run indefinitely without incurring further expense.
3. No cost for software upgrades through the AMC period.
4. Ability to set alarm thresholds and issue SMS text. There must also be an ability to send email to any number of stakeholders, based on either a single condition of multiple conditions.
5. Ability to automatically enter rating tables that are produced by the time series processing software.
6. Ability to export the data in xlsx or xls format as well as in text format. The text format shall be in conformance to Agency standards. The export facility must be one that can be run automatically to feed another system (hot drive), such as the DSS or forecasting system.
7. Color map display of stations and alarm related data that is automatically updated as data is received. Colors of station data on the map will be user programmable based on the requirements of the user. A simple interface to program the display must be available.
8. Ability to move data from the Central Location computer server to the cloud server.

The provision must be kept to move to a different software package like e-SWIS, being developed separately by Central Water Commission. The bidder must make sure that the data protocols are flexible enough for smooth transition.

#### Time Series Processing Software

Time series processing software is required to perform quality control and develop rating tables. The software is required to have the following capabilities:

* Graphical and Tabular viewing facility
* Real-time and historical trending of data
* Data exporting features
* Multiple data base feature (it is required to keep the raw data as well as the processed data, but in separate tables of the data base)
* RDBMS Microsoft SQL Server or MySQL
* Automatic and Scheduled reporting features
* Diagnostic report
* Development of rating curves
* Statistical capabilities
* Manual data entry and input programs
* Printing graphical and tabular data
* Data Aggregation (e.g. hourly totaling by basin.

#### Field Maintenance Tracking Software

There is a requirement for field maintenance tracking software. This software will allow the field crews to log daily activities, especially activities that have to do with the AWS, ARG, AWLS, Stream Gauging, and Data Center operations. The field maintenance software will provide the following:

* Record all station visits including the following activities
	+ Date of visit
	+ Time of arrival
	+ Station name
	+ Technician(s) name
	+ Purpose of visit
	+ Operational status upon arrival
	+ Operation status upon departure
	+ Activities performed during visit
	+ Recommendation of activities on future visit
	+ Time of Departure
* The records will be sortable by any of the fields. For instance, the software must produce a record of all activities at a given station, or all activities performed by a given technician, or any combination of fields.
* The field maintenance tracking software will be used to produce monthly reports that will be prepared by the Bidder and delivered to the Purchaser no later than the 5th day after the end of the month the report is valid for.

# Personnel Requirements

The project requires the Bidder to provide staff positions to fill the tasks of hydrography and computer systems & software support. The personnel will be required to be dedicated to the project as scheduled below, and will remain onsite for the period of the schedule. **Agency** will provide office space and furnishing (desk, chair, cabinets) for the Bidder provided staff at **Agency** facilities. The hydrographers will have their own arrangements for reliable transportation which will also be supplied by the Bidder. It is required that the vehicle being used will be a 4x4 vehicle capable of holding and securing all of the equipment used for field measurements.

### Staff schedule requirements

The Bidder supplied staff will be required to work in the field during the period of commitment. It is most important that the staff be entirely committed during the flood prone season, which goes from approximately 1 July through 30 October. Absences during this period should be minimal and coordinated with **Agency** in the event such absences are required.

**Table 11 Staff Commitment Periods**

|  |  |
| --- | --- |
| Position | Period of Commitment |
| Central Office |
| Senior Computer System & Software Specialist | Full Time |
| Computer System & Software Specialist | 1 May – 1 October |
| Field Office 1 |
| Senior Hydrographer | Full Time |
| Hydrographer | 1 May – 1 October |
| Field Office 2 |
| Senior Hydrographer | Full Time |
| Hydrographer | 1 May – 1 October |
| Field Office 3 |
| Senior Hydrographer | Full Time |
| Hydrographer | 1 May – 1 October |

### Hydrographer Responsibilities, Qualifications and Supervision

There are two levels of hydrographers required. There will be a Senior Hydrographer and a Junior Hydrographer.

#### Responsibilities

The hydrographers will be responsible for maintaining all stations installed by the Bidder. The hydrographers will be required to record activities at the stations using the maintenance tracking software purchased as part of this tender. The hydrographer will also work with the time series data base in storing stream gauge measurements and developing rating curves.

The Hydrographers will be responsible for supporting the data flow from the sensor to the data station, as transmitted and received from the **telemetry system**.

#### Senior Hydrographer

The senior hydrographer will be highly trained and certified to have expertise in operation and maintenance of the equipment used in the project. The senior hydrographer will also be certified to have expertise in complete knowledge and understanding in making stream gauging measurement with the profiling ADCP that will also be acquired in this project. The senior hydrographer should have a firm grasp of the installed technology and be able to train hydrographers from both **Agency** and Bidder supplied hydrographers.

It is paramount that the senior hydrographer be able to maintain, repair, and replace all hydromet equipment including the testing and replacement of **telemetry system** as required.

#### Junior Hydrographer

The hydrographer will work under the senior hydrographer and assist in performing stream gauging measurements and performing other duties as assigned, including the repair of equipment. The hydrographer shall be certified by the Bidder to maintain data stations and perform stream gauging measurements.

#### Supervision

The hydrographers (both senior and junior) will take supervision from **Agency**. This means that hydrographer activities must be carefully coordinated with **Agency**. Regular dialogue is required between the Bidder and **Agency**. **Agency** can also request stream gauging measurements.

### Computer System & Software Responsibilities, Qualifications and Supervision

There are two levels of computer system & software staff required. There will be a Senior Computer Systems & Software Specialist and a Junior Computer Systems & Software Specialist.

#### Responsibilities

The computer system and software specialists will have the responsibility if maintaining the computer systems and network that were acquired as part of this project. The specialists will also be responsible for operating the **Data Acquisition** software, Time Series software, and any other software that is procured as part of this tender.

#### Senior Computer System and Software Specialist

The Senior Computer System and Software Specialist will be highly trained and certified to use the **Telemetry** base station software, time series software for developing rating curves and all other software packages that are procured. The senior specialist will have a firm grasp of the software and be capable of training **Agency** officials as requested by **Agency** and also training the seasonal junior specialist. The senior specialist will assure that the data transmitted to the center is be**ing properly stored on the** base station software.

The Senior Specialist will also be capable configuring web pages that are used to disseminate and visualize the collected data.

