GOVERNMENT OF WEST BENGAL
IRRIGATION & WATERWAYS DIRECTORATE
BURDWAN INVESTIGATION & PLANNING DIVISION
Purta Bhawan, 3rd Floor, Purba Burdwan - 713103

NOTICE INVITING BUDGETARY QUOTES

NIQ No. : WBIW/NHP/NIQ- 02 /2019-20

Memo No. 213/NHP-02/02 **Dated. 04.06.2019**

Sealed quotations for rates are hereby invited by the Executive Engineer, Burdwan Investigation & Planning Division, Irrigation & Waterways Directorate, Govt. of West Bengal, Purta Bhawan, 3rd Floor, Purba Burdwan – 713103 from the bonafide & resourceful agencies to ascertain unit rates [budget quotes] in connection to ***"Supply, installation, testing, commissioning, training, Operation and maintenance of SCADA based Automatic Operation of Durgapur Barrage"*** as per enclosed schedule.

The Ministry of Water Resources (MoWR), Government of India (GoI) has initiated 'National Hydrology Project (NHP) in which ***"Supply, installation, testing, commissioning, training, Operation and maintenance of SCADA based Automatic Operation of Durgapur Barrage"*** has been planned for monitoring and control of water flow through the main Barrage and head regulators of Durgapur Barrage.

The key objectives of the SCADA consist of the following;

The broad objective of the project is monitoring and control of water flow through the main Barrage and head regulators of Durgapur Barrage.

The SCADA system will receive controlled water discharge information from upstream reservoirs in Maithon and Panchet (about 60-80 Km away), total discharge at Asansol (about 45 Km upstream) and Upstream pond level & downstream discharge from Durgapur barrage based on which SCADA system will decide on the desired level of discharge as per guideline document by using Measurement of Water Discharge in Durgapur and Asansol.

Further, the gates are required to be operated from the barrage control room as per the dynamic operational schedule to be incorporated in SCADA to achieve automatic gate operation of Barrage. To achieve this objective, an agency will be engaged for the following:

1. Automation of the Barrage by installing a suitable SCADA system with remote viewing facility & control the parameters on line from the Barrage Control Room.

2. The control system along-with SCADA Software shall be provided in the Barrage control room (BCR) and the information available at control room (BCR) should also be available on 3 client laptops which shall have a licensed monitoring Client software installed in it having all features for real time monitoring of data from BCR. The Data provided in BCR should be displayed in complete explicit way and can be extracted in different formats it shall have capability of monitoring the real time data of BCR & trend analysis etc.
   Also, through web server all reports (hourly, daily, weekly, monthly, quarterly, half yearly & yearly etc.) shall be available at any PC/Laptop and on mobile located at any place through web with user name & password protection.

3. Four client SCADA software's with real time monitoring function of BCR shall be provided along with laptops with latest configuration as per technical specifications.

Client laptops along with high speed internet connection (4G/3G dongles) shall be provided at Xen office, SE office, Head office (Salt Lake) & one at BCR for configuration purposes.

4. The Contractor shall supply, install & commission all instruments, terminal boxes, cabling & conduits etc. necessary to make the tendered services complete and ready for operation even if these are not indicated explicitly in this document.

5. The main items of control & equipment to be supplied and installed under this section comprise the following:

i) **RTU/PLC** based remote control systems complete in all respect located at Barrage top for Control and operation of spillway gates and silt flushing gates. (Offer of the Bidder shall contain complete proposed SCADA schematic view & control methodology)

ii) **Gate position Sensors** for indication and monitoring of Spillway gates, Intake Gates, Silt flushing gates.

iii) Six (6) sets of **Radar based water level** sensors for Level indication & computed discharge measurement function along with necessary alarms functions at Barrage area and 3 sets for Asansol, maithon & Panchet for monitoring of river discharge inflow to Durgapur barrage.

iv) Data loggers with solar power back up for remote water level transmitters located at Asansol, Panchet & Maithon.

v) VFD (Variable frequency drive) panel for each motor

vi) 2 no. PTZ & 44 no. Bullet cameras for surveillance of Barrage & gates respectively

vii) Master PLC controller at BCR (Barrage Control Room).

viii) SCADA system complete in all respects including Servers, PC, UPS system, printers, 110" LED screen/video wall/ (70", 2X1) DLP based system & IT hardware (static IP, router with modem, firewall system) etc. for Barrage Control Room.

ix) DG Set of 10 KVA as power back up for SCADA system & instrumentation involved in BCR automation.

The Work shall be complete with all necessary auxiliaries such as primary elements (position transmitters, limit switches, sensors etc.), cabling, conducting etc., as well as frames, cantilever (as required), cable trays including all spare parts and special tools required. All the Equipment shall be standard-type from well-known manufacturers

Interested quotationers are required to download all documents related to this quotation papers and submit the same after satisfying the eligibility criteria as given below:

Eligibility Criteria of Bidders:

I Financial Capability

The Bidder shall furnish documentary evidence so 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 not less than INR **150 Lakhs** or its equivalent amount in a freely convertible currency.

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 **300 Lakhs** or its equivalent amount in a freely convertible currency. Period of 5 years shall be reckoned from 31st march of financial year preceding the year in which bid is published.

iii) Further, bidder should be in continuous business of supplying and/ or after sale services of products similar to that specified in the 'Schedule of requirement' during the last 5 years prior to date of bid submission.

iv) Bidder shall furnish the legal status, place of registration and principal place of business of the company or firm or partnership, etc.;

v) Details of experience and past performance on equipment offered and on those of similar nature within the past seven years (Prior to the date of bid submission) and details of current contracts in hand and other commitments to be submitted by the bidder.

vi) The bidder should furnish a brief write-up, backed with adequate data, explaining his available capacity and experience (both technical and commercial) for the supply of the required equipment within the specified time of completion after the meeting all their current commitments.

vii) Reports on financial standing of the bidder such as profit and loss statements, balance sheets and auditor's report for the past three years, bankers certificate, etc.

viii) A firm can submit only one bid in the same bidding process, A bidder who submits or participates in more than one bid will cause all the bids in which the bidder has participated to be disqualified.

ix) Should possess GST Registration.

II Experience and Technical Capacity of Bidder

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

The bidder must have supplied, installed and commissioned & successfully completed PLC/RTU based SCADA system in water sector (Irrigation, water supply, water utility applications in Power industry) with satisfactory operation for at least two years period in any one/two contracts of PLC/RTU based SCADA system of total contract value not less than **Rs.200.00 Lac**

Bidder shall invariably furnish self-attested copies of Work Orders, Completion Certificate and Performance Certificate for two year from the date of installation support of above equipment's for water sector (Irrigation, water supply, water utility applications in Power industry) under Govt./Public sector/Private sector.

III Manufacturer Authorization for equipment's

i) If the bidder is not the manufacturer of PLC/RTU & SCADA (i.e. listed in schedule of requirements),the bidder shall furnish a legally enforceable authorization from manufacturer in the prescribed Form [Section-IV] assuring full guarantee and warranty obligations as per GCC and SCC for the goods offered;

ii) If the bidder, himself is a manufacturer of the equipment's (listed in Schedule of requirements), then a self-authorization suffices.

iii) Further, bidder should furnish the documentary evidence from the manufacturer of the equipment's (PLC/RTU and SCADA) to establish that the manufacturer has manufactured and supplied the 100% quantity of the equipment as specified in schedule of requirements in each of the year during a period of last 5 years from the last date of submission of bid document.

iv) The bidder should have after sales support in the region [within a radius of 500 km from the State Capital]. If bidder does not have any after sales support office within 500 km from state Capital at the time of bidding, he shall require to be establish the

same within one month after successful award of contract [Applicable during IFB for execution]

v) Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or record of poor performance such as, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc. [Applicable during IFB for execution]

The intending quotationer should submit their quotation papers in respective formats enclosing self attested photocopies of valid Trade License , PAN , GST , IT and all required documents regarding credential as indicated above [sl. I & sl. II , under eligibility criteria of bidders] etc. as applicable.

Time schedule of quotation

1) Last date of receiving / uploading filled up quotation paper: **11.06.2019 up to 4:30 p.m.**

2) Date & time of opening quotation: **12.06.2019 after 12:30 p.m.**

Terms and Conditions:

1) The schedule of items and other documents are to be collected by the eligible quotationer free of cost from the office of the Burdwan Investigation & Planning Division, Irrigation & Waterways Directorate, Govt. of West Bengal, Purta Bhawan, 3rd Floor, Purba Burdwan - 713103 or Office of the Superintending Engineer, I& P.Circle–II, Jalasampad Bhawan (5th Floor),Salt Lake, Kolkata – 700091 . The same may also be downloaded from web portals of I.&W. Deptt**.** GoWB **[www.wbiwd.gov.in]**

2) The intending agencies should submit budgetary quotes [including all documents related to credentials of bidders as desired] either e-mail to the following mail address or in closed envelop in tender box at ;

   i. Office of the Superintending Engineer, I & P. Circle – II, Jalasampad Bhawan (5th Floor), Salt Lake, Kolkata – 700091 / e-mail ID: seipc2iwd@gmail.com **or**
   ii. Office of the Executive Engineer, Burdwan Investigation & Planning Division, I & W Dte, Govt. of West Bengal, Purta Bhawan, 3rd Floor, Purba Burdwan – 713103 / e-mail ID: eebipd2012@gmail.com

3) **The intending quotationer should submit their rates after going through all technical specifications and observing all terms and conditions as enclosed with this quotation.**

4) The intending quotationer should submit their rates in a tabular format in excel sheet which has been uploaded. The quotationer should download the excel sheet, quotes their rate in Rupees (INR) both in numeric against each item, sign it and submit either scanned copy through e-mail or in closed envelop in tender box. Any correction in the rates must be duly signed by the quotationers and each page of the schedule are to be signed by the quotationer along with his seal.

5) No quotation paper will be accepted after expiry of date and time mentioned above.

6) Duly filled up sealed quotation with all desired documents is to be submitted / uploaded with a forwarding letter in respective letter heads to the office mentioned above.

7) Accepting Authority i.e. The Superintending Engineer, Investigation & Planning Circle-II, I.&W. Directorate, GoWB reserves the right to accept or reject any or all quotations without assigning any reasons whatsoever.

8) Informal/conditional / partly filled up quotation is liable to be summarily rejected.

9) **No Earnest Money Deposit [EMD] is required to be deposited for this quotation**.

10) **This rate is only to ascertain unit rates [budget quotes] for official purpose only hence no work order will be issued in favour of any agency against this quotation.**

Sd/-
(SOMNATH KUNDU)
Executive Engineer
Burdwan Investigation & Planning Division

Technical Specifications

1. About Durgapur Barrage

Durgapur Barrage is constructed on Damodar River. Its Construction was completed in 1955. There are 10 Nos. under sluice gates, 24 Nos. other bay gates in this Barrage. RBMC and LBMC are constructed on right and left side of barrage respectively, for the purpose of irrigation. Water supply canal off-take from the Left bank main canal is located at approximately 500 feet downstream of LBMC head regulator.

Note: Please read RBMC Head Regulator number as (2) instead of (4).

Fig. 1 A map of the Barrage and Canals (figure in brackets indicate No. of Gates)

Salient Features:

Construction year	-	1952 - 1955
Length of Barrage	-	692 meter
No of Gate	-	24 + 10
Gate Size	-	60 * 18 feet
Design discharge maximum	-	550,000 cusecs
Discharge Passed	-	1,978, 380,000 cusec.
UP Stream H.F.L	-	212.0 Metres
Normal Pond level	-	211.5 Metres
AC Motor on Spillway Gates	-	4 HP 3-Phase

Brief Detail of Canal gates:

Number of Gates on LBMC Head regulator:	8 Gates (20 * 08 feet)
Number of Gates on RBMC Head regulator:	2 Gates (20 * 08 feet)

Dial

The existing gate drive is 3-phase 4 HP AC Motor drive with phase reversal starter panel with RAISE/LOWER/STOP buttons for manual control.

g. 2 Front View of existing control panel

The speed is reduced by a series of gears from 3000 rpm to one revolution in about 20 minutes to drive the drum on which the rope moving the gate is wound. The diagram below shows the display Dial for Gate Position with pointer connected directly to the drum shaft. The drum is located just behind the dial

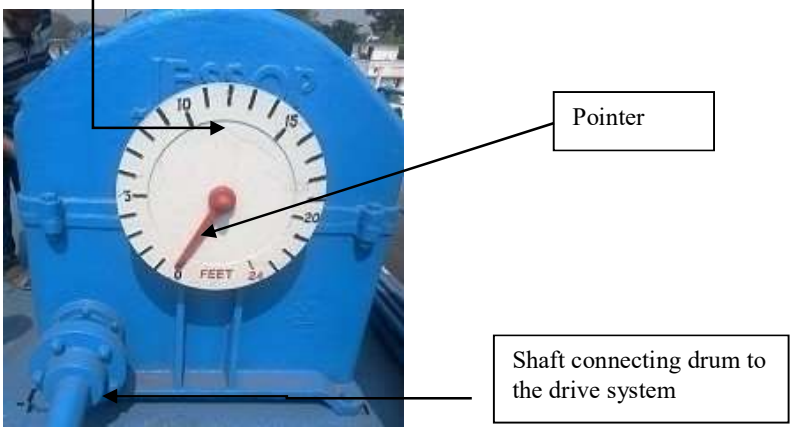

Fig. 3 Display Dial

2. Objective

The broad objective of the project is monitoring and control of water flow through the main Barrage and head regulators of Durgapur Barrage.

The SCADA system will receive controlled water discharge information from upstream reservoirs in Maithon and Panchet (about 60-80 Km away), total discharge at Asansol (about 45 Km upstream) and Upstream pond level & downstream discharge from Durgapur barrage based on which SCADA system will decide on the desired level of discharge as per guideline document by using Measurement of Water Discharge in Durgapur and Asansol.

Further, the gates are required to be operated from the barrage control room as per the dynamic operational schedule to be incorporated in SCADA to achieve automatic gate operation of Barrage. To achieve this objective, an agency will be engaged for the following:

2.1 Automation of the Barrage by installing a suitable SCADA system with remote viewing facility & control the parameters on line from the Barrage Control Room.

2.2 The control system along-with SCADA Software shall be provided in the Barrage control room (BCR) and the information available at control room (BCR) should also be available on 3 client laptops which shall have a licensed monitoring Client software installed in it having all features for real time monitoring of data from BCR. The Data provided in BCR should be displayed in complete explicit way and can be extracted in different formats it shall have capability of monitoring the real time data of BCR & trend analysis etc.

Also, through web server all reports (hourly, daily, weekly, monthly, quarterly, half yearly & yearly etc.) shall be available at any PC/Laptop and on mobile located at any place through web with user name & password protection.

2.3 Four client SCADA software's with real time monitoring function of BCR shall be provided along with laptops with latest configuration as per technical specifications.

Client laptops along with high speed internet connection (4G/3G dongles) shall be provided at Xen office, SE office, Head office (Salt Lake) & one at BCR for configuration purposes.

2.4 The Contractor shall supply, install & commission all instruments, terminal boxes, cabling & conduits etc. necessary to make the tendered services complete and ready for operation even if these are not indicated explicitly in this document.

2.5 The main items of control & equipment to be supplied and installed under this section comprise the following:

i) **RTU/PLC** based remote control system complete in all respect located at Barrage top for Control and operation of spillway gates and silt flushing gates. (Offer of the Bidder shall contain complete proposed SCADA schematic view & control methodology)

ii) **Gate position Sensors** for indication and monitoring of Spillway gates, Intake Gates, Silt flushing gates.

iii) Six (6) sets of **Radar based water level** sensors for Level indication & computed discharge measurement function along with necessary alarms functions at Barrage area and 3 sets for Asansol, maithon & Panchet for monitoring of river discharge inflow to Durgapur barrage.

iv) Dataloggers with solar power Back up for remote water level transmitters located at Asansol, Panchet & Maithon.

v) VFD (Variable frequency drive) panel for each motor

vi) 2 no. PTZ & 44 no. Bullet cameras for surveillance of Barrage & gates respectively

vii) Master PLC controller at BCR (Barrage Control Room).

viii) SCADA system complete in all respects including Servers, PC, UPS system, printers, 110" LED screen/video wall/ (70", 2X1) DLP based system & IT hardware (static IP, router with modem, firewall system) etc. for Barrage Control Room.

ix) DG Set of 10 KVA as power back up for SCADA system & instrumentation involved in BCR automation.

The Work shall be complete with all necessary auxiliaries such as primary elements (position transmitters, limit switches, sensors etc.), cabling, conduiting etc., as well as frames, cantilever (as required), cable trays including all spare parts and special tools required. All the Equipment shall be standard-type from well-known manufacturers.

3. Scope of Work

Scope of work shall include supply, installation, testing and commissioning of all components necessary for implementation of the functional requirements described in Objectives. This will include but will not be limited to Hardware, System Software and Utilities, Application Software, Computers, Switches, Controlling Devices (e.g. RTU/PLC), Data Communication Devices, Field Instruments and Sensors, Device Drivers, Power and Signal Cabling including necessary trenching and junction boxes, Power Supplies, and all structures and fittings necessary for installation of all subsystems and Instruments and Sensors in Control Room and in Field. The following will include in the scope of work:

i) Supply, installation and commissioning of hardware and software necessary for the SCADA system for:

ii) The Automatic Gate Operation and Control of Durgapur Barrage based on water Level/ discharge from Head Regulators at Barrage Control Room.

iii) On-line monitoring & control of Barrage from Barrage Control Room

iv) To protect gates from Accident causes, Access Gate opening control via Remote location (Control Room) and also troubleshoot problems in gate control systems, , unauthorized user protection, information storage of all the events regarding operation of gates, pond levels, reporting system and log information in real time.

v) Controlling of barrage by SCADA system at BCR and real time monitoring & reporting of various parameters of barrage through client software & web server using latest technology of GPRS & GSM.

vi) Electrical grounding for all electronic and electrical equipment should be done by following standard CPWD procedure & all equipment's (Sensor, Controllers etc.) shall be protected using lightening arrestors.

vii) Comprehensive Warranty & Operations of SCADA based System for a period of 5 years is in scope of bidder.

3.1 SCADA System Control Methodology

The Contractor shall supply and install all equipment's along with necessary accessories & installation hardware etc. necessary to make the Automation of Barrage through SCADA to run the gates from control room and acquiring all data of Barrage at local control room and viewing at various designated locations as per specifications, Complete and ready for operation even if these are not indicated explicitly in this document. This proposal is for Supply, Installation, Testing & Commissioning of a SCADA System based on PLC/RTU for the following functions: -

i) Automatic Control of Gates of Durgapur Barrage and head Regulator's LBMC &RBMC situated on DVC River. Besides Automatic Control through Automatic Reservoir Monitoring and Control (ARMAC), Provision for Manual operation of Gates shall be provided at site within RTU/PLC panel & through push buttons.

ii) Monitoring of gate positions with various site operations & safety aspects of the Barrage structures via. CCTV system at BCR.

iii) On Line Measurement & Display of water Level/discharge in SCADA system.

iv) Recording of all the above parameters on line & storage of records for analysis.

v) Generation of customized reports as per the input of Engineer in Charge.

vi) Reporting of all acquired/calculated variables on web pages for information sharing with all authorized personnel.

vii) Real time display of gate positions using solid-state rotary type shaft encoders.

viii) Real Time data monitoring of BCR via client software's at Head office Salt Lake and by Ex-En, SE & CE using laptop & high-speed internet connection.

ix) The individual PLC/RTU system at Head Regulator & barrage gates shall be capable of controlling the gate operations based on the actual measured discharge, scheduled demand requirement & availability of water. simultaneously all PLC/RTU & datalogger systems shall be connected via GPRS/GSM telemetry system to Centralized SCADA system located in Control Room.

The spillway operation shall be based on a strategy of balancing the Reservoir inflow and outflow by continuously checking and comparing measurements.
The specified measuring system shall provide the data (reservoir level, gate position and spillway discharge) to determine the three above-mentioned parameters by the main server in the BCR (Barrage Control Room).

3.2 Design Data:
The instruments shall be designed & supplied based on following criteria.

i) Rated voltage: 230AC/110V, D.C.
ii) Maximum ambient temperature: 50 degree C
iii) Degree of protection for Panels: IP 54
iv) Degree of protection for transducers/sensors: IP 67 /IP65 (as per specification)
v) Special treatment Tropicalized
vi) Transmitter Output Signal- analogue 4-20 mA(2-wire)/RS485/output compatible with RTU/PLC
vii) All instruments & PLC/RTU shall be CE/ UL certified

3.3 Equipment for Remote Control System

All the real-time data from all instruments specified above shall be transmitted and incorporated in the control system located at barrage control room.
Operator station / workstations shall include Server and monitor of latest configuration and latest popular operating system preferably windows, with hard disk, DVD writer and LED (110inch)/ DLP (70", 2X1) /video wall screen as per specifications for operation and monitoring of gate movement. The operator shall be able to view the gate positions or any gate status with the help of graphic display in the screen.
The Control Room shall have Master PLC controller with firm ware based hot redundancy so that the failure of one of the controllers shall not cause any discontinuity in the control system and shall ensure that no loss of data takes place during change over. The bidder shall also provide A3 size colour printer for printing various logs, instructions and reports.

Interlocking shall be provided between Operator's station and local control panels located near the individual gates via hard wiring and GPRS based wireless technology.
At any time, individual gates shall be allowed to be switched over from the automatic mode to local mode of operation, and vice versa, however the operation from the local panel cannot be overruled by the remote/automatic operation stage once the selector switch is set on the local position. Manually adjusted gates shall, when returned to automatic mode of operation, be adapted to their normal functioning in the automatic mode. The automatic system shall work independent of the number of available gates with the same characteristic. If all gates have been changed over to MANUAL, the master controller shall be reset so as to permit a smooth switching-over to MANUAL operation.
All the input display from field including water level of reservoir/Barrage shall be displayed at the Screen. The system shall continuously monitor the reservoir/Barrage level and depending upon this level it shall be able to calculate the input discharge in to the barrage depending upon the profile made available by the user (**OPTIONAL FACILITY**). In addition to this the gate opening of spillway/radial gates should be displayed in the form of graphic display. The system shall be able to display the output discharge through spillway gates so that operation of spillway gates can be carried out in auto mode. This will be achieved using the standard software (ex. FLOWCAL etc.)**.** Necessary inputs for using software &ADCP to calculate the discharge through spillway gates will be provided by the user department. Bidder based on the inputs shall integrate the the discharge rating curve with SCADA system
Formats for various reports & screen displays will be finalized during the detailed engineering stages and bidder shall submit their reporting and screen formats for prior approval from Engineer in charge along with Schematic & control methodology. The software supplied by the bidder should allow any modifications at site without involvement of any other special software.

One uninterruptible power supply (UPS- 1kVA) to provide back up (minimum 2 hours) to the system in case of failure of main power supply to equipment shall also be provided in each remote PLC/RTU Panel. Also, DG Set of 10 KVA shall be provided by bidder as a backup for main power supply to field equipment's & BCR if power failure is more than 2 hours.
For BCR equipment bidder shall provide a 3 KVA online UPS system with 4 hours back up.

3.4 Control of the Barrage and Canal Gates

Barrage Gates	34	Gates
LBMC Head Regulator	8	Gates
RBMC Head regulator	2	Gates

Minimum Control Inputs: 3 for each Gate- RAISE, LOWER and STOP

Note: In case of any problem with the control of the automated system, it should be possible to revert to the manual system of Gate immediately.

Data Acquisition from Barrage Site

The system will acquire the following parameters at specified intervals and store them in a data base. The parameters will be displayed in wide screen monitor.

- **Gate Position and Gate Status (Moving UP/Moving Down/Static) of the following:**

Main Gates	34	Gates
LBMC Head Regulator	08	Gates
RBMC Head regulator	02	Gates

- **Barrage /Pond Level:**

Pond Level in Durgapur Barrage 1 Sensing Unit

- **Automatic Weather Station (AWS) Parameters:**

Air Temperature	1	Sensing Unit
Relative Humidity	1	Sensing Unit

Rainfall	1	Sensing Unit
Air Pressure	1	Sensing Unit
Wind Direction & Speed	1	Sensing Unit
Solar Radiation	1	Sensing Unit

- **Video Surveillance System**

Barrage Gates	34	Bullet Cameras
LBMC Head Regulator	08	Bullet Cameras
RBMC Head regulator	02	Bullet Cameras
Complete Barrage Overview	02	PTZ Cameras

The location of the camera should be decided in consultation with site Engineer of the purchaser such that operation of each gate is clearly visible by cameras.

- **Water Discharge (Gate wise and Total)**

Barrage River Discharge	2	Computed Parameter
LBMC Canal Discharge	1	Computed Parameter
RBMC Canal Discharge	1	Computed Parameter

- **Remote Inputs to be integrated in SCADA System:**

Water Level of Asansol	1	Remote Input
Water Discharge in Panchet Dam	1	Remote Input
Water Discharge in Maithon Dam	1	Remote Input

In general, while designing the system, the Bidder will conform to:

- Use of state of the art and reliable technology suitable for 24x7 operations
- Modular design and ease of maintenance

Maximum No. of gates controlled by a field level gate control unit shall be 4. The device should preferably be an intelligent device (here as Slave Gate Control).

It is mandatory that the successful Bidder will submit a detailed description of the proposed system in each location complete with Block Diagram clearly indicating individual subsystems /units /instruments /sensors and their interconnections and how the proposed system will address the requirements referred in the technical specifications and features.

3.5 Scope of Work at Remote Stations

Radar type water level sensor shall be provided at Asansol, Maithon & Panchet in downstream of dam along with GPRS /GSM based Datalogger with Solar power system, which shall transmit data to SCADA on real time basis with configurable sampling interval.

Asansol, Maithon & Panchet Water Level Monitoring Site will be treated as a remote station for the SCADA. Water Level Data shall be received in the Control Room of Durgapur Barrage and Water Discharge will be computed and displayed in the SCADA and saved in the Data Base.

4.0 Technical Specifications of SCADA system & instrumentation

4.1 Water Level Measuring Systems

The bidder shall design, supply and install best quality Level sensors considering the following points.

a) Radar type level measuring system shall comprise of radar type level transmitter, and any other item required to complete the level measurement loop.

b) Radar based reservoir/ pond level measurement & downstream level of main barrage & Head regulator. These points are to be selected so that most accurate measurement level is obtained. All accessories along-with cage to avoid theft and Monkey Menace and also proper mounting arrangement (cantilever etc.) for these instruments shall be supplied by the bidder.

c) The level sensor shall be suitable for flange or thread mounting as required. The installation shall avoid any degradation of instrument performance due to spurious reflections, absorption and condensation. Facilities shall be provided for rejection of spurious reflection.

d) The radar type level instrument shall have the facility for dampening/ averaging the effect of waves, undulations on the water surface and discriminate the rate of change of levels to provide steady readings.

e) All necessary instruments, interconnecting wiring, HDPE/GI pipe work, housing, cabling, panel, etc., shall be provided according to the type of equipment proposed to supply in the Tender and accepted in the Contract. Adequate safety measures shall be included in the design of these sensors to negate the effects of disturbances due to turbulence of water levels, strong air currents & electromagnetic waves etc.

f) The Technical Details are as follows:

Feature	**Value**
Site Conditions	
Ambient Temperature	From 0 ºC to + 50ºC
Humidity	
Sensor	
Sensor Type	Microwave non-contact sensor,
Range	30 meters
Resolution	3 mm or better
Accuracy	0.02 % FSO
Output Interface	SDI-12 / RS 485 / 4-20 mA
Power Supply	2 wire type, to be powered from PLC/RTU/Datalogger (locally)
Protection	IP67 or better
Enclosure	Die cast aluminium or any corrosion resistant metallic enclosure
Isolation	circuits shall be galvanically isolated from each other.
Display	Digital Read out at site LCD / LED Display
Manufacturer Calibration Certificate	Required
Beam angle	Less than 12 degrees.
General Features	
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 with proper HDPE/ GI Pipe conduiting, cables and other accessories as required
Mounting/Installation Arrangements	Above FRL, below a bridge girder wherever available otherwise horizontal cantilever arrangement from a mast/wall/pedestal to be provided
Radar Sensor should have inbuilt diagnostic feature & averaging function	

4.2 Gate Position Measuring System

Suitable sensors shall be provided for exact measurement & indication of position of spillway radial gates, intake gates & silt flushing gates. These sensors shall be equipped with suitable shaft couplings and electronic circuits to transmit the signals to the SCADA System via remote PLC/RTU for indication in BCR & for further processing. All sensors are to be mounted in the outdoor locations. Hence, suitable protection class of the enclosures shall be ensured. Minimum IP65 protection class shall be provided. Suitable safe & reliable arrangements of coupling with the motors of gates shall be provided. It shall be ensured that there is no slippage between the motor shaft & the transducers.
The bidder shall provide the gate sensors with following minimum specifications.