#### Junior Computer System and Software Specialist experience

The Junior Computer System and Software Specialist will serve the Senior Specialist in providing assistance in maintaining the computer server and all software packages and all other activities of the Senior Specialist.

#### Supervision

The computer system and software specialists (both senior and junior) will take supervision from **Agency**. This means that **IT** activities must be carefully coordinated with **Agency**. Regular dialogue is required between the Bidder and **Agency**. **Agency** can also request stream gauging measurements.

# Warranty Period

The warranty period shall begin immediately after all stations have been commissioned. The warranty period will last for two years’, during which time the Bidder will be responsible for the operation and maintenance of the entire network. The Bidder will be responsible to replace faulty or damaged equipment that they provided through the contract.

The Bidder will electronically record all maintenance activities on software specified previously in this document. Monthly maintenance reports will be provided to Agency that summarizes the number of visits, sites, visited, and purpose of visits. The bidder may also be required to perform ad-hoc queries that are requested by the purchaser. Further explanation of the monthly maintenance reports can be found in the “Maintenance Reports” section.

The bidder will provide a minimum of 6 hydrological technicians that will be dedicated to the project and remain at the assigned field offices full-time. There will be two instrument technicians at each field office. The maintenance field offices are located at Agency compounds in xxx, yyy and zzz cities. Agency will provide space for the instrument technicians at Agency facilities, though costs of transportation and ancillary equipment and tools will be the responsibility of the bidder. The hydrological technicians will maintain the newly installed network during the warranty period. The technicians will restore station/sensor outages within 48 hours of the outage occurring. This will mean that the instrument technicians will be placed at the regional centers to help reduce response time and meet the requirement of station outages lasting no longer than 48 hours. The instrument technicians will also serve as hydrographers and make stream gauging measurements with equipment that is to be supplied under this contract and as specified.

There will also be two Information Technology Specialists to maintain the newly procured and established Data Center servers. The two IT Specialists will be dedicated to the project full-time, and work out of **Central Locations**. Agencywill provide office space for the IT specialists. The IT Specialists will be tasked to overseeing the collection of data, managing the **DAS** system software, and reprogramming **if required**.

# Operation and Maintenance

The bidder shall provide a bid for Operation & Maintenance (O&M), also known as an Annual Maintenance Contract (AMC) for the three year period following the warranty period. The bidder will supply the same numbers of full-time staff as required during the warranty period, being 6 hydrological technicians, 2 each at the Agency field offices and two IT Specialists located at the Central Location. The AMC services will include the following activities:

## Hydrological Technicians:

* Maintenance of observation network including:
	+ Preventative Maintenance (PM) of observation network to occur every 3 months or sooner whereby each station will be visited at that interval or sooner.
	+ Emergency Maintenance (EM) of observation network as required (stations down or delivering questionable data)
* Document maintenance visit, whether PM or EM, using software specified and to be acquired by the bidder
* Provide monthly maintenance reports accounting for all field visits performed, nature of visits, action taken
* Ship equipment requiring maintenance
* Receive equipment
* Maintain and document equipment inventory
* Stream gauging measurements to occur once per month, or sooner at all river gauging sites in the area of responsibility
* Development of rating curves using software as specified

## Information Technology Specialists:

* Manage the data flow from the Telemetry network into the data base
* Manage the data base
* Manage the web page and provide changes in presentation as required by the purchaser
* Provide monthly operation and maintenance reports on computer operation, including the documentation of down time, changes in data dissemination (web page), changes in early warning protocol, etc., or other related activities as directed by the purchaser.
* Process rating curves using stream gauging measurements made in the field.
* Perform quality control on all data coming in from the stations using the time series data base software.

## Maintenance Reports

There is a requirement for the bidder to provide monthly operation & maintenance reports during the warranty period. The reports are due the 7th day of every month documenting the previous month’s activity. The reports must include an accounting of all station visits actions taken.

# Inspections and Tests

The following inspections and tests shall be performed:

## Testing and Inspection

It is the Bidder’s responsibility to ensure that the equipment is sufficiently tested prior to shipment and installation. During final acceptance testing, the Bidder will have to demonstrate full functionality and performance of all system components according to specifications. Prior to final acceptance, all expenditures related to unsatisfactory performance of the equipment, such as the costs of repairs, additional site visits, shipping costs etc., will be at the Bidder’s expenses.

The costs for all tests and for all inspections to be made under the contract shall be borne by the Bidder and shall be deemed to be included in the Contract Price with the exception of the Purchaser’s costs for witnessing tests.

## Factory Acceptance Test

Prior to system shipment, the bidder shall conduct a Factory Acceptance Test (FAT). The FAT shall be conducted at the bidder’s facilities and shall demonstrate “end-to-end” performance of the system components. In order to avoid delays, the factory acceptance testing shall not be witnessed. However, the bidder is required to write a FAT report that will describe the test layout, the individual testing results for each station / component, as well as any problems found. All deficiencies revealed by testing shall be rectified by the bidder at his own expenses and to the approval of the Purchaser. Rectified components shall be subject to re-testing.

## Receiving Inspection

The system is to be inspected in-country, after clearing customs, to ensure that 100 percent of the shipment is received and delivered. The Bidder is to arrange for this receiving inspection as well as for customs clearance and delivery to appropriate storage facilities near Chennai to be provided and maintained by the Bidder.

## Site Installation and Acceptance Tests

The Bidder will install all the equipments and will undertake site tests of each gauge and tests for each lot of equipments included in the Schedule of Requirements. The exact locations for installation by Bidder shall be decided by the Purchaser. A list of proposed stations is provided in Section VI (Schedule of Requirements).

After final configuration and programming, the Bidder will conduct an “end-to-end” operational test for each of these stations. A formal check list shall be followed and the results of the tests shall be recorded. The Purchaser’s personnel will be trained in conducting the same site acceptance tests. A Site Acceptance Test will be passed if all sensors and data collection platforms obtain and store correct values for a period of 24 hours.

## Operational Test (OT)

Operational Tests shall be conducted at two stages of project implementation. In each case, any operational problems related to the remote stations are to be fixed before approval can be received for the system OT. The first OT must be conducted immediately after the first lot of remote stations has been installed by the Bidder. All hardware and software components of this real time network have to be tested. The OT will be considered to be successful if all components as a whole have been operating without problems during at least 72 hours period.