Feature	Value
Site Conditions	
Ambient Temperature	From 0 ºC to +50ºC
Humidity	5 to 95 % (non-condensing)
Sensor	
Sensor Type	Shaft Encoder based rotary position sensor with minimum 4" Digital Display
Range	1-20 meters
Resolution	3 mm or better for gate position
Accuracy	0.025 % FSO
Output Interface	SDI-12 / RS 485 / 4-20 mA compatible to PLC/RTU
Power Supply	2 wire type, to be powered by RTU/PLC
General Features	
Material	Corrosion Resistance Metal (Stainless steel or Aluminium)
Enclosure	Lockable (key) box provided by the supplier to be mounted on sensor, with IP65 or better protection.
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Mounting	Wiring from sensor to RTU/PLC must be through HDPE/ GI Pipe Conduiting or flexible metallic conduiting as applicable
Display	Read out LCD / LED Display
Process connections	through suitable coupling
Manufacturer's Calibration Certificate	Required

4.3 Automatic weather stations at BCR

The Automatic weather station shall be placed at Barrage which shall be connected to Main PLC controller placed in BCR. The Automatic weather station shall be provided with following minimum specifications.

Feature	Value
Site Conditions	
Ambient Temperature	From 0 to +50 Degree C
Humidity	5 to 95 % (non-condensing)
Altitude	0 to 2500 meter
Automatic Rain gauge	
Sensor Type	Tipping Bucket type with reed switch
Range	250 mm/h or better
Resolution	0.5 mm or better
Accuracy (Intensity)	2% or better, ± 2 mm
Output Interface	SDI12/ RS 485 / 4-20 mA/Switch closure output
Material	Corrosion Resistance Metal (Stainless steel/ Aluminum)
Enclosure	NEMA 4 or IP65
Certification	IMD/ WMO certification shall be provided.

Protection	Bidder shall provide spout filter and bird cage to prevent ingress of insects and debris
Air Temperature Sensor	
Sensor Type	Platinum resistance or better or equivalent
Range	0 to 50 Degree Celsius
Resolution	± 0.1ºC
Accuracy (Intensity)	Within ±0.2ºC in the entire working range
Response Time	10 secs or lesser
Relative Humidity Sensor	
Sensor Type	Capacitive/ Solid State Humidity Sensor
Range	0 to 100 %
Resolution	1%
Accuracy	±3% or better
Power Supply	To be powered by PLC Located at BCR
Response time	10 secs or lesser
Wind Speed and Direction Sensor	
Sensor Type	Ultrasonic sensor (No moving Parts)
Range	0-60 m/s for speed and 0–359 degrees for direction
Resolution	0.1m/s for Speed; ±1 degree for Direction
Accuracy	±0.5m/s or better for wind speed; ±5º or better for wind direction
Response time	Less than 1 second lag in operating range
Mounting	All accessories for mounting the instrument e.g. special cross arm clamps or flag if any shall be provided.
Air Pressure Sensor	
Sensor Type	Temperature Compensated
Range	600 to 1100 hPa
Resolution	± 0.1 hPa
Accuracy	±0.2hPa
Power Supply	To be powered by PLC Located at BCR
Solar Radiation Sensor	
Sensor Type	Silicon Pyranometer
Threshold	120 W/m2 of direct solar irradiance
Methodology	Alternate shading of sensor to account for sky radiation or sunshine duration shall be computed in PLC/SCADA system
Spectral Range	400nm to 1100 nm
Range	0-2000 W/Square meter
Resolution	1 W/Square meter
Accuracy (Including Temperature Compensation)	3% or better
General Features	
Material	Corrosion Resistance Metal (Stainless steel / Aluminum)
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
Power Supply	To be powered by PLC/RTU
Enclosure	NEMA 4 or IP65
Certification	IMD/ WMO certification shall be provided.
Output Interface	SDI 12/RS 485/ 4-20 mA/Analog/Compatible with RTU/PLC

4.4 Surveillance System

Primary Purpose of Surveillance system is to view gate movement from Control room. Operator should be able to see that the gates moves up/down or stop when the appropriate command is given.
Bullet cameras IP based shall be placed to monitor the position of all the gates & PTZ cameras shall be installed on the main barrage in a way to ensure the complete monitoring of the Barrage. The same shall be connected with NVR (Network Video Recorder) which shall have a memory of at least 30 days. Cameras shall be connected to internet, to have its accessibility from farthest point through IP address.
The cameras shall have a provision of connecting with NVR through hardwiring using video cable (RG-6 coaxial cable)/OFC and simultaneously through wireless connectivity.
The following minimum features shall be available in CCTV system

i) **Bullet Camera** (Fixed Type)- IP based Night Vision (I.R.) Out door Weather Resistant, 2 Mega Pixel,72 LED Color Camera.6 or 8 or 12 MM (According to site suitability) 2 MP Auto Iris Lens in Elegant Metal Die Cast Housing. Outdoor weather resistant IP 66.

ii) **Pan Tilt Zoom** (PTZ) 36 X Optical and 12 X Digital Zoom; 2 Mega Pixel IP (DIGITAL) Sensor, 500 mtrs. Night Vision (Multiple Intelligent Array system) in IP66 Weather Resistant Outdoor Metallic Housing.

iii) Standalone **NETWORK VIDEO RECORDER** (NVR) 32 Channel 1080 P Full HD, Real time Recording and Reviewing in H.264 Compression Format. With HDD. Remote Viewing Capability thru Internet /Android /Apple /Mobile App Xmeye /CMS software with password protection & user name.

iv) Necessary mounting arrangement like MS/ GI Poles 4/6/8 1nch Dia Medium Grade Pipe of Standard Make with suitable length along with junction box & other accessories as per the suitability shall be provided by the bidder for installation of CCTV system.

4.5 Data Logger with 2 channel Inputs

The datalogger with 2 channel input shall be provided by bidder at Remote monitoring stations for data logging & transmission on real time basis with following minimum specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From 0 to +50 Degree C
Humidity	5 to 95 % (non condensing)
Sensor Interface	
Input type	2 channels, compatible with outputs of sensors as specified in BOQ
Input - Output Interfaces	
Data Transfer	USB stick option for Data transfer
Port for Configuration	One Serial Port (RS232) for communication with Laptop for programming
Port for Telemetry	1 Ports for Communication with Telemetry (GPRS/GSM) device
Computer Software	
Operating System	Windows software for system configuration / communication
Version	English language version
Licenses	All required licenses shall be included
Analog to Digital Converter	
Resolution	16 bit or better
Sample intervals	1 Sec to 24 hours (user scalable)
General Features	
Flash memory	Minimum 1GB Non-volatile Flash memory that can store one year of data and shall be expandable
Resolution	A/D resolution ≥16 bit
Firmware Operating System	Multi-tasking operating system - must log data and transmit at same time

Display	Inbuilt Digital Display for viewing current data and setting values
Power Supply	Shall be powered by solar Power supply to be provided by bidder
Battery Voltage	Monitoring of battery voltage level
Internal battery	Internal battery backup for clock, lithium battery, storage 2 years
Charge Controller	Internal or External
User Permissions	Different user levels, system of user rights / passwords, access restricted to authorized personnel
Keypad	For displaying or transferring data to memory stick, configuration of data logger and sensors
Real time clock	GPS synchronized
Enclosure	for wall-mounting in a shelter / enclosure with IP65 protection or better
Accessories	Serial cable + adaptor. 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).
GPRS MODEM	
Operating Temperature	From 0 to +50 Degree C
Performance	Data Reception availability of 95% or better
Form factor	The GSM /GPRS modem 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 network for two-way TCP/IP (INTERNET) connection and SMS
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, FTP, SMS to transmit and receiving data to the Data Center
Accessories	All associated equipment, including Antenna all cables and mounting hardware
Antenna features	
Frequency range	900 MHz: 824-960 MHz/1800MHz:1710-1880 MHz, 4G and better
Radiation	Omni-directional
Operating temperature	0 to + 50 degrees Celsius
Connector	SMA or suitable RF connector adaptable to GSM/GPRS modem
Cable length	As required at site

4.6 Remote PLC/RTU:

CE/UL approved manufacturer's Remote Terminal Unit/Programmable Logic Controller (RTU/PLC) in IP54 enclosure having modular PLC/RTU (Plug and play type) for control & monitoring with Modular Controller and should have modular communication. The PLC should be able to communicate to the master controller on an open protocol such as Profibus / Modbus over ethernet TCP/IP using OFC cable & bidder shall provide the memory map of the same for III party etc. simultaneously the remote PLC/RTU shall be able to communicate with BCR via GPRS based wireless technology in order to create redundancy in telemetry to avoid loss of communication & Data. It should be possible to view the reports of SCADA system without requiring any software, from any PC, using web-based protocols. Data logs should be stored inside the CPU and should be downloadable in CSV format. It should be possible to increase the I/O handling capacity of the PLC/RTU, without changing the CPU. Maximum number of gates that shall be controlled by a single PLC/RTU shall be 4. The remote PLC/RTU shall communicate to the central monitoring station on Optical Fibre Cable. It should be possible to remotely program the PLC/RTU from the control room. Each CPU shall be shall be tested to work in a temperature range of 0 to +50 degree Celsius. The CPU shall have integrated non-volatile memory capacity of not less than 1MB & expandable memory up to 4MB using memory card. All must be complied with IEC-611131-03 and IEC 61158(4-20Amp). Suitable industrial grade AC to DC Power Supplies shall be mounted inside each PLC/RTU. Each PLC/RTU shall have separate

power supplies for electronics and field. Surge Protection Device shall be provided inside each PLC/RTU, to safeguard against transient & lightening surges.

i) Industrial grade Fibre Optic convertor shall be housed in each PLC/RTU for optical communication between PLC/RTU & central controller. Each PLC/RTU shall have GPRS modem for wireless based communication with BCR.

ii) Each PLC/RTU shall also be integrated with up to 4 no. digital drive starters panel and capable of operation at up to 50 degrees Celsius. The PLC/RTU equipment shall be housed in a properly sized, weather-proof panel and must be protected with lightening & surge arrestor.

The PLC/RTU shall be designed as per following minimum specifications

A. Panel in Climatic Conditions:

The panel shall be fitted with two cooling Fan with filters, and protection, for better control of internal temperature. The individual cooling fans shall be controlled /switched ON/OFF by the PLC/RTU according to the application requirement.

B. **Temperature Monitoring**

The PLC panel shall be fitted with the temperature sensor/ thermostat and shall be connected to the monitoring system. The monitoring system shall continuously monitor the panel temperature, and if it exceeds the set value, it shall automatically switch ON the cooling Fan's. The cooling
FAN shall be Switched OFF after the temperature of the panel is brought back to normal level.
In case of Emergency Sequence of power back-up, the cooling FAN shall be switched OFF to save the power.
The PLC/RTU shall be capable of monitoring and controlling the temperature inside the panel and shall transmit the following information to the central control room.
i. Panel temperature
ii. Status of cooling Fan's

C. Power Supply Scheme
Protection shall be provided in the input side of the mains power supply as follows;

i. Input mains Fault Protection MPCB: The proposed system mains power supply fault level protection shall be 100kA. The mains input shall be protected using MPCB (with adjustable current limiting) and auxiliary signaling contact. Auxiliary signaling contacts shall monitor the Healthy/Trip condition of the MPCB. The signaling contact status information shall be updated in the control room.

PLC/RTU can be provided with Isolation transformer for 415 to 230 Vac. Also, the relay board/contactor switches to be installed for acquiring the status of electrical parameters shall be from reputable manufacturers with better standability against voltage fluctuations.

ii. **Control Voltage**: The proposed PLC/RTU system control power supply voltage shall be 24V-48VDC and the same shall be derived with the use of SMPS Power Supply Unit. The SMPS input power shall be protected with suitable MCB. The power to the input of the SMPS
shall be switched ON/OFF from the PLC/RTU through Auxiliary relay contact. The panel control switch gear, PLC/RTU unit, Communication unit, HMI Screen Panel, indication lamp, hooter, instruments, Auxiliary Relays, Signal Conditioners/isolators, etc shall be energized by control voltage of 24V -48V DC.

D. **Power Supply On/Off**

All the field instruments integrated with each remote PLC/RTU, shall be connected to the single power supply bus and energized with the control voltage supply of 24V-48 VDC. The PLC/RTU according to the application program (periodically) shall switch OFF the control voltage supply via the DC contactor, and Switch ON the control voltage supply after a programmable time delay by actuating the DC Power contactor and the use of programmable mechanical/electrical timer switch gear unit automatically to clear the memory and other floating memory locations errors, warning, faults, etc. Ultimately it shall Reset (Power-ON-Reset) the PLC/RTU.
The Power Supply ON/OFF function command shall be activated manually locally, or from the remote central control room PLC and/or through timer fitted in PLC. The event shall be recorded in the database and suitable reporting system shall be implemented.

E. **GPRS Communication Network**

The proposed Intelligent GPRS communication unit shall have GPRS communication network capability.

Reliable Integration: The modem should be tightly integrated with the PLC/RTU network.
Failure of Global System for Mobile Communications: The PLC/RTU should store data in buffer memory of at least 2MB if unable to transfer due to maintenance of Global Packet Radio Service of the service provider or power failure in the cell towers etc. Data shall be transferred to central location in secure manner. i.e. No data loss in case of no connectivity.

F**. PLC / RTU:**

The PLC should have inbuilt RTU functionality with a support for USB/RS 485/RS232/Ethernet port Modem connection.

The PLC/RTUs shall have minimum communication ports as follows:

i) Two Ethernet ports for connectivity to Master Station

ii) 1x RS232 ports for the PLC/RTU maintenance and configuration. It shall be possible to increase the number of communication ports in the PLC/RTU by addition of cards, if required in future.

iii) PLC/RTU shall be designed with cyber security features based on IEC 62443-4-1 & shall have international certification (for ex. certification Level II or equivalent).

iv) The access to the Server shall be restricted with passwords both at Windows level and at Application Level. Also, all the data should be stored in a separate file system which can be independently accessed by the Remote Network without disturbing the PLC/RTU operation and thereby maximizing the cyber security.

v) The PLC/RTU should support for follow minimum features:

- Should have the facility for the Force Simulation
- Facility of Forcing Input /output variables when the physical devices are not functional
- Should have user access with pass word protection
- Should have the facility to program the PLC/RTU for all the different phases
  a) Startup phase
  b) Normal operation phase
  c) Shut down phase
- The PLC/RTU based SCADA system should have the facility of the Web Server, the same shall be audited by NIC & hosted by NIC server in order to minimize the cyber security issues.
- The PLC/RTU should support firmware upgrades through network.
- The PLC/RTU should have facility of storing intermediate variables
- Program protection feature, network filter setup, Operation log function, function removal feature should be available
- User authentication, user-based operation restriction, and CPU operation restriction should be available.
- The CPU should be fast enough and capable of multi-tasking capabilities like running various tasks at different programmable cycle times.
- The CPU should have minimum 1 MB RAM to cater to current and future program additions.
- The PLC/RTU shall support all the file operating functions so that CSV file log can be stored in the basic CPU memory/buffer memory of GPRS modem for maintaining the log in case of network connection failure.
- The PLC /RTU shall be designed to a modular concept, with separate modules for each function. The modules shall be rack mounted and may be quickly exchanged for field repair. It shall not be necessary to remove field wiring in order to exchange a module. The PLC/RTU shall support a wide range of input /output signals including status inputs, pulse (accumulator) inputs, analogue inputs, analogue outputs, and control outputs. The PLC/RTU shall support any combination of the above I/O points.

• It shall be possible to add PLC/RTU's and software enhancements in the future, without taking the system out of service. The design and physical layout of the PLC/RTU equipment shall be on a modular basis, so that extra facilities, such as an increase in the number of status points or analogues, may be added with minimum of disturbance.

• The PLC/RTU shall be expandable by simply adding I/O modules to the system bus. Other than user-friendly configuration of the new modules, no additional PLC/RTU software or firmware shall be required.

• The operational status of the PLC/RTU shall be indicated on the front panel of the processor module by means of LED lamps. In addition, each I/O card shall have LED status indication.

• Modbus TCP/IP on Ethernet /Profibus (IEEE 802-3) communication shall be provided for PLC/RTU network interconnection towards Master station.

• SCADA System is to be capable for configuring and programming of PLC/RTU remotely, from Control room.

G. Microprocessor /Microcontroller Module (CPU)

- Built-in minimum 1MB RAM should be available for storing Data and log records as files. Memory Card of minimum 4 MB is supported for storing data, programs and log records as files Built-in Ethernet port should be available;
  In addition to normal scanning, CPU module should have an independent multiple constant scan function capable of a maximum scan speed i.e fast response should also be achievable.

- CPU should have a compact body

- CPU should have facility to be programmed in minimum 4 different languages like Ladder, Function Block, Sequential Flow Chart, Instruction List.

- Large-capacity programs and large device sizes shall be supported to cope with advanced, complex control applications.

- A rich set of functions should be provided to facilitate program debugging and maintenance. For example, a forced SET/RESET function independent of program processing results.

- PLC/RTU shall employ solid-state technology and use an industrial standard, suitable for operation in an aggressive environment with high levels of temperature, humidity and dust being common. It shall operate correctly up to a temperature of 50 degrees Celsius and up to 95% non-condensing humidity.

- On-board battery backed Real Time Clock (RTC) is required. The RTC will operate on the battery power even when the main power is lost.

- The PLC/RTU shall have a separate watchdog circuit independent from the main processor, which will reset the system if the firmware program fails in any way. The watchdog circuit shall be capable of being enabled or disabled by means of a jumper or by software.

H. Communications Interfaces

- Communication interfaces shall correspond communications between the central PLC and distributed PLC/RTU units, via hardwired OFC cable and GPRS wireless technology.

- Adequate number of process Bus (Profibus/Modbus over ethernet TCP/IP) Communication Ports shall be configured for communication interfacing to intelligent Instrumentation. Serial communication RS232 Port/Ethernet for local laptop connection shall be available as well.

- The RTU/PLC at gates shall be communicating to BCR primarily through Optical Fiber Cable (OFC). It should possible to remotely program RTU/PLC from the control room. Industrial grade optical fiber convertor shall be housed in each RTU/PLC at gates for optical communication between RTU/PLC and central controller.

I. PLC/RTU I/O Facilities

a) General

- PLC analogue and digital inputs and outputs shall meet the requirements of test voltage of class II of IEC 255-4 appendix E.
- The PLC /RTU's should be of modular structure, equipped with separate I/O modules foreach type of I/O signals, as follows.

b) Analogue Inputs

Analogue inputs shall be capable of accepting current signals of, (4-20) mA, with overrange capabilities and support for 2/4 wire communications.

All components used in measuring circuits that affect accuracy shall be of high stability and low temperature coefficient.

A/D conversion shall be provided on each analogue module. The module scan cycle shall be rapid so as to satisfy the overall analogue response time specified to the master workstations.

It shall be possible by means of the PLC/RTU configuring software, to modify the signal dead-band, so that fluctuating signals are not continuously reported to the Master Station.

c) Digital Inputs

Digital input modules shall be optically isolated. Digital filtering to suppress contact bounce shall be provided. In addition, software filtering of two successive cycles shall enable confirmation of state.

To reduce data transmission, time tagging shall be selectively applied. Only some inputs shall be time tagged at the PLC/RTU, but other inputs shall be time tagged on arrival at the Master Station.

d) Digital Outputs

- The digital output modules shall support isolated outputs in, latched and BCD mode. Individual LEDs will indicate the status of each output. The outputs shall be isolated to at least 500VDC Controls transmitted between the control station and the PLC/RTU shall comprise a select, check-back, execute sequence (or other means of providing high message security). On receipt of a select message, the PLC shall prepare to operate the output relay, and then return confirmation of correct selection of the relay to the Control Station. This signal shall be obtained as far as possible and shall be generated locally, not derived from the incoming signal. On receipt of the execute command, the output relay shall operate and confirmation of execution shall be returned to the SCADA Control Station.

- Not more than one digital output shall be possible at a time. Selection of two or more contacts simultaneously or in quick succession without one having been completed, shall result in cancellation of both requests and return an alarm to the Master Station.

- Software interlocking schemes shall be applied with reference to process requirements.

e) Analog Outputs

- The PLC shall support analogue set point outputs. These may be used to issue controls directly to controllers, or to drive displays.

- Analogue outputs shall generate (4-20) mA DC output signals into a minimum load of 500 Ohms at a nominal operating voltage of 24V DC.

- Simultaneous operation of individual digital outputs shall be provided, where this facility is required. Set point outputs shall provide the security to ensure that false selection of controls is minimized, similar to individual digital outputs.

f) Dummy Control

To provide test facilities, a remote dummy control shall be provided. The dummy controls and associated status indications shall be allocated with discrete addresses and operate as if they are real equipment. To set up a dummy control a PLC/RTU with dummy control set up for training of operational staff shall be provided.

J. PLC/RTU Operation Features

a) Operation with Control Station

- PLCs shall have their own unique address and not transmit information to the Control Station without the request. In order to reduce communications channel load, PLCs/RTU shall incorporate data transmission reduction methods. PLC/RTU shall reply to each interrogation on a “Report-by-exception” basis with the Control Station, also being fully updated on a regular basis. Digital input data shall only be transmitted when the status has changed since the last pool interrogation. Analog values shall be transmitted when a defined percentage change occurs from the last transmitted value. Each PLC/RTU reply shall automatically include the verification of the address in the response.

- Full details of the management of digital and analogue data input shall be submitted for approval.

- PLC/RTU's shall be also available to be polled at any time from the Control Station, either on a periodic basis or on operator command. In case of polling, all inputs may be scanned.

- Control messages from the Control Station, shall be capable of being initiated at any time to control the barrage, and shall have priority over all other messages.

b) Automatic Restart

Following power interruption and /or communications failure, the PLC/RTU shall be arranged to restart automatically. This may be accomplished by retaining memory in non-volatile store.

K. Local HMI Facilities

The remote PLC/RTU system shall be equipped with adequate operator panel to enable monitoring and control for the operator at the barrage level.
The operator panel shall be preferably accomplished by means of LED/LCD backlit display of 7 inches or above at Local Control Stations & 12" at Central PLC. The graphical LED/LCD should be easily detachable such that its failure does not affect the PLC/RTU functionality.

L. PLC Programming

- PLCs shall be reconfigurable from either a locally connected portable programming device /laptop, or remotely over the communication links from the control station.

- Configuration changes shall be protected by access codes. Option for download & reconfiguring of PLC/RTU software from control Station is required.

- User-friendly designed PLC/RTU programming editor supporting all IEC 61131-3 programming languages shall be included in the set of engineering software. For local process control, the PLC shall support open PLC programming standard, according to IEC 61131-3, including five main programming methodologies:

  • Ladder Diagram (LD)
  • Function Block Diagrams (FBD)
  • Instruction List (IL)
  • Structured Text (ST)
  • Sequential Function Charts (SFC)

- PLC/RTU application software shall be installed in contiguous PLC/RTU memory data area, in order to ensure sufficient PLC/RTU computing speed. The PLC memory shall be sized to ensure it is not more than 50% occupied and that maximum occupancy does not significantly slow down the computing functions.

M. PLC/RTU Process Operation

- PLC/RTU shall be enabled for effective SCADA monitoring, control and data transfer with control station, as well as for local PLC /RTU level closed loop process control, control logic and other local automation applications.
- The PLC/RTU shall be controlled by application software making it capable of the following minimum functions:
  • Command outputs
  • Select before operate feature
  • Digital filter
  • Adjustable chatter frequency
  • Time-tagging of events
  • Alarm handling

The PLC shall be of Industrial grade with the IEC Certification.

4.7 1KVA UPS for each remote RTU/PLC as a power back up

1 KVA Ups shall be installed in each Local PLC/RTU panel to provide a power back up of minimum 2 hours, with following minimum specifications:

Features	
Capacity	1000VA / 600W
Voltage Range	140VAC-290VAC
Compact Size	YES
Boost and buck AVR for voltage stabilization	YES
Auto restart while AC is recovering	YES
Simulated sine wave	Modified sine wave
Off-Mode charging & Cold start function	YES
INPUT-	
Nominal Voltage	230Vac
Frequency Range	50Hz
OUTPUT-	
AC Voltage Regulation (Batt. Mode)	230VAC ± 10%
AC Mains Frequency (Batt. Mode)	50Hz ± 1%
Transfer Time	Typical 4-8ms
Waveform (Batt. Mode)	Modified sinewave
BATTERY-	
Battery Type	12V/ 7Ah x2
Minimum Backup Time	2 hour
Typical Recharge Time	Shall be less than 8 hours up to 90% capacity
INDICATORS-	
Battery Mode	Yellow flashing
AC Mode	Green lighting
ALARM-	
Battery Mode	Sounding every 1minute

Low Battery	Sounding every second
Overload	Sounding every 1 second
Fault	Continuously Sounding
Output Sockets	India output
ENVIRONMENT-	
Humidity	0-90% RH @ 0-40degC (non-condensing)

4.8 RTU/PLC Enclosures / Housing boxes of protection protocol of IP54 and above

A. Enclosure for PLC/RTU

- Factory fabricated to requirements, lockable doors, dead-front, self-supporting.
- Cabinets shall consist of a rigid self-supporting structure constructed of not lighter than 2 mm thick, cold rolled, stretcher levelled sheet steel, braced rigidly where required with structural members. Panels and doors shall be constructed of the same weight and type of material as the housing. Housings, including doors and panels, shall show no evidence of warping, weaving, or distortion upon completion of installations.
- All cable entry in to the panel shall be form bottom using cable glands of adequate size.
- The panel shall be provided with forced fan cooling system as a standard.
- The internal panel layout must be designed considering proper approach to the PLC/RTU, instruments, relays, terminals and other accessories for maintenance
- The Cubicles should in sheet steel construction, free floor mounting with front and back access. The doors and side covers should be of 2- mm thick sheet and all load-bearing members are 2 mm thick.
- Arrange doors with minimum 90- 105 degrees open position and with stops. Construct doors so that they neither weave nor warp; provide stiffening members where necessary to ensure rigidity.
- Provide ample duct space for adding and removing wiring from the top.
- Dimensions – As per site requirement & as approved by Engineer In charge.
- Lock System: Slam lock /Screw Fixed - with common key or unique key.
- The cabin shall be provided with power distribution units with sufficient number of sockets to provide power to equipment's hosted inside the cabin
- Provide channel base for mounting.