The second, third, fourth and final OT will be witnessed by the Purchaser’s designated representatives as each lot of stations are completed. It will take place when all the remote stations have been installed; however, the final OT will not be delayed due to delays or problems related to the installation of individual remote stations. The Purchaser shall decide the start date of the test in consultation with the Bidder. The Bidder shall notify the Purchaser accordingly and shall perform the OT.

The final OT shall be test for “end-to-end” performance of the entire system for a period of one week. The bidder shall demonstrate and document that the system correctly generated 95% of all expected data (normally scheduled data collections and transmissions) for the one-week period. The Bidder will produce a report documenting the quantities of data expected / received and indicating the success / failure of the OT. The OT will be repeated until the 98% success level is achieved or a specific waiver of the requirement (minimum 95%) is obtained.

All equipment failures will be counted except those that can be specifically determined to be “acts of God”. Failure of stations due to acts of God (natural disasters or other incidents) will not count against the 95%. Equipment needed for testing shall be provided by the Bidder.

## Final Acceptance

When the system has passed the Final OT, the Bidder can apply for Final Acceptance. When Final Acceptance is given, the system will be officially considered to be under Warranty.

# Technical Specifications

## Automatic Rain Gauge Stations

### Automatic Rain Gauge

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -5 to +50 Degree C |
| Humidity | 5 to 100 % |
| Altitude | 0 to 2000 meter |
| **Sensor** |
| Sensor Type | Tipping Bucket reed switch |
| Range | 0-250 mm/h |
| Resolution | 0.5 mm |
| Accuracy (Intensity) | 2 % or better |
| **General Features** |
| Output Interface | SDI12/ RS 485 / Compatible with Data logger |
| Material | Corrosion Resistance Metal (Stainless steel/ Aluminum or PVC) |
| Enclosure | Ability to service tipping buckets without involving the re-leveling of the gauge. |
| Protection | NEMA 4 or IP65 |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessaries | Sensor Mounting support, cables and other accessories as required |
| **Specific Features** |
| Collecting Funnel Diameter  | 200 mm or 8 Inch or equivalent |
| Insect Screen | Insect covers on all openings should be provided |

### Rain and Snow Gauge

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| Sensor Type | Storage Gauge with Anti-freeze system without heating |
| Capacity | 1000 mm minimum |
| Resolution | 0.5 mm or better |
| Accuracy (Intensity) | 2 % or better, ±2 mm |
| **General Features** |
| Output Interface | SDI12/ RS 485 / Compatible with Data logger |
| Power Supply | 12 V DC or switch rated for 12 VDC |
| Material | Corrosion Resistance Metal (Stainless steel or Aluminum) |
| Enclosure | NEMA 4 |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessaries | Sensor Mounting support, cables and other accessories as required |

### Snow Depth Sensor

|  |  |
| --- | --- |
| Feature | Units |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| Sensor Type | Ultrasonic sensor |
| Range | 0-10 meter |
| Resolution | 1 mm or better |
| Accuracy | 0.25 % of measuring distance |
| **General Features** |
| Output Interface | SDI12/ RS 485 / Compatible with Data logger |
| Power Supply | 9-18 V DC |
| Material | Corrosion Resistance Metal (Stainless steel/ Aluminum or PVC) |
| Enclosure | NEMA 4 |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessories | Sensor Mounting support, cables and other accessories as required |

## Automatic Water Level Stations

### Shaft Encoder

|  |  |
| --- | --- |
| **Feature** | **Value** |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| (\*) Sensor Type | Shaft Encoder based rotary position sensor with Digital Display |
| (\*) Range | 1-100 meter |
| (\*) Resolution | 3 mm or less |
| (\*) Accuracy | 0.025 % FSO |
| Output Interface | SDI-12 / RS 485 / 4-20 mA / compatible with data logger |
| Power Supply | 12 V DC or Switch rated for 12 V DC |
| **General Features** |
| Material | Corrosion Resistance Metal (Stainless steel or Aluminum) |
| (\*) Enclosure | Lockable (key) box provided by the supplier to be mounted in Stilling well or Gauge hut, with IP65 or NEMA 4 protection |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Graduated Tape | The tape should be of high quality to withstand harsh and humid environment, should not get twisted or wrinkeled while operation. |
| Accessaries | Sensor Mounting support, Floats, graduated tapes (metric), wheel, counterweight, and cabling |

### Radar

|  |  |
| --- | --- |
| **Feature** | **Value** |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| (\*) Sensor Type | Microwave non-contact sensor |
| (\*) Range | 30 meter |
| (\*) Resolution | 3 mm or better |
| (\*) Accuracy | 0.02 % FSO |
| Output Interface | SDI-12 / RS 485 / 4-20 mA / compatible with data logger |
| Power Supply | 10-15 V DC |
| **General Features** |
| Material | Corrosion Resistance Metal (Stainless steel / Aluminum or PVC) |
| Enclosure | The Sensor shall be easy to dismount and replace in the event of malfunction.  |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessories | Sensor Mounting support, cables and other accessories as required |
| (\*) Protection | NEMA 4 or IP64 |

### Ultrasonic Sensor

|  |  |
| --- | --- |
| **Feature** | **Value** |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| (\*) Sensor Type | Ultrasonic non-contact sensor |
| (\*) Range | 10 meter |
| (\*) Resolution | 3 mm or better |
| (\*) Accuracy | 0.02 % FSO |
| Output Interface | SDI-12 / RS 485 / 4-20 mA / compatible with data logger |
| Power Supply | 10-15 V DC |
| **General Features** |
| Material | Corrosion Resistance Metal (Stainless steel / Aluminum or PVC) |
| Enclosure | The Sensor shall be easy to dismount and replace in the event of malfunction.  |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessories | Sensor Mounting support, cables and other accessories as required |
| (\*) Protection | NEMA 4 or IP64 |