B. Equipment Arrangement

- Wiring ducts to provide easy access for inspection and maintenance.
- Design and arrange ducts and terminal blocks to accommodate bottom entry to cabinet for control, alarm, status, power, and instrumentation cables, as required.

C. Ground Bus

Provide continuous copper bar ground bus, size not less than 6 mm by 25 mm along the full length at the rear of the panel.

D. Nameplates

- Engraved 20-gauge metal/baked enamel or phenol plastic, black background/white letters, drilled for screw mounting with round head screws.
- Provide nameplates for all equipment, instruments, power supplies, relays, circuit breakers, fuses and other devices furnished and mounted in the cabinet. Provide nameplates for each device on panel interior door.
- Submit size, type, and wording for authorties approval. All nameplates shall be in English.

E. Terminal blocks

- Terminal blocks for switchboard control wiring shall be rack mounted screw clamp type.
- Provide white or other light-colored markers to the terminal block, for terminal designations.
- Make no more than two connections at each terminal point.
- Confine switchboard internal wiring to one side only of the terminal block. The other side shall be reserved for incoming leads.

- Twenty percent of terminal points in each panel section shall have no connections and shall be designated as spare terminals.
- Form control wire bundles without sharp bends and support adequately.

F. INDICATING LAMPS

The indicating lamp assemblies shall be a heavy-duty type with color caps. Indicating lamps shall be suitable for AC/DC power supplies, utilizing long life incandescent type lamps.

G. LIGHTED PUSHBUTTONS

Each lighted pushbutton shall be mechanically interlocked, illuminated type. Lighted buttons shall be the recessed guarded type to preclude inadvertent operation. Gate control lighted pushbuttons shall be furnished with a flasher so the lamps will blink at a 1-second on and off rate when the maintained pushbutton is operated.

H. PUSHBUTTONS

Each unit shall be a maintained contact type. Pushbuttons shall be the recessed guarded type to preclude inadvertent operation.

I. RELAYS/Contactors

Auxiliary relays: The auxiliary relays shall be in accordance with IS standards and shall be machine tool or industrial type. The relays shall have convertible contacts and shall be self-resetting. A minimum of two spare contacts shall be furnished on each relay.

J. SPECIAL TOOLS

The bidder shall furnish any special tools that may be required to allow proper connections of wiring to devices and all terminal blocks.

K. SURFACE FINISH

Cabinet has to be Nano-Ceramic/Epoxy powder coated with RAL 7035 after proper Pre-Treatment as per the best industry practice, with thickness of 80 to 120 microns.

L. TEST PROCEDURE

After the cabinets are completely assembled and wired, perform the following tests and procedures.

- Dielectric test on all circuits in accordance with standard test requirements. Instruments or other devices that cannot withstand test voltage shall be disconnected.
- Circuit continuity test to verify connections.
- Functional tests of all control switches and indicating lamps.
- Verify operation of Operator Interface Unit on cabinets.
- Temperature testing to ensure that operational temperature of all equipment's is maintained.

4.9 VFD STARTERS PANELS

3Phase VFD Starter panel shall consists of S.P.P, MCB, OLR, Timer, Main Switches of reputed makes including wiring and Electronic Digital Indicator etc.

The control module must be able to drive motors with the following control modes: linear, parabolic and parameterizable V/f characteristic, V/f characteristic with forward/reverse current control, linear and parabolic V/f characteristics with eco mode for additional power saving, vector control without sensor, torque control without sensor. The drive system must be protected through thermal motor protection, thermal converter protection, monitoring for under voltage and overvoltage, overloading, grounding, short circuiting, stalling and blocking of the motor. All digital and analogue inputs and outputs must be freely parameterizable and assigned to a specific function in the factory setting.
To parameterize the drive, an integrated USB interface for PC/Laptop connection is needed, saving and loading parameter records and firmware updates must be possible by a memory card. The terminals have to be identified by replaceable labelling strips for individual marking.

4.10 Equipment's at BCR

Hardware at BCR shall be provided by bidder which will mainly comprise of following major item:
a) Main Server and Server as Workstation (operating Station)
b) Necessary data switch, router with modem, Static IP, and fire wall for System

c) 3KVA online UPS with 4 hours backup time
d) External memory for data storage of 8TB for 5 years.
e) A3 size Color printer
f) 110" LED display/video wall/(70",2X1) DLP based system
g) Master PLC Controller

4.11 Central Control Panel (Main PLC Controller at BCR)

The central controller shall be based on modular PLC with firm ware based hot redundancy. Main and Redundant CPU shall be mounted in two separate racks. Event-driven synchronization method shall be provided for fast and bump less changeover to the redundant CPU in the event of a fault, without any loss of information and control. When a CPU is replaced, all the current programs and data are automatically to be synchronized by master CPU with standby CPU.The central PLC controller & SCADA shall be of the same make/manufacturer as the PLC/RTU controller in the remote station. The central controller & the PLC/RTUs shall be able to exchange data with each other freely & seamlessly, without requirement of any intervening hardware, apart from Optical convertors. The central controller shall have a 12" HMI colored screen for indicating the diagnostic & other information. It should be possible to view detailed information by using buttons on the screen, to drill-down to the appropriate page.

The remote PLC/RTU shall pass-on all the I/O information directly to the central controller, and shall act as a slave.
The controller should be able to communicate over an open protocol such as Profibus / Modbus over ethernet TCP/IP and GPRS wireless technology etc. The communication should be integrated in the CPU and should not require any additional cards or gateways. It should be possible to view, control & troubleshoot the PLC without requiring any additional software apart from SCADA software. Data logs should be stored inside the CPU and should be downloadable in CSV format using a web browser. It should be possible to increase the I/O handling capacity of the PLC, without changing the CPU, by the addition of appropriate I/O cards. The central controller should have a non-volatile memory of at least 4 MB & with 16 MB RAM memory card and should be tested for operation from region to region change in temperature range of 0 to 50 degrees Celsius. The central controller shall have high immunity to electro-magnetic interference according to IEC 61000-6-2 and vibrations according to EN 60068-2-6.

4.12 Computer Servers

Server shall be industrial grade PC with USB, RS232/RS485, Ethernet Ports, OS Windows 8 or higher compatible to SCADA System. BCR shall have Master server with SCADA Software.
110" LED display/ (70", 2X1) DLP based System/video wall Unit to be connected to server with separate USB Port/ Ethernet Port.

There will be two servers with monitors required (one as work station), with the Master Controller (PLC) placed at the BCR. These Computer servers are expected to operate the SCADA software as well as all software required for the project. The computer servers will be managed and operated by the successful bidder and his skilled trained experienced operators/engineers till the end of 5 years warranty period. The minimum specifications for the servers are given in Table below:

1.	Form Factor	Rack Mount Server
2.	Processor	Intel XEON ES-2440 or higher compatible configuration
3.	DIMM Memory	Speed: 1600MT/s RDIMMS or higher compatible configuration 8GB RDIMM, 1600MT/s, Low Volt, Dual Rank or higher compatible configuration
4.	Hard Drive	RAID 5 Software or Hardware Controller compatible 5-1TB 7.2K RPM Near-Line SAS 6Gbps 2.5in Hot-plug Hard Drive or higher compatible configuration
5.	Network Adapter	2 GB or higher compatible
6.	Power Supply	Dual, Hot-plug, Redundant Power Supply/Solar Power and battery backup as compatible configuration
7.	Electrical Supply	220V AC and supply from AC distribution, DC of DG Set
8.	Connecting Devices	Soft touch Keyboard, Optical Mouse, Monitor (23" TFT) 110" LED screen (combination of more than one permitted) monitors/Video Wall/(70", 2X1) DLP based.

9.	Software	SCADA compatible as per specification and OS Windows 8 or higher compatible.
10	Additional Memory Rack	Additional memory Rack of minimum 8TB that shall be suitable for data logging for a period of at least 5 years.
11	Accessories	Power Cord Rack Rail with cable management system Power Points as needed

Computer Rack and related parts
The bidder is required to procure full height Server racks that will hold the servers and UPS system.

4.13 LAPTOP

laptops (i7,5th Gen) with all allied software and hardware accessories, for programming & configuration & monitoring of SCADA system shall be provided by bidder with 4 licenced version client SCADA software.

4.14 Colour A3 size Printer

i. Functions: Print, Copy, Scan
ii. Printing Up to 20 page/minute
iii. Black Print Speed (ppm) -12
Colour Print Speed (ppm)-8
iv. Up to 8000 pages printing
v. Recommended monthly page volume: 250 to 2000
vi. Processor speed: 600MHz
vii. Connectivity: e print capability
Paper Handling: -
viii. Paper handling input, standard: 100 sheet input trays
ix. Paper handling output, standard: 100-sheet face-down bin
x. Maximum output capacity (sheets): Up to 100 sheets
xi. Duplex printing: Manual (Driver support provided)

4.15 Uninterruptible Power Supply Systems (3 KVA UPS System)

i) General Design

- The UPS System shall be Single Phase LVAC 50Hz output with the charger and inverter normally supplying the load.
- The charger shall be of thyristor-controlled type. The battery shall be of Nickel Cadmium/ SMF type. The inverter shall be of the Pulse Width Modulated (PWM) type, providing a single-phase output. Configuration with galvanic isolation transformer at the mains supply shall be supported.
- UPS 3 KVA minimum capacity and all its consisting elements shall cover the required Station load, together with 20% spare for future use.

ii) Operation Requirements

- UPS charger shall continuously supply the load via the UPS inverter, while simultaneously maintaining the battery charge in the float charge mode. In the event of interruption or depression in the AC mains voltage to the charger, the battery shall supply the load requirements via inverter.
- Upon restoration of the AC mains voltage, the UPS charger shall take over the power supply of the load via the inverter, while simultaneously recharging the battery.
- UPS shall be capable of energizing the load within the permissible tolerances, without the battery connected.

iii) **Charger and Battery**

- The charger shall operate according to the constant voltage, current limiting principle, and shall incorporate a soft-start feature to gradually accept load on initial energizing.
- UPS charger output characteristic shall provide an output voltage regulation of + 1%, for load changes 0-100 % and mains voltage supply and frequency within the tolerance ranges. Automatic compensation feature related on battery temperature shall be provided in case if lead-acid battery is installed.

iv) **Inverter**

- The UPS inverter output voltage shall be maintained to + 1% of the nominal value for load changes 0-100 % and mains voltage supply and frequency within the tolerance ranges. The dynamic output voltage variations shall not exceed + 10% of the rated output voltage under any circumstances of instantaneous load changes

v) **Readings/Instrumentation and Alarms**

- The following readings /instrumentation/LED indication shall be supplied as a minimum:

  Battery voltage

  UPS output voltage

- The following alarms/LED Indication shall be supplied as a minimum:

  Charger fails

  Inverter input voltage high /low

  Inverter fails

vi) **UPS Distribution**

- The distribution system shall be designed for incoming and outgoing AC supplies. Double pole miniature or moulded case circuit breakers complying to IEC 60157 shall be supplied, fitted with auxiliary contacts that operate when the circuit breaker trips. MCBs shall be rated to meet the load requirements and shall be labelled with the destination of the load.

4.16 Display Units

The 110" industrial grade LED video wall/ (70", 2X1) DLP based to be provided by Bidder in BCR for monitoring of SCADA system. The Workstation shall be connected to the screen LED /DLP display panel through communication bus.
All the required information from the PLC panel shall be continuously updated in the screen LED/DLP display panel. The screen LED/DLP display panel shall map and display the vital information like, all reservoir levels, discharge, panel status, power availability, energy meter reading, Motor data etc.
Specifications as below or better for 110" LED/ video wall/DLP based system shall be provided

Display Unit for 110" LED /Video Wall/DLP based/System	
Each Screen Size	55" class (54.64" diagonal)
Native Resolution	1920 x 1080 (FHD)
Pixels (H x V x 3)	6,220,800
Brightness	700 cd/m2
Contrast Ratio	1,400:1
Viewing Angle	178°/178°
Running Time	24Hr
Orientation	Portrait & Landscape
INPUT	

HDMI	Yes
RS232C IN	Yes
RJ45	Yes
IR Receiver	Yes
USB (USB3.0, USB2.0)	Yes

OUTPUT	
DP Out	Yes
Audio Output	Yes
RS232C Output	Yes
SPECIAL FEATURES	
Temperature Sensor	Yes
Check Screen	Yes
Embedded Template	Yes
Set ID Setup	Manual, Auto
Password Change	Yes
Intelligent Auto	Yes
Digital Audio Input	Yes
Local Time Auto Setting	Yes
Sync Mode	Time sync, Content sync
Calibration Mode	Yes
Internal Memory	8GB (System 4GB + Available 4GB)
Brightness/Contrast /Backlight	Yes
Energy Saving	Yes, Off / Minimum / Medium / Maximum / Screen Off
Auto Config/Phase	Yes
Basic	Remote Controller, Power cable, DP Cable, Manual, IR Receiver, RS-232C Cable, LAN Cable, Guide Bracket, Screw
POWER	

Power Supply	100–240V~, 50/60Hz
ENVIRONMENT CONDITIONS	
Operation Temperature	0 to 50 degree Celsius
Operational Humidity	10%~90%

4.17 SCADA SYSTEM FOR BARRAGE AUTOMATION

A. General

The Barrage control room will have two servers (one as a workstation), Monitor with internet connection with static IP & firewall system in combination with router. The Customized SCADA software will accept information sent by all the remote PLC/RTU, store the information in a data base, display the information in appropriate mimic displays, analyze past data and trends, will have the authentication feature by way of user name and password for operating the software; Updating of parameters of the PLC/RTU along with instrument can be done interactively from this software.

The development of software has to be customized with end user.
The control room will have main PLC system with IOs, main SCADA system, GPRS Modem, gateway software etc.

The control system along-with SCADA Software shall be provided in the Barrage control room (BCR) and the information available at control room (BCR) should also be available on any other PC/Laptop and on mobile located at any place through web. The Data provided in BCR should be displayed in complete explicit way and can be extracted in different formats.

In Head Office located at Salt Lake, Kolkata three sets of laptops installed with licensed version client SCADA software, internet (4G/3G dongles) shall be provided by bidder for monitoring of system by Executive engineer, SE office, CE office in Salt Lake.

The local control and computing system for the gates shall be able to calculate the actual discharge depending on reservoir water level and gate opening.
The local computing system shall be interconnected with the latest industrial grade Server with monitor and LED video wall not less than 110" size / (70", 2X1) DLP based system via master PLC Controller in the BCR, from which the command for the necessary discharge, to spillway gates shall be provided. All signals shall be sent and received to/from the BCR. Operating system shall be based on Windows server 2008 or latest.

A master controller shall define the required total gate opening. The PLC/RTU shall compare the required value with the total actual opening found by adding up the individual opening values, if the deviation of one or more gates from the required value is large enough, an 'Open'- or 'Close'- instruction shall be given to the respective gate(s). However, to prevent hunting of hoist the deviation should be beyond the preselected tolerance band.

In a selection circuit the 'open'- instruction shall be transferred to that gate, which at the time of the comparison controls the smallest opening. Similarly, a 'close' - instruction shall be given to the gate controlling the largest opening.

For the gate selection, only the gates shall be considered, of which the manual switches are in the 'Automatic 'position, and where no alarm signal has been received from, the 'open'- or 'close'- instruction shall remain with the selected gate, unless any of the following conditions is met:

- The required and actual openings agree and the positioner cancels the instruction, or
- The gate had previously reached its limit position, or,
- The max. Permissible deviation (pre-set difference in position between controlled gate and average of all gates available) has been reached previously.
- The selected gate is not in operating condition.

In the event of major changes in required size of opening, the gates shall be moved successively one step each, i.e. after re-setting all gates again agree within the pre-set margin in size of opening. After all available gates have reached their limit positions a corresponding signal shall be given.

At any time, individual gates shall be allowed to be switched over from the automatic mode to manual mode of operation, and vice versa, however, the operation from the local panel cannot be overruled by the remote/automatic operation stage. Adjustments made manually are to be automatically compensated for with the other gates by the automatic control system.

Manually adjusted gates shall, when returned to automatic mode of operation, be adapted to their normal functioning in the automatic mode. The automatic system shall work independent of the number of available gates with the same characteristic. If all gates have been changed over to MANUAL, the master controller shall be reset so as to permit a smooth switching-over to AUTO operation.

The system is to be designed to monitor the duration of the instruction. The monitoring is to prevent, that an instruction is maintained over a period, that is longer than a pre-select e.g. in the event of a malfunction of a gate selected by the controller, if the monitoring system is actuated, the particular gate is to be cancelled from the group of gates available for selection.

Electronic attenuation is to be included to provide against unsteady level signals. The system should be compatible with flood fore-casting system to be provided by the employer for the monsoon period.

B. Functions/ Features of SCADA Software

- Normally Dynamic Gate Operation Scheduling Program will decide position of each Gate depending on the Water Discharge requirement.

- Development of Dynamic Scheduling Program is included in the scope of work.

- Operator in Control room should be able to control movement of individual gates via. SCADA software. This is needed for testing and emergency handling.

- The customized, with life time licensed version SCADA software shall be designed, developed, Supplied, installed & commissioned by bidder based on the inputs provided by Engineer-in- Charge which shall have following minimum features:

i. It shall accept information send by all the remote locations /sites

ii. Stores the information in a data base

iii. Display the information in appropriate mimic displays

iv. Will have a provision to analyse past data and trends

v. Will have the authentication feature by way of user name and password for operating the software.

vi. Updating of parameters of the PLC/RTU along with instrument can be done Interactively from this software.

vii. SCADA software shall be of at least 5000 tags & screens shall be provided as per user requirement.

viii. Automatic alarm generation

ix. Automatic report generation

x. Auto e mail and SMS with web server facility

SCADA Software should mandatorily provide Graphical User Interface from Main menu for:

1. Parameterisation and configuration setting of Sensor
2. Programming of PLC/RTU.
3. Real time data monitor on GUI and LED display.
4. File creation and Storage controller.
5. External Data transmission controller.
6. Burglar and alarm warning system controller
7. Power status monitor and logging.
8. Motor status monitor and logging.
9. Data exporting features
10. Integration of rating curves
11. Manual data entry and input programmes
12. Printing graphical and tabular data

The Successful bidder shall upgrade all such developed software during the O & M period on need basis and provide the latest versions of all such software including Source Codes, while handing over the facilities to Authority.
In addition, it shall be possible to export SCADA data to Hydrological Information System (HIS)
to be developed under National Hydrology Project in Future.

4.18 Tele-metering and Supervisory Control

The bidder shall provide Broadband with minimum internet speed of 8mbps for uploading and downloading along with necessary router with modem, static IP, firewall system & switches for GPRS communication. The bidder shall also provide the digital transmitters and their indications via the bus system. The SCADA System software should have the facility to track the non-functional sensors on daily basis and display on the web.

Tele-metering Items

Digital type gate position indications.

Digital type water level indication.

Digital type discharge indication.

Digital type Automatic weather station data

Supervisory Items

Alarms & Indications shall be provided at BCR. These shall include, but not limited to, the following:

- A.C. fault
- Common Alarm
- O/L Trip
- Open
- Close
- Stop
- Remote/Local

4.19 Solar Power System for Dataloggers

i) Supply, Erection and commissioning of Solar power system with all allied ancillaries for providing un interrupted power supply to dataloggers located at canal systems for Minimum 5 days Backup without sunshine. The Solar Panels shall be provided in anodized aluminium frame with batteries, Solar panel should conform to IEC- 61730, 61215 and 61701.

ii) The Bidder shall supply a pole – mounted arrangement including a standard pole and necessary foundation and fixing arrangements. The location of solar power installation shall be indicated by the concerned engineer – in – charge.

iii) The batteries required for the equipment above shall be maintenance free, rechargeable sealed batteries with Overcharge and deep discharge protection Leak-proof Easy handling, Excellent recharge ability.

iv) The battery pack shall also include arrangements of charging through a standard AC power supply available at canal system and also from solar panels established as above.

v) The power supply unit shall have audio or visual alarms for overcharging and deep discharging conditions. The sealed construction shall allow trouble-free, safe operation in any position. The battery case shall be high-impact, with sufficient resistance to shock, vibration, chemicals and heat.

vi) The battery system shall be installed in the site building located near the Cross/Head regulator of Canal system

vii) Successful bidder shall provide the necessary calculations to ensure the battery backup time of 5 days considering the transmission of data in every 30 minutes & event based.

4.20 Standards

The design, manufacture and testing of all works and installations shall strictly comply with the latest edition of the relevant IEC publications/IEEE/IS.
All the instruments/ transmitters shall be UL/CE certified.

4.21 Wiring/Cabling requirements

Shielded OFC cables complying with IEC 60793-1-1 shall be used for external Cabling from the RTU/PLC to Master controller & for entire instrumentation system to ensure the reliable operation of the SCADA system with necessary conduiting/ cable trays as per site requirement.
These are minimum requirements. Bidder is free to propose improved cabling technology which shall be subjected to approval from Engineer in Charge.

The cabling system design criteria shall be as follows.

i). The term cable shall always include necessary type of connectors at both the ends for connecting between two equipment. The connectors shall be properly anchored with protective sheathing of the cable in such a way that the loads due to pulling and twisting shall be borne by the protective sheathing and the conductors shall not be subjected to any stress.

ii). The connectors shall be so fixed on the individual components of the system that the metal/ plastic connector shall always transfer the loads due to pulling and twisting directly to the protective body of the component and the internal interface cards/ connections shall not be subjected to any load.

iii). Laying of necessary data and power supply cables for connecting various components and embedding them or protecting them with necessary conduits shall be carried out as per directions of engineer-in-charge.

iv). Wherever the cables are to be laid indoors and the length of the individual cable run exceeds 1 meter, the cable shall be housed in a protective conduit made of electrical supply grade conduit of appropriate diameter and the conduit shall be fixed with the wall at a height not less than 1 meter above the floor surface. Whenever the indoor cable is required to cross the floor, it shall be housed in a HDPE /GI flexible conduit pipe of 25 mm internal diameter and the pipe shall be fixed to the floor with suitable protective covering to avoid tripping of personnel using the area or disturbance to the pipe due to such movement.

v). Wherever cables are to run through open ground including the public road and pathways, the cable shall be armoured and shall be water ingress proof up to static water pressure of 5 kg/cm2. All joints made in cable shall also meet the water proofing criteria. In addition, the cable shall be protected by housing the same in 25mm galvanized iron pipe embedded at a depth of not less than 1.0 meter below the ground surface with a warning brick on the same. A sketch of the cable layout with respect to the identifiable marks of the area shall be prepared and handed over to the Engineer-in-charge for each such cable run on completion of the work of cable laying operation.

vi). The joints in the cable connecting between the sensor and data collection unit shall be avoided by measuring the appropriate length of the cable required and attaching the same in one piece. If the cable joints become necessary, prior permission of the Engineer-in-charge shall be obtained before executing the same. The joint fabricated through a splicing and jointing kit shall be stronger than the parent cable.

vii). The cable carrying data and electrical power shall be housed separately in different conduits separated by adequate distance to prevent leakage currents. The data cables shall also be laid out in such a way that the data integrity is not compromised due to mutual interference.

4.22 Discharge Measurement

Discharge profiling of barrage and head regulator shall be carried out by the bidder to obtain data regarding width (m), Area (m^2), Mean Speed (Mtr/s), Total Discharge (M^3/s), Max Measured Depth (Mtr), Max Measured Speed (Mtr/s). Profiling should be done twice in a year & accordingly rating curves developed shall be integrated in SCADA system by successful bidder.

4.23 Manufacturer

Only CE/UL certified Sensors, RTU/PLC shall be used. The Remote-Control system is to be sourced from a reputed designer cum manufacturer.

Following names are given as reference for PLC/RTU & SCADA system

a) Allen Bradley/Rockwell
b) GE
c) Siemens
d) Schneider electric
e) ABB
f) Mitsubishi

If the bidder proposes alternative sourcing from an equally reputed and expert Remote- Control System manufacturer, he can propose the same with complete details, references, lists of successful Remote-Control Systems supplied/installed for prior approval from Engineer-In-Charge before placement of order with any of the manufacturer. The Employer reserves the right to reject any or all of such proposed manufacturers including manufacturers named above.

4.24 DIESEL GENERATOR SET 10KVA

- Supply, Installation, Testing and Commissioning of Silent DG Set of 10 KVA for power supply to entire SCADA system in case of power failure for more than 2 hours shall be provided by bidder.
- Alternator shall be self-regulated with Standard Alternator protection (Over Voltage, Over Speed, Under Voltage, Under Speed warning & Shutdown).

- Engine shall have industrial silencer, Electronic/Mechanical Governor, Manual & Electric Start, Batteries, Engine Instrument panel, AVM and with water proof powder coated Acoustic enclosure for DG Set.

A. ENGINE

- Vertical, 2 cylinders, four stroke cycle Air / Water cooled cold starting compression / ignition, diesel engine under NTP conditions as per BS: 5514.
- The engine will have following standard accessories:
  Heavy flywheel
  Air cleaner dry type/Oil bath type.
  Governor mechanical type
  Starter 12 volts DC
  12-volt Battery with leads
  Dynamo / Alternator
  Silencer Industrial (without piping)
  Fuel lift pump.

B. ALTERNATOR

- 415, three Phase, 50 cycles/ sec., 1500 RPM, self-excited, self-regulated screen protected drip proof alternator in accordance with BS: 2613.

C. ARRANGEMENT

The Engine and Alternator shall be close couple mounted on a common fabricated base plate.

D. **CONTROL PANEL**

M. S. / CRCA Steel fabricated L.T. switchboard suitable for indoor floor / wall mounting installation & for controlling the above generating set. The control panel will be equipped with.

1. Digital Energy Meter
2. Main On/Off switch / MCB
3. Set of indicating lamps.
4. Set of instrument fuses.
5. Set of current transformers.
6. Over voltage Relay
7. Suitable MPCB

The switchboard will be complete with internal wiring, front cover, rust proof, powder coated paint and arrangement for receiving incoming and outgoing cables. The control panel shall have an automatic mains failure feature for remote automatic starting from the PLC based Control panel at the Field Station. Necessary equipment like solenoid coil etc. shall be provided for the same along with an IP54 or better panel.

E. FUEL TANK

Eight hours continuous running capacity, fuel tank complete with inlet/ outlet, air vent, drain plug, inlet arrangement for direct filling. The fuel tank level shall be displayed at the local panel and the RTU/PLC based control panel at the Field Station.

4.25 SPARE PARTS AND TOOLS

All spare parts to be supplied shall be interchangeable with the corresponding parts of all the Works supplied under these Specifications and shall be of the same material and workmanship. They shall be replaceable without cutting or destruction of adjacent components. Before issue of the Taking-Over Certificate the spare parts shall be checked and tested at the Site by bidder in presence of the Engineer.

Acceptance of any spare parts will not take place before the bidder has submitted the complete final detailed list of all spare parts and tools. All spare parts, tools and materials shall be delivered in marked boxes of sufficient sturdy construction to withstand long term storage cum maintenance.