### Bubbler

|  |  |
| --- | --- |
| **Feature** | **Value** |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| (\*) Sensor Type | Continuous bubbling system and non-submersible transducer |
| (\*) Range | 15 PSI |
| (\*) Resolution | 3 mm @ 15 PSI or better |
| (\*) Accuracy | 0.02 % FSO |
| Output Interface | SDI-12 / 4-20 mA / RS485, compatible with Data logger |
| Power Supply | 11 to 15 V DC |
| Average current Draw | <15mA based on 1 bubble per second |
| Purge | Manual line purge |
| Bubble Rate | Programmable 30–120 bubbles per minute |
| (\*) Desiccators | The bubbling mechanism and the non-submersible transducer must be equipped with a desiccating system to keep system from malfunction for a period not less than 6 months. |
| **General Features** |
| Tools | Complete tool kit for installation and routine maintenance |
| Manuals | Full documentation and maintenance instructions in English |
| Accessories | Sensor Mounting support, cables and other accessories as required |
| (\*) Enclosure | NEMA4 or IP64 |

### Pressure Transducer

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor** |
| (\*) Sensor Type | Pressure Sensor |
| (\*) Range | 30 meter |
| (\*) Resolution | 3 mm or better |
| (\*) Accuracy | 0.02 % FSO |
| Output Interface | SDI-12 / RS 485 / 4-20 mA / compatible with data logger |
| Power Supply | 10-15 V DC |
| **General Features** |
| Material | Corrosion Resistance Metal (Stainless steel / Aluminum or PVC) |
| Enclosure | The Sensor shall be easy to dismount and replace in the event of malfunction.  |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessories | Sensor Mounting support, cables and other accessories as required |
| (\*) Protection | NEMA 4 or IP64 |

## Automatic Weather Stations

### AWS Sensors

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Temperature Sensor** |
| Sensor Type | Resistance type Temperature Sensor |
| Range | -20 to 60 Degree C |
| Resolution | ± 0.1°C |
| Accuracy (Intensity) | 0.3°C or better |
| Power Supply | 12 V DC or switch rated for 12 VDC |
| **Humidity Sensor** |
| Sensor Type | Capacitive/ Solid State Humidity Sensor |
| Range | 5 to 100 % |
| Resolution | 0.5 Percent |
| Accuracy | ±3% or better |
| Power Supply | 12 V DC or switch rated for 12 VDC |
| **Wind Speed and Direction Sensor** |
| Sensor Type | Ultrasonic sensor (No moving Parts) |
| Range | 65m/s for speed ;0–360 degrees for direction |
| Resolution | 0.01 m/s for Speed; 0.1 degree for Direction |
| Accuracy | 0.2 m/s or 3% for wind speed;+/- 2 degrees for direction |
| **Pressure Sensor** |
| Sensor Type | Temperature Compensated |
| Range | 800 - 1200 hPa |
| Resolution |  ± 0.01 hPa |
| Accuracy |  ± 0.5 hPa |
| Power Supply | 12 V DC or switch rated for 12 VDC |
| **Solar Radiation Sensor** |
| Sensor Type | ISO Class 1 Pyranometer (CMP 11 or better) |
| Spectral Range | 300-1000 nm |
| Range | 0-2000 W/Square meter |
| Resolution | 1 W/Square meter |
| Accuracy (Including Temperature Compensation) | 3% |
| **General Features** |
| Material | Corrosion Resistance Metal (Stainless steel/ Aluminum or PVC) |
| Tools | Complete tool kit for operation and routine maintenance |
| Manuals | Full Documentation and maintenance manual in English |
| Accessories | Sensor Mounting support, cables and other accessories as required |
| Output Interface | SDI 12/RS 485/ 4-20 mA/ Compatible with Data logger |

## Groundwater Level Stations

### Groundwater Level Sensor without Vent Tube

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5-100 % |
| Altitude | 0-5000 meter |
| **Sensor** |
| Sensor Type | Submersible pressure transducer with atmospheric pressure and temperature compensation on individual Sensors |
| Range | 30 psi |
| Accuracy | 0.1% FSO |
| Resolution | 3 mm |
| Input Power | 10-16 VDC |
| Non-Vented Cable | Includes barometric sensor for post-processing |
| Output | SDI-12, RS-485 |
| **Datalogger** |
| Internal Memory | 32 mb |
| Battery Voltage Monitoring | Monitoring and transmission of Battery Voltage level |
| Datalogger Location | If Data logger and transmitter are integral parts of sensor, it should be located on top (near ground surface) instead of bottom |
| **GSM / GPRS Transmitter** |
| Performance | Data Reception availability of 95% or better |
| Communication Direction | Utilize GPRS network for two-way TCP/IP (INTERNET) connection |
| VPN protocol | Radio to utilize VPN protocol |
| Transmission trigger | Data collection to be triggered by interrogation from Data Center, or by event based transmission triggered by remote site |
| Power Saving | Ability to disable interrogation system in order to save power at remote site |
| Communication Protocol | Data transmission to execute HTTP Post or FTPS to transmit data to the Data Center |
| Accessories | All associated equipment, including Antenna all cables and mounting hardware |
| **Software** |
| Operating System | Windows software for system configuration, transfer and analysis of data to computer |
| Version | English language version |
| License | All required licenses included |
| **General Features** |
| Battery | The battery should be easy to replace, and easily available in the market |
| Tools | Complete tool kit for installation and routine maintenance |
| Manuals | Full documentation and maintenance instructions in English |

### Groundwater Level Sensor with Vent Tube

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +60 |
| Humidity | 5-100 % |
| Altitude | 0-5000 meter |
| **Sensor** |
| Sensor Type | Submersible pressure transducer with atmospheric pressure and temperature compensation |
| Range | 30 psi |
| Accuracy | 0.1% FSO |
| Resolution | 3 mm |
| Input Power | 10-16 VDC |
| Non-Vented Cable | Includes barometric sensor for post-processing |
| Output | SDI-12, RS-485 |
| **Datalogger** |
| Internal Memory | 32 mb |
| Battery Voltage Monitoring | Monitoring and transmission of Battery Voltage level |
| Datalogger Location | If Data logger and transmitter are integral parts of sensor, it should be located on top (near ground surface) instead of bottom |
| **GSM / GPRS Transmitter** |
| Performance | Data Reception availability of 95% or better |
| Communication Direction | Utilize GPRS network for two-way TCP/IP (INTERNET) connection |
| VPN protocol | Radio to utilize VPN protocol |
| Transmission trigger | Data collection to be triggered by interrogation from Data Center, or by event based transmission triggered by remote site |
| Power Saving | Ability to disable interrogation system in order to save power at remote site |
| Communication Protocol | Data transmission to execute HTTP Post or FTPS to transmit data to the Data Center |
| Accessories | All associated equipment, including Antenna all cables and mounting hardware |
| **Software** |
| Operating System | Windows software for system configuration, transfer and analysis of data to computer |
| Version | English language version |
| License | All required licenses included |
| **General Features** |
| Battery | The battery should be easy to replace, and easily available in the market |
| Tools | Complete tool kit for installation and routine maintenance |
| Manuals | Full documentation and maintenance instructions in English |