The Following Spare Part List shall be provided by Successful bidder

a) Mandatory Spare Parts

b) Recommended Spare Parts

4.26 SCHEDULE OF WORK AND PROGRESS REPORTS

Schedule of Work

The time and the date of completion of work as stipulated shall be deemed to be the essence of the contract. The bidder shall submit a detailed program for all the activities to perform the work as per the Contract. The schedule will be in the form of a detailed PERT network consisting of adequate number of activities covering various key phases of the works such as designs and drawings, procurement, manufacturing, shop assembly and painting. This network shall also indicate the interface facilities to be provided by the Purchaser, if any, and the dates by which such facilities are needed.
The Supplier shall so organize his resources and perform his work as to complete it not later than the date agreed to by him. The time for completion of the supplies contracted for, shall be reckoned from the date of award of supplies to the Supplier. During the performance of the contract, if in the opinion of the Engineer-in-Charge proper progress is not maintained suitable changes shall be made in the schedule to ensure proper progress.

Progress Reports

The above PERT network shall be reviewed and periodic reports shall be submitted by the bidder as directed by the Engineer-in-Charge before initiating the procurement/manufacturing, the bidder shall submit a detailed list of items/materials to be bought out from outside agencies . The list should be exhaustive and should serve as a check list for reviewing the progress from time to time. It shall be obligatory on the part of the bidder to submit a detailed monthly report by 7th of every month (for the previous month) giving the progress of the following activities:

a. Designs, data sheet, Drawings & QAP approval of complete assembly for its prior approval by Engineer in charge, within one month of issue of letter of acceptance.
b. Procurement of materials and bought out items

c. Fabrication of various assemblies and sub-assemblies indicating detailed status of fabrication of critical items involved and expected date of completion.

d. Stages of shop assembly.

e. Shop testing

f. Dispatch of materials.

g. Installation status

h. Maintenance schedules

4.27 DRAWING SUBMISSION

- The complete General Arrangement Drawing along-with each component drawing and complete architecture of SCADA, data sheet approval & QAP shall be submitted within 30 days from the issue of letter of acceptance for its approval to Engineer-in-Charge. Failure in submitting drawing in stipulated time shall amount to breach of the Contract.

4.28 SUBMISSION OF FOLLOWING DOCUMENTS

Bidder shall submit details of following on separate sheets for each of them, for evaluation of Bids along-with their offer: -

(1) Warranty Related Services
(2) Software License
(3) O&M Staff details
(4) Training to the Departmental staff
(5) Installation and Commissioning Services
(6) Detail Commentary against Technical Specifications
(7) Deviation Sheet
(8) Brief SCADA system architecture & control Philosophy

The prices as to-be quoted in BOQ shall include all the prices of above services/Software/Staff.

4.29 TECHNICAL **RESPONSIVENESS:**

Bidders are requested to confirm that all requirements of technical specifications have been met without any material deviation or reservation by submitting duly signed and stamped bid documents & detailed clause by clause Commentary against technical specifications specified in Annexure1 & in case of any deviation, it shall be clearly stated in deviation sheet failing which offer of the firm may be considered as non-responsive.

4.30 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 twelve (12) months followed by a Warranty and operation & maintenance period of 5 years. The bidder must comply with the milestones indicated in the delivery schedule and schedule for installation and commissioning.

4.31 TRAINING

A. Training Programme

The Bidder is required to provide an extensive training programme for the SCADA 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 daily allowances for the trainees shall be borne by the Purchaser.

B. 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 instrumentation/ SCADA specialists. The training shall include following:

Table: Formal training courses

S. No.	Description	Numbers of training	Number of Participants per session
1	User Training Course for senior management. Design, operation and maintenance back-up, recovery and web-services for officers. (2 days)	2	10
2	User Training Course for working staff. (2 days)	2	15
3	Operation and Maintenance course onsite & class room (3 days). Course topics will include sensor calibration, PLC operation, SCADA operation & configuration, report generation & analysis, Trouble shooting of SCADA system, maintenance requirements, and procedures for equipment configuration, installation, site testing and commissioning.	2	10
4	Theory and practice of discharge measurements, and development of rating curves. (2 days)	2	10

Theoretical training will take place in Durgapur or Kolkata as decided by the purchaser. On-job training will be in Durgapur. In case of formal training, the Purchaser will provide classroom and other logistics. The Bidder will facilitate the professional and the training material. On-the-job training will be provided by the Bidder in conjunction with the installation of instrumentation system and during the course of operation & maintenance as required.

The Bidder shall prepare a training course plan and include the same in the Bid Document.

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.

4.32 After Sales Service

A. LOCAL PARTNER

The Bidder is required to be an Indian firm or Indian arm of an international firm so as to develop an in-country technical support base during and after the project implementation phase. The bidder /manufacturer shall have after sales support center in region (within a radius of 500km from state capital) or shall set the same within 30 days from the receipt of LOA.

B. OPERATION AND MAINTENANCE (O&M)

The Bidder shall be responsible for Operation & Maintenance of all stations/ components after installation, commissioning & site acceptance and operational test, during the contract period. All associated cost shall be part of contract price and bid price for evaluation. This operation & maintenance support contract shall refer to the complete instrumentation network of Barrage automation as per the schedule of requirement, proper functioning of SCADA and the hardware and software components. Assistance and troubleshooting shall be provided for all necessary maintenance, servicing, testing, and recalibration operations.

The Bidder will intervene with his personnel within the agreed dates, in-situ, in case of damages or malfunctioning of equipment or software and will proceed to the investigation of the cause and search a prompt solution to ensure proper working of the system.

Bidder shall provide a minimum one no. of Service engineer for operation of SCADA system at BCR from commissioning stage till completion of 5 years warranty, operation & maintenance period The Service Engineer shall have experience of working on Instrumentation / SCADA system for period of at least 3 years and shall be well versed with Operation and Maintenance aspects of SCADA systems. Operation and Maintenance shall include free of cost repairs/ replacement of hardware and Software necessary to keep the system functional for the period of five years from Date of Issuance of Final acceptance certificate from Engineer in Charge.

4.33 Legal Issues and Intellectual Property Rights

All hardware and software supplied will be legal and without any dispute on intellectual property rights. The Bidder indemnifies the purchaser against any legal issues that may arise out of usage of any part or the whole supplied system. The Supplier shall provide complete and legal documentation of hardware, and licensed operating systems in the name of purchaser. The supplier shall also indemnify the purchaser against any levies/penalties on account of any default in this regard. Supplier shall be responsible for any upgradations & renewals required for software & hardware.

4.34 Civil Works

All the civil works required for installation, commissioning and operation of the system should be provided by the bidder and included in the cost. The civil works would include erection of suitable masts for mounting the sensors, RADAR, PLC/RTU, cameras and all other associated equipment ‘s of the Automation system. The mounting structure should be sturdy enough to withstand wind speed as specified.

4.35 System Performance Criteria

The following performance parameters must be strictly maintained.
Average uptime – 95% for 24x7 operations
MRTR (Maximum Response Time to Repair) when the system is down as per definition given below:
- 48 hours during rainy season (June - October)
- 120 hours during the rest of the year.

Note

Computation of Down time:

The System will be considered to be down under any of the following conditions:

A. Control for more than 2 (two) Barrage Gates are down at a time

B. Control for more than 1 (one) Canal Gate on LBMC Head Regulator are down at a time

C. Control for more than 1 (one) Canal Gate on RBMC Head Regulator are down at a time

D. Monitoring of Water Level in Durgapur Barrage is down for more than three (3) hours

E. Monitoring of any other parameter is down for more than (3) hours.

F. Remote Monitoring of Barrage from is down for more than 3 (three) hours.

G. Any particular hardware or software functionality defined in technical specifications is down for more than 3 hours (including BCR equipment’s)

Unless otherwise stated, Control/Monitoring as referred above will mean Monitoring or Control from Barrage Control Room.

4. Drawings

These Bidding Documents includes *[insert "thefollowing "or "no"]* drawings.

[If documents shall be included, insert the following List of Drawings]

List of Drawings		
DRAWING NR.	**Drawing Name**	**Purpose**

5. Inspections and Tests

The following inspections and tests shall be performed:

5.1 General:

1. After award of Contract bidder shall provide the Control philosophy, System Architecture drawing, datasheets of all instruments, QAP/ITP for all equipment's and SCADA software details for necessary approval from purchaser & after approval bidder /manufacturer can start manufacturing of equipment's.

2. After manufacture, the supplier shall get each equipment/item of Goods inspected in manufacturer/s works as per approved datasheets and QAP/ITP. Bidder shall forward test reports & calibration reports to the Purchaser along with his letter seeking to inspect a equipment/item of Goods conform to contract specifications.

3. Upon receipt of the test certificate and calibration certificates, the purchaser or its representative shall arrange for inspection and/or test of any or part or all the equipment /Goods prior to issuance of dispatch clearance. In cases where the supplies are received from abroad, the purchaser may waive the pre-dispatch inspection.

4. However, the inspection and dispatch clearance by the Purchaser or the waiver thereof shall not prejudice the right of the Purchaser or its consignee to test the equipment/goods on receipt at destination. Upon receipt of the goods at final destination, the Purchaser shall have the right to inspect and/or test the equipment/Goods to confirm their conformity to contract specifications.

5. If the equipment fails to meet the contract specifications during inspection, whether pre-dispatch or upon receipt at final destination, the supplier shall take immediate steps to remedy the deficiency or replace the defective equipment to ensure that all supplies meet with the specifications specified in the contract

5.2 Shop Tests

All equipment shall be checked by the Contractor in order to ascertain its correct functioning and shall be witnessed by the Employer's Representative on the basis of approved datasheets, QAP/ITP & drawings (if applicable).

5.3 Site Inspection and Tests

During erection, commissioning and trial operation, the Contractor shall organize at suitable intervals all inspections and tests in the presence of the Engineer in order to prove the orderly execution of the work in accordance with the Contract. Unless otherwise specified, all costs for testing at site and of the works and charges associated with it shall be borne by the Contractor. This includes the measuring devices, properly calibrated, and any pertinent accessories which shall be made available by the Contractor for the entire duration of the tests. The Contractor shall delegate his experts to supervise the tests at site.

Tests to be performed shall include, but not be limited to, the following:

- Checking sensitivity of transducers, water level transmitters, shaft encoders etc.
- Checking of sensitivity of all Equipment.
- Checking of correct functioning and correct calibration of all Equipment.
- Automatic operation of the gates shall be tested "dry" by simulating various reservoir elevations at the level-sensing equipment.

Local Control Systems

It shall consist of complete set of local controls for all equipment near their installation including their Running tests & Overload tests.

All electrical equipment shall be designed for use in a tropical climate. In order to avoid operational errors and accidents, the hoisting equipment of all gates shall be equipped with an electrically operated emergency stop such that all operations of the machine are stopped on pushing of an emergency stop button.

Complete wiring of the electrical equipment and the control device with all cables shall be included, under the scope of Contractor

All such tests and checks shall be performed in the presence of the Employer's Representative. If not satisfied with the performance of the tests and checks, the Employer's Representative shall have the liberty to ask for additional tests or repetition of same. The testing at site shall be complete in every respect to prove the successful performance and operation of all the works and works supplied and erected under the Contract.

5.4. Acceptance Tests

The Bidder will install all the equipment's and will undertake site tests of each gauge and tests for each lot of equipment's included in the Schedule of Requirements. The exact locations for installation by Bidder shall be decided by the Purchaser. 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 Site Engineer in charge personnel will be trained in conducting the same site acceptance tests. A Site Acceptance Test will be passed if all sensors and RTU/PLC will perform as per the required objective of the SCADA system in the presence of Site Engineer in charge

5.5 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 7 days period.
The second, third, fourth and final OT will be witnessed by the Site Engineer in charge as each lot of stations are completed. Final OT will take place when all the remote stations (PLC/RTU station) system work satisfactorily for a period of one week. The bidder shall demonstrate and document that the system correctly generated 95% of all expected control operations & desired daily & weekly reports 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 95% success level is achieved.

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.

5.6 Final Acceptance

When the system has passed the Final OT, the Bidder can apply for Final Acceptance. When Final Acceptance is given & found satisfactory by the Site Engineer in charge the system will be officially considered to be under Warranty.

5.7 Warranty, Operation & Maintenance Period

The Bidder shall provide 5 years warranty & comprehensive operation & maintenance of all equipment supplied, installed and erected for barrage automation from the date of acceptance by Site Engineer in charge after successful commissioning.
During 5 years Warranty Period, the contractor shall ensure quality, performance as per Detailed Technical Specifications and all commitments as per the Contract.

Annexure-1

Technical Responsiveness Form

Technical Specifications as per the Bid document		Technical Specifications as per Bidder
4.0 Technical Specifications of SCADA system & instrumentation		
4.1 Water Level Measuring Systems The bidder shall design, supply and install best quality Level sensors considering the following points.		
a) Radar type level measuring system shall comprise of Radar level sensor & transmitter, and any other item required for completing the level measurement loop.		
b) Radar based reservoir / pond level measurement & downstream level of main Barrage & Head regulators. These points are to be selected so that most accurate measurement level is obtained. All accessories along-with cage to avoid theft and Monkey Menace and also proper mounting arrangement (cantilever etc.) of these instruments shall be supplied by the bidder.		
c) The level sensor shall be suitable for flange or thread mounting as required. The installation shall avoid any degradation of instrument performance due to spurious reflections, absorption and condensation. Facilities shall be provided for rejection of spurious reflection.		
d) The radar type level instrument shall have the facility for dampening/ averaging the effect of waves, undulations on the water surface and discriminate the rate of change of levels to provide steady readings.		
e) All necessary instruments, interconnecting wiring, HDPE/GI pipe work, housing, cabling, panel, etc., shall be provided according to the type of equipment proposed to supply in the bid document and accepted in the Contract. Adequate safety measures shall be included in the design of these sensors to negate the effects of disturbances due to turbulence of water levels, strong air currents & electromagnetic waves etc.		
f) The Technical Details of RADAR level Transmitters are as follows:		
Feature	**Value**	
Make		
Model No.		
Site Conditions		
Ambient Temperature	From 0°C to +50 °C	
Humidity	5 to 95 % (non condensing)	
Sensor		
Sensor Type	Microwave non-contact sensor	
Range	30 Meters	
Resolution	3 mm or better	
Accuracy	0.02% FSO	
Output Interface	SDI-12/ RS-485/ 4-20 mA	

Power Supply	2 wire type, to be powered from PLC/ RTU/Datalogger (locally)	
Protection	IP67 or better	
Enclosure	Die-cast aluminum or any corrosion resistant metallic enclosure	
Isolation	Circuits shall be galvanically isolated from each other	
Display	Digital Read-out at site LCD/ LED Display	
Manufacturer Calibration Certificate	Required	
Beam Angle	Less than 12 Degrees	
General Features		
Mounting	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 with proper HDPE/ GI pipe conduiting, cables and other accessories as required	
Mounting/ Installation Arrangements	Above FRL, below bridge girder wherever available otherwise horizontal cantilever arrangement from a mast/ wall/ pedestal to be provided	
Radar Sensor should have inbuilt diagnostic feature and averaging function		

4.2 Gate Position Measuring System

Suitable sensors shall be provided for exact measurement & indication of position of spillway radial gates, intake gates & silt flushing gates. These sensors shall be equipped with suitable shaft couplings and electronic circuits to transmit the signals to the SCADA System via remote PLC/RTU for indication in BCR & for further processing. All sensors are to be mounted in the outdoor locations. Hence, suitable protection class of the enclosures shall be ensured. Minimum IP65 protection class shall be provided. Suitable safe & reliable arrangements of coupling with the lifting motors of gates shall be provided. It shall be ensured that there is no slippage between the motor shaft & the transducers.