## Water Quality Stations

### Water Quality Sensors

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | -5 to 45 Degree C |
| Humidity | 5-100 % |
| Altitude | 0-5000 meter |
| **Multi parameter Sonde** |
| Ports | 6 or more |
| Response Time | <90 s |
| Output | SDI-12, RS-232 |
| **Depth** |
| Accuracy | 0.003 m |
| Resolution | 0.001 m |
| Range | 0 to 60m |
| **Conductivity** |
| Accuracy |  +/- 3% FS or 5μS/cm |
| Resolution |   |
| Range |  0 - 100 μS/cm |
| **Dissolved oxygen (optical)** |
| Accuracy |  +/- 5% reading or +/- 0.2 mg/L |
| Resolution | 0.01 mg/L |
| Range | 0 to 50 mg/L |
| Sensor Cleaning | Automated sensor cleaning mechanism |
| **Temperature** |
| Accuracy |  +/- 0.2oC |
| Resolution | 0.2oC |
| Range |  -5 to 45o C |
| **Turbidity** |
| Accuracy |  +/- 5% reading or 2 NTU |
| Resolution | 1 NTU |
| Range | 0 to 1000 NTU |
| Sensor Cleaning | Automated sensor cleaning mechanism |
| **pH** |
| Accuracy |  +/- 0.2 pH units; +/- 1.0 mV |
| Resolution | 0.01 pH unit; 0.1 mV |
| Range | 2 - 12 pH units (minimum) ; 0-14 pH units (Preferred) |
| **General Features** |
| Tools | Complete tool kit for installation and routine maintenance |
| Manuals | Full documentation and maintenance instructions in English |

## Discharge Measurement

### ADCP

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | -5 to 45 Degree C |
| Humidity | 5-100 % |
| Altitude | 0-5000 meter |
| **Sensor** |
| ADCP Type | Broadband ADCP for measurement of discharge in open channel environment |
| Profiling Range | 0.4–25m |
| Profiling Velocity | +/-20 m/s |
| Velocity Accuracy | 0.25% of measured velocity |
| Velocity Resolution | 0.001m/s |
| Depth Range | 0.3-80 m |
| Depth Accuracy | 1%. |
| Depth Resolution | 0.001 m |
| Positioning | Optional capability to acquire position by bottom tracking or integrated GPS. |
| Computations | All performed internally or on Windows-based software (supplied) |
| **Accessories** |
| Platform | Floating platform for tethered ADCP deployment |
| Positioning | GPS for positioning |
| Tethers | All necessary tethers and taglines  |
| Software | Windows-based software for display of velocity, discharge, depth, and width information in real-time. |
| **General Features** |
| Tools | Complete tool kit for installation and routine maintenance |
| Manuals | Full documentation and maintenance instructions in English |

## Telemetry

### GSM / GPRS

|  |  |
| --- | --- |
| Feature | Value |
| Operating Temperature | From -20 to +60 |
| Performance | Data Reception availability of 95% or better |
| Form factor | The Transmitter should either be integral part of data logger specified above, or it should be supplied as independent unit compatible with supplied data logger |
| **Specific Features** |
| Communication Direction | Utilize GPRS network for two-way TCP/IP (INTERNET) connection |
| VPN protocol | Radio to utilize VPN protocol |
| Transmission trigger | Data collection to be triggered by interrogation from Data Center, or by event based transmission triggered by remote site |
| Power Saving | Ability to disable interrogation system in order to save power at remote site |
| Communication Protocol | Data transmission to execute HTTP Post or FTPS to transmit data to the Data Center |
| Accessories | All associated equipment, including Antenna all cables and mounting hardware |

### INSAT Radio

|  |  |
| --- | --- |
| Feature | Value |
| Operating Temperature | From -20 to +60 |
| Environment Relative Humidity | 0 to 100 % |
| Career Frequency | 402 - 403 MHz |
| Output Power | 3-10 W, user settable |
| Data Bit Rate | 4.8 kbps |
| Antenna cable  | LMR 400 grade or better |
| Performance | Data Reception availability of 99% or better |
| Form factor | The Transmitter should either be integral part of data logger specified above, or it should be supplied as independent unit compatible with supplied data logger |
| **Yagi Antenna** |
| Polarization | LHCP or RHCP, switchable in field |
| Gain | Minimum 11 dbi or better |
| Center Frequency | 402-403 MHz |
| Mounting | Proper mounting and Pointing arrangement for 360 degree azimuth and elevation adjustment |
| Operating Wind speed | 250 kmph |
| Wind Survival | 300 kmph |
| Material | Rust-proof and Oxidation-proof |
| **Specific Features** |
| Satellite System | INSAT Radio System to be Used on the INSAT Satellite operated by ISRO |
| Certification | Certificate of acceptance required by ISRO and/or IMD as part of the bid package |
| Demonstration in India | Demonstrated use of the satellite radio with at least 200 radios in current operation in India using INSAT |
| Accessories | All associated equipment, including GPS, GPS Antenna, INSAT Antenna, all cables and mounting hardware |

### VSAT Trans-receiver

|  |  |
| --- | --- |
| Feature | Value |
| Operating Temperature | From -20 to +60 |
| Antenna cable  | LMR 400 grade or better |
| Performance | Data Reception availability of 99% or better |
| **Specific Features** |
| Communication Direction | VSAT Radio system to allow two-way communication system between Data Center and remote station |
| Single Hop | VSAT communication will be direct link, and use the internet or any surface based topology for data communication (i.e. leased lines) |
| Bandwidth Sharing | VSAT bandwidth will be able to be shared among all stations |
| Alarm Conditions | VSAT remote stations shall be able to transmit based on alarm conditions at the remote site such as critical water level or exceptional precipitation events |
| Accessories | All associated equipment, including Antenna all cables and mounting hardware |

## Data Collection Platform

### Power Supply

|  |  |
| --- | --- |
| Feature | Units |
| **Battery** |
| Voltage | From -20 to +60 |
| Type | Sealed Maintenance free |
| Capacity | Based on site conditions and Telemetry method, to provide 21 days of backup |
| **Solar Panels** |
| Size | Based on Site conditions and Telemetry method used for 21 days of backup |
| Mounts | The mounts should be sturdy in design; the solar panel should not move or rotate with wind. It should have provision to adjust direction and elevation during installation for optimal solar power generation |
| Charger | Smart solar charger with protection |
| **General** |
| The supplier should determine optimal size of solar panels and batteries, such that system should be operational for at least 21 days in the absence of charging |

### Data Logger for 1-2 Sensors

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +50 Degree C |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor Interface** |
| Analogue Inputs | 8 Analogue Input Channels |
| SDI Port | One SDI-12 Interface port |
| Digital Inputs | 6 Digital Channels, bidirectional |
| Pulse Input | 2 Input for Rain Gauge impulse |
| **Input - Output Interfaces** |
| Data Transfer | USB stick option for Data transfer |
| Port for Configuration | One Serial Port (RS232) for communication with Laptop or programming |
| Port for Telemetry | Port for Communication with Telemetry Device (GSM/VSAT/INSAT) specified below |
| **Computer Software** |
| Operating System | Windows software for system configuration / communication |
| Version | English language version |
| Licenses | All required licenses included |
| **General Features** |
| Flash memory | Non-volatile Flash memory that can one store year of data and expandable to a minimum of 1GB. |
| Resolution | A/D resolution ≥16 bit |
| Recording Interval | Individual recording intervals for each sensor/parameter |
| Firmware Operating System | Multi-tasking operating system - must log data and transmit at same time |
| Display | Digital Display for viewing current data and setting values |
| Power Supply | Power supply 12V DC, low current drain (quiescent ≤10.0mA) |
| Battery Voltage | Monitoring of battery voltage level |
| Internal battery | Internal battery backup for clock |
| User Permissions | Different user levels, system of user rights / passwords, access restricted to authorized personnel |
| Internal clock | Internal clock with drift less than 2 seconds per day or using GPS |
| System integrity | System integrity check procedures |
| Enclosure | for wall-mounting in a shelter / enclosure with IP65 (NEMA 4) protection or better |
| Accessories | Serial cable + adaptor (if required) for notebook connection. All accessories (fixing units, etc.) as required |
| Tools | complete tool kit for installation and routine maintenance giving full detail( number of pieces and type)  |
| Manuals | full documentation and maintenance instructions in English (1 copy per station). |

### Data Logger for Multiple Sensors

|  |  |
| --- | --- |
| Feature | Value |
| **Site Conditions** |
| Ambient Temperature | From -20 to +50 Degree C |
| Humidity | 5 to 100 % |
| Altitude | 0 to 5000 meter |
| **Sensor Interface** |
| Analogue Inputs | 8 Analogue Input Channels |
| SDI Port | One SDI-12 Interface port |
| Digital Inputs | 6 Digital Channels, bidirectional |
| Pulse Input | 2 Input for Rain Gauge impulse |
| **Input - Output Interfaces** |
| Data Transfer | USB stick option for Data transfer |
| Port for Configuration | One Serial Port (RS232) for communication with Laptop or programming |
| Serial / RS 485 | One for the INSAT radio |
| RS232 | One for the addition of GSM radio  |
| LAN Port | RJ 45 port for LAN / VSAT |
| **Computer Software** |
| Operating System | Windows software for system configuration / communication |
| Version | English language version |
| Licenses | All required licenses included |
| **General Features** |
| Flash memory | Non-volatile Flash memory that can one store year of data and expandable to a minimum of 1GB. |
| Resolution | A/D resolution ≥16 bit |
| Recording Interval | Individual recording intervals for each sensor/parameter |
| Firmware Operating System | Multi-tasking operating system - must log data and transmit at same time |
| Display | Digital Display for viewing current data and setting values |
| Power Supply | Power supply 12V DC, low current drain (quiescent ≤10.0mA) |
| Battery Voltage | Monitoring of battery voltage level |
| Internal battery | Internal battery backup for clock |
| User Permissions | Different user levels, system of user rights / passwords, access restricted to authorized personnel |
| Internal clock | Internal clock with drift less than 2 seconds per day or using GPS |
| System integrity | System integrity check procedures |
| Enclosure | for wall-mounting in a shelter / enclosure with IP65 (NEMA 4) protection or better |
| Accessories | Serial cable + adaptor (if required) for notebook connection. All accessories (fixing units, etc.) as required |
| Tools | complete tool kit for installation and routine maintenance giving full detail( number of pieces and type)  |
| Manuals | full documentation and maintenance instructions in English (1 copy per station). |

**SECTION VI-A : QUALIFICATION CRITERIA**

 (Referred to in Clause 13.3(b) of ITB)

 After determining the lowest-evaluated bid, the Purchaser shall carry out the post qualification verification of the Bidder in accordance with ITB Clause 38, using only the requirements specified. Requirements not included in the text below shall not be used in the evaluation of the Bidder’s qualifications.

(A) **Financial Capability:**

The Bidder shall furnish documentary evidence that it meets the following financial requirement(s):

i.    Capacity to have a cash flow - The Bidder must provide a letter from a reputed bank stating the availability of liquid assets and/or credit facilities exclusively for this Contract only, of no less than *INR 15.0 Million*. In the case of joint Ventures, the cumulative liquid assets of the members of joint venture will be considered.

 ii.   The Minimum required annual turnover in respect of supply, installation and commissioning of goods for the successful Bidder in any two of the last five (5) years shall be of *INR 50 Million or its equivalent*. In the case of joint Ventures, the cumulative turnover of the members of joint venture will be considered, but lead member of joint venture must at least meet 40% of this requirement.

(B) **Experience** **and Technical Capacity**

* + 1. The Bidder should be a manufacturer who must have manufactured, tested and supplied the equipment (s) similar to the offered type specified in the ‘Schedule of Requirements’ up to at least 50 sensors (in 50 sites) coupled with a data logger in any one of the last 3 years. The equipment offered should strictly conform to or exceed the product specification and be in satisfactory operation for 6 months as on date of Bid opening. Further, Bidder should be in continuous business of manufacturing products similar to that specified in the schedule of requirements in India during the last three years prior to Bid opening.
		2. Bids of Bidders quoting as authorized representative of an equipment manufacturer, meeting with the above requirement in full, can also be considered provided :

(i) the manufacturer furnishes authorization in the prescribed format assuring full guarantee and warranty obligations as per GCC and SCC and

(ii) the Bidder, as authorized representative of their manufacturer has supplied, installed and commissioned satisfactorily at least 50 sensors (in 50 sites) coupled with a data logger similar to the types specified in the Schedule of Requirements in any one of the last three years which must be in satisfactory operation for at least 6 months on the date of Bid opening. The Bidder must provide evidence of providing maintenance services for the above type of sensors coupled with a data logger installation in at least ONE centre in the Country for over one year. In case the Bidder is unable to provide evidence for maintaining such systems the Bidder should provide a plan for provision of after sales service and annual comprehensive maintenance for the next five years along with the evidence of maintaining instruments using similar technology (a sensor coupled with the datalogger) with similar coverage and amounting to at least 70% of the total cost of the offered Bid in any one of the last three years.

iii) The bidder shall guarantee that adequate specialized maintenance capability and expertise will be made available in the country.

1. The Bidder shall provide evidence to the satisfaction of the Purchaser to the effect of having inhouse or externally engaged hydrological and hydraulic expertise to
	1. Conduct the river gauging operations to measure the discharges at different river water levels with all the required equipment like current meters, ADCPs, and trained manpower;
	2. Develop the conversion of the river water levels into river discharges, like stage discharge curves for river courses/bridges and co-efficient of discharge for weirs/sluices.

The Bidder shall provide the CVs of the hydrological and hydraulic experts, field operators and the list of equipment. The CVs of these personnel should demonstrate the successful operation of atleast one such assignment.

1. The Bidder shall furnish documentary evidence to demonstrate that the Goods it offers meet the following Purchaser requirement in general and also the Purchaser requirements specified in detail in Technical Specifications of this bidding document. In case the Bidder is not the manufacturer or producer of the goods it offers to supply and has submitted the bid in accordance with ITB clause 19.1 (b), the bid shall include the above information about the manufacturer whose equipments are being offered.
2. The Bidder should furnish the information on all past supplies and satisfactory performance for both (a) and (b) above, in Proforma under Section XI.
3. All the Bids submitted shall also include the following information along with formats under Section XV.
4. Copes of original documents defining the constitution or legal status place of registration and principle place of business of the company or firm or partnership etc.
5. The Bidder should furnish a brief write up backed with adequate data explaining his available capacity and experience (both technical and commercial )for the manufacture and supply of the manufacturer and supply of the required systems and equipment within the specified time of completion after meeting all their current commitments.
6. The Bidder should clearly confirm that all the facilities exist in his factory for inspection and testing and these will be made available to the Purchaser or his representative for inspection. The Purchaser shall decide and propose necessary tests as it may deem fit for the purpose of evaluation.
7. Details of Service Centres and information on service support facilities that would be provided after the warranty period (in the Service Support form given in Section XIV).

Reports on financial stating of the Bidder such as profit and loss statements balance sheets and auditor‘s report for the past three years bankers certificates etc.

**SECTION VI-A : Technical Responsiveness Matrix**

# Technical Responsiveness Matrix

## ARG Station

|  |
| --- |
| Automated Rain gauges (Tipping Bucket Type) |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 10 to 1000 m |  |  |
| Rainfall sensor | Sensor | Tipping bucket with siphon |  |  |
| Material | Corrosion resistant metal (like stainless steel); shock and vibration resistant; insects proof. |  |  |
|  |  |  |  |
| Measuring range/ intensity | 0- 500 mm /hr |  |  |
| Receiver/ collecting funnel diameter | 200 mm±0.3 diameter with machined aluminium 8 inch rim or equivalent |  |  |
| Accuracy | ± 0.2 mm; 2% of intensity (over a period of 15 minutes),  |  |  |
| Sensitivity | one tip at 0.2 mm or 0.01 inch |  |  |
| Serviceability | ability to service tipping bucket gauge without re levelling the gauge. |  |  |
| Contact system | dual reed switch, potted in Silicon rubber |  |  |
| Power supply | 12 V DC or switch rated for 12 V DC |  |  |
| Output interface | as required for the data logger specified below |  |  |

## Automatic Weather Station (AWS)

### Air Temperature Sensor

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 10 to 1000 m |  |  |
| Air Temperature Sensor | Range | 10° C to +50° C |  |  |
| Accuracy | ± 0.1°C or better |  |  |
| Resolution | 0.1°C  |  |  |
| Sensor type | Resistance Type |  |  |
| Response time | 60 seconds  |  |  |
|  |  |  |  |
| Power supply | 12 V DC or switch rated for 12 V DC |  |  |
|  |  |  |  |

### Relative Humidity Sensor

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 10 to 1000 m |  |  |
| Relative Humidity Sensor | Sensor type | Capacitive/ Solid State |  |  |
| Range | 0% to 100 % RH |  |  |
| Accuracy | ±3% or better |  |  |
| Resolution | 0.5% or better |  |  |
| Response time | 60 seconds or better |  |  |
|  |  |  |  |
| Power supply | 12 V DC or switch rated for 12 V DC |  |  |
| Output interface | as required for the data logger specified below |  |  |

### Sensors (Wind, Solar radiation, Pressure)

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
| Site conditions | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 10 to 1000 m |  |  |
| All sensors | Power supply | 12 V DC or switch rated for 12 V DC |  |  |
| Output interface | as required for data logger specified below |  |  |
| Wind speed and direction sensor |  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Sensor type | Ultrasonic anemometer (no moving parts) |  |  |
| Range | 0 to 65 m/s (wind speed), 0 to 360 degree for direction |  |  |
| Starting threshold | 0.5 m/s |  |  |
| Accuracy | 0.2m/s or ± 4% (wind speed), ± 2 degrees (wind direction) |  |  |
| Resolution | 0.5 m/s (wind speed); 1 degree (wind direction) |  |  |
| Solar global radiation sensor  |  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Sensor type | silicon photovoltaic or thermopile |  |  |
| Range | 0 to 1500 W/m²  |  |  |
| Accuracy | ± 5% |  |  |
| Resolution | 5 W/m² |  |  |
| Barometric pressure sensor  |  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Sensor type | temperature compensated |  |  |
| Range | 800 to 1100 h Pa or as determined by sensor elevation |  |  |
| Accuracy | ± 0.5 mb |  |  |

## Data Collection Platform

|  |
| --- |
|  |

### Mast and Supports

|  |
| --- |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
| Mast | Height | as per need (2-5 m) |  |  |
| Resistance to wind  | including guys and all accessories / tools for mast mounting must be able to resist a wind speed of 110 km/hour. |  |  |
| Resistance to corrosion | Corrosion free. |  |  |
| Sensor Supports, Brackets and accessories | Material | Aluminium or stainless steel  |  |  |
| Resistance to wind  | able to resist a wind speed of 110 km/hour. |  |  |
| Resistance to corrosion | Corrosion free. |  |  |
| Lightning Protection | Components | * lightning rod, ground rod and conductors
* lightning / over voltage protection devices for sensors, data logger, transmitter and solar power supply, as required
 |  |  |

### Data logger

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions   | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 0 to 1000 m |  |  |
| Data logger | Model | Well proven and widely used model, produced by a primary brand name and tested in a large number of installations. Provide manufacturer’s certificate that the model proposed has been in production for at least 3 years. |  |  |
| Design | Open design, operating with a wide variety of sensors. |  |  |
| Operating system | multi tasking operating system capable of simultaneous data collection and transmission. |  |  |
| change of setup | change of setup do not affect logged data. |  |  |
| plug and play | plug and play ease of setup using a windows based graphical views. |  |  |
| Flash memory | Non-volatile Flash memory that can one store year of data and expandable to a minimum of 1GB. |  |  |
| resolution | ADC resolution ≥ 16 bit. |  |  |
| recording intervals | User defined recording intervals. |  |  |
| triggering | user configurable alarms (triggering) |  |  |
| voltage level | monitoring of voltage level. |  |  |
| Internal clock | Internal clock with drift less than 2 seconds per day (can be accomplished with GPS specified below) |  |  |
| Input Interface | As required for the sensors |  |  |
| GSM/GPRS Protocol | TCP/IP type capable of sending data based on threshold exceedence as well as responding to queries through GPRS. |  |  |
| Input/ Output interface | Should match minimum requirements of particular application: * for use with AWS, 8 analogue channels and 8 digital input / output channels needed
* for use with only rain gauge single counter input might be sufficient
* for water level recorder digital input through SDI-12
* The SDI-12, RS232 and USB interfaces are required to connect to different purposes.
* output needed for:
1. permanent connection to transmission unit.
2. manual readout.
3. direct data downloading to a USB flash drive without the need for a laptop or data retrieval device.
 |  |  |
| Housing for equipment | Enclosure | for wall-mounting in a shelter / enclosure. protection IP65 (NEMA 4) or better |  |  |
| Software | Operating System | Windows software for system configuration / communication. |  |  |
| language | English version |  |  |
| licenses | All required licenses included |  |  |
| User levels privileges | Different user levels, system of user rights / passwords, access restricted to authorised personnel. |  |  |
| Data security | Redundant storage, periodic automatic backup procedures. |  |  |
| System integrity | System integrity check procedures |  |  |
| Accessories | Accessories | Serial cable + adaptor (if required) for notebook connection. All accessories (fixing units, etc.) as required |  |  |

### Power Supply

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions  | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 0 to 1000 m |  |  |
| Power supply | Common | Common power supply for data logger, sensors, and transmitter. |  |  |
| Input | input power 12 V solar photo voltaic system with the capacity to power all equipments associated with the station. |  |  |
| Capacity | the solar panel and battery must be sized according to the needs of the equipment provided and ensure at least 30 days of full operation without recharge. A power budget indicating how this requirement will be met should be attached. |  |  |
| Regulator | including voltage / charge regulator, a solar regulator for each station to regulate power and maintain optimum battery and data collection platform operation. |  |  |
| battery test indicator | with battery test indicator |  |  |
| On line Status reporting | The balance battery charge available and the number of days it can support all the equipment at a site should be reported everyday live to the Data Centre. |  |  |
| battery chargers | include battery chargers (in: 230 V AC / out: 12 V DC) |  |  |

### Enclosure / Shelter

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions  | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 0 to 1000 m |  |  |
| Enclosure for equipment | equipment | To accommodate data logger, sensor cards, battery and regulator, transmitter unit, over voltage protection devices, etc. |  |  |
| Material | Material should withstand hostile environment and provide protection against vandalism and be agreed with the Purchaser. protection IP65 (NEMA 4) or better. |  |  |
| Locks | safety locks of good quality |  |  |

## Automatic Water Level Station (AWLS)

### Shaft Encoder

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Technical specifications | Specification offered by bidder with brand and Model No | Complied/Not Complied |
|  |  | Manufacturer Name: Place:Tel:Fax:Email: |  |
| Site conditions   | Ambient temperature | 10 to 50 degrees C |  |  |
| Relative humidity | 10% to 100%,  |  |  |
| Altitude | 0 to 1000 m |  |  |
|  Shaft Encoder Sensor       | Type | Shaft Encoder with digital readout. |  |  |
| material | Corrosion resistant metal (like aluminium, stainless steel), shock and vibration resistant |  |  |
| Weather resistance | to operate and with stand harsh environmental and weather condition maintaining the reliability and accuracy |  |  |
| range/ intensity | 1 - 15m |  |  |
| Accuracy | ± 3 mm  |  |  |
| power supply | 12 V DC or switch rated for 12 V DC |  |  |
| output interface |  as required for the data logger specified below |  |  |
| Anti slip and slide | Anti slip and slide arrangements should be there to transfer data from the float/rope to the sensor, without any loss of data. |  |  |
| Accessories  | Supports | Sensor mounting support, cables (power and signal), float, counterweight, wheel, graduated tape (metric) and other accessories as required. |  |  |
| Guide pipes  | Separate PVC guide-pipes and fixing accessories for accommodating the Float and the Counterweight with adequate tolerance and to full measuring range. |  |  |
| Enclosure | Corrosion resistant Lockable (key) box to be mounted within the gaugewell. |  |  |