The bidder shall provide the gate sensors with following minimum specifications

Feature	**Value**	
Make		
Model no.		
Site Conditions		
Ambient Temperature	From 0 ºC to +50ºC	
Humidity	5 to 95 % (non-condensing)	
Sensor		
Sensor Type	Shaft Encoder based rotary position sensor with minimum 4” Digital Display	
Range	1-20 meters	
Resolution	3 mm or better for gate position	
Accuracy	0.025 % FSO	
Output Interface	SDI-12 / RS 485 / 4-20 mA compatible to PLC/RTU	
Power Supply	2 wire type, to be powered by RTU/PLC	
General Features		
Material	Corrosion Resistance Metal (Stainless steel or Aluminum)	
Enclosure	Lockable (key) box provided by the supplier to be mounted on sensor, with IP65 or better protection	
Tools	Complete tool kit for operation and routine maintenance	
Manuals	Full Documentation and maintenance manual in English	
Mounting	Wiring from sensor to RTU/PLC must be through HDPE/ GI Pipe Conduiting or flexible metallic conduiting as applicable	
Display	Read out LCD / LED Display	
Process connections	Through suitable coupling	
Manufacturer’s Calibration Certificate	Required	

4.3 Automatic weather stations at BCR

The Automatic weather station shall be placed at Barrage which shall be connected to Main PLC controller placed in BCR. The Automatic weather station shall be provided with following minimum specifications.

Feature	Value	
Make		
Model No.		
Site Conditions		
Ambient Temperature	From 0 to +50 Degree C	
Humidity	5 to 95 % (non-condensing)	
Altitude	0 to 2500 meter	
Automatic Rain gauge		
Sensor Type	Tipping Bucket type with reed switch	
Range	250 mm/h or better	
Resolution	0.5 mm or better	
Accuracy (Intensity)	2% or better, ± 2 mm	
Output Interface	SDI12/ RS 485 / 4-20 mA/Switch closure output	
Material	Corrosion Resistance Metal (Stainless steel/ Aluminum)	
Enclosure	NEMA 4 or IP65	
Certification	IMD/ WMO certification shall be provided.	
Protection	Bidder shall provide spout filter and bird cage to prevent ingress of insects and debris	
Air Temperature Sensor		
Sensor Type	Platinum resistance or better or equivalent	
Range	0 to 50 Degree Celsius	
Resolution	±0.1ºC	
Accuracy (Intensity)	Within ±0.2ºC in the entire working range	
Response Time	10 secs or lesser	
Relative Humidity Sensor		
Sensor Type	Capacitive/ Solid State Humidity Sensor	
Range	0 to 100 %	
Resolution	1%	
Accuracy	±3% or better	
Power Supply	To be powered by PLC Located at BCR	
Response time	10 secs or lesser	
Wind Speed and Direction Sensor		
Sensor Type	Ultrasonic sensor (No moving Parts)	
Range	0-60 m/s for speed and 0–359 degrees for direction	
Resolution	0.1m/s for Speed; ±1 degree for Direction	
Accuracy	±0.5m/s or better for wind speed; ±5º or better for wind direction	
Response time	Less than 1 second lag in operating range	
Mounting	All accessories for mounting the instrument e.g. special cross arm clamps or flag if any shall be provided.	
Air Pressure Sensor		
Sensor Type	Temperature Compensated	
Range	600 to 1100 hPa	
Resolution	± 0.1 hPa	
Accuracy	±0.2hPa	
Power Supply	To be powered by PLC Located at BCR	
Solar Radiation Sensor		
Sensor Type	Silicon Pyranometer	
Threshold	120 W/m2 of direct solar irradiance	
Methodology	Alternate shading of sensor to account for sky radiation or sunshine duration shall be computed in PLC/SCADA system	
Spectral Range	400nm to 1100 nm	
Range	0-2000 W/Square meter	
Resolution	1 W/Square meter	
Accuracy (Including Temperature Compensation)	3% or better	
General Features		
Output Interface	SDI12/ RS 485 / 4-20 mA/Switch closure output	
Power Supply	To be powered by PLC/RTU	
Material	Corrosion Resistance Metal (Stainless steel/ Aluminum)	
Enclosure	NEMA 4 or IP65	
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	

Certification	IMD/ WMO certification shall be provided.	

4.4 Surveillance System

Primary Purpose of Surveillance system is to view gate movement from Control room. Operator should be able to see that the gates moves up/down or stop when the appropriate command is given.

Bullet cameras IP based shall be placed to monitor the position of all the gates & PTZ cameras shall be installed on the main barrage in a way to ensure the complete monitoring of the Barrage. The same shall be connected with NVR (Network Video Recorder) which shall have a memory of at least 30 days. Cameras shall be connected to internet, to have its accessibility from farthest point through IP address.

The cameras shall have a provision of connecting with NVR through hardwiring using video cable (RG-6 coaxial cable)/OFC and simultaneously through wireless connectivity

The following minimum features shall be available in CCTV system

Make & Model No.	
i) Bullet Camera (Fixed Type)- IP based Night Vision (I.R.) Out door Weather Resistant, 2 Mega Pixel,72 LED Color Camera.6 or 8 or 12 MM (According to site suitability) 2 MP Auto Iris Lens in Elegant Metal Die Cast Housing. Outdoor weather resistant IP 66.	
Make & Model no.	
ii) **Pan Tilt Zoom** (PTZ) 36 X Optical and 12 X Digital Zoom; 2 Mega Pixel IP (DIGITAL) Sensor, 500 mtrs. Night Vision (Multiple Intelligent Array system) in IP66 Weather Resistant Outdoor Metallic Housing.	
Make & Model no.	
iii) Standalone **NETWORK VIDEO RECORDER** (NVR) 32 Channel 1080 P Full HD, Real time Recording and Reviewing in H.264 Compression Format. With HDD. Remote Viewing Capability thru Internet /Android /Apple /Mobile App Xmeye /CMS software with password protection & user name.	
iv) Necessary mounting arrangement like MS/ GI Poles 4/6/8 1nch Día - Medium Grade Pipe of Standard Make with suitable length along with junction box & other accessories as per the suitability shall be provided by the bidder for installation of CCTV system.	

4.5 Data Logger with 2 channel Inputs

The datalogger with 2 channel input shall be provided by bidder at Remote monitoring stations for data logging & transmission on real time basis with following minimum specifications:

Feature	Value	
Make		
Model No.		
Site Conditions		
Ambient Temperature	From 0 to +50 Degree C	
Humidity	5 to 95 % (non condensing)	
Sensor Interface		
Input type	2 channels, compatible with outputs of sensors as specified in BOQ	
Input - Output Interfaces		
Data Transfer	USB stick option for Data transfer	
Port for Configuration	One Serial Port (RS232) for communication with Laptop for programming	
Port for Telemetry	1 Ports for Communication with Telemetry (GPRS/GSM) device	
Computer Software		
Operating System	Windows software for system configuration / communication	
Version	English language version	
Licenses	All required licenses shall be included	
Analog to Digital Converter		
Resolution	16 bit or better	
Sample intervals	1 Sec to 24 hours (user scalable)	
General Features		
Flash memory	Minimum 1GB Non-volatile Flash memory that can store one year of data and shall be expandable	

Resolution	A/D resolution ≥16 bit	
Firmware Operating System	Multi-tasking operating system - must log data and transmit at same time	
Display	Inbuilt Digital Display for viewing current data and setting values	
Power Supply	Shall be powered by solar Power supply to be provided by bidder	
Battery Voltage	Monitoring of battery voltage level	
Internal battery	Internal battery backup for clock, lithium battery, storage 2 years	
Charge Controller	Internal or External	
User Permissions	Different user levels, system of user rights / passwords, access restricted to authorized personnel	
Keypad	For displaying or transferring data to memory stick, configuration of data logger and sensors	
Real time clock	GPS synchronized	
Enclosure	for wall-mounting in a shelter / enclosure with IP65 protection or better	
Accessories	Serial cable + adaptor. 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).	
GPRS MODEM		
Operating Temperature	From 0 to +50 Degree C	
Performance	Data Reception availability of 95% or better	
Form factor	The GSM /GPRS modem 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 network for two-way TCP/IP (INTERNET) connection and SMS	
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, FTP, SMS to transmit and receiving data to the Data Center	
Accessories	All associated equipment, including Antenna all cables and mounting hardware	
Antenna features		
Frequency range	900 MHz: 824-960 MHz/1800MHz:1710-1880 MHz, 4G and better	
Radiation	Omni-directional	
Operating temperature	0 to + 50 degrees Celsius	
Connector	SMA or suitable RF connector adaptable to GSM/GPRS modem	
Cable length	As required at site	
4.6 Remote PLC/RTU:		
Make		
Model No.		
CE/UL approved manufacturer's Remote Terminal Unit/Programmable Logic Controller (RTU/PLC) in IP54 enclosure having modular PLC/RTU (Plug and play type) for control & monitoring with Modular Controller and should have modular communication. The PLC should be able to communicate to the master controller on an open protocol such as Profibus / Modbus over ethernet TCP/IP using OFC cable & bidder shall provide the memory map of the same for III party etc. simultaneously the remote PLC/RTU shall be able to communicate with BCR via GPRS based wireless technology in order to create redundancy in telemetry to avoid loss of communication & Data. It should be possible to view the reports of SCADA system without requiring any software, from any PC, using web-based protocols. Data logs should be stored inside the CPU and should be downloadable in CSV format. It should be possible to increase the I/O handling capacity of the PLC/RTU, without changing the CPU. Maximum number of gates that shall be controlled by a		

single PLC/RTU shall be 4. The remote PLC/RTU shall communicate to the central monitoring station on Optical Fibre Cable. It should be possible to remotely program the PLC/RTU from the control room. Each CPU shall be shall be tested to work in a temperature range of 0 to +50 degree Celsius. The CPU shall have integrated non-volatile memory capacity of not less than 1MB & expandable memory up to 4MB using memory card. All must be complied with IEC-611131-03 and IEC 61158(4-20Amp). Suitable industrial grade AC to DC Power Supplies shall be mounted inside each PLC/RTU. Each PLC/RTU shall have separate power supplies for electronics and field. Surge Protection Device shall be provided inside each PLC/RTU, to safeguard against transient & lightening surges.	
iii) Industrial grade Fibre Optic convertor shall be housed in each PLC/RTU for optical communication between PLC/RTU & central controller. Each PLC/RTU shall have integrated GPRS modem for wireless based communication with BCR. iv) Each PLC/RTU shall also be integrated with up to 4 no. digital drive starters panel and capable of operation at up to 50 degrees Celsius. The PLC/RTU equipment shall be housed in a properly sized, weather-proof panel and must be protected with lightening & surge arrestor.	
The PLC/RTU shall be designed as per following specifications	
A. Panel in Climatic Conditions: The panel shall be fitted with two cooling Fan with filters, and protection, for better control of internal temperature. The individual cooling fans shall be controlled /switched ON/OFF by the PLC/RTU according to the application requirement.	
B. **Temperature Monitoring** The PLC panel shall be fitted with the temperature sensor/thermostat and shall be connected to the monitoring system. The monitoring system shall continuously monitor the panel temperature, and if it exceeds the set value, it shall automatically switch ON the cooling Fan's. The cooling FAN shall be Switched OFF after the temperature of the panel is brought back to normal level. In case of Emergency Sequence of power back-up, the cooling FAN shall be switched OFF to save the power. The PLC/RTU shall be capable of monitoring and controlling the temperature inside the panel and shall transmit the following information to the central control room. i. Panel temperature ii. Status of cooling Fan's	
C. Power Supply Scheme Protection shall be provided in the input side of the mains power supply as follows; **i) Input mains Fault Protection MPCB**: The proposed system mains power supply fault level protection shall be 100kA. The mains input shall be protected using MPCB (with adjustable current limiting) and auxiliary signaling contact. Auxiliary signaling contacts shall monitor the Healthy/Trip condition of the MPCB. The signaling contact status information shall be updated in the control room. PLC can be provided with Isolation transformer for 415 to 230 Vac. Also, the relay board/contactor switches to be installed for acquiring the status of electrical parameters shall be from reputable manufacturers with better standability against voltage fluctuations.	
ii)Control Voltage: **Control Voltage**: The proposed PLC/RTU system control power supply voltage shall be 24V-48VDC and the same shall be derived with the use of SMPS Power Supply Unit. The SMPS input power shall be protected with suitable MCB. The power to the input of the SMPS shall be switched ON/OFF from the PLC through Auxiliary relay contact. The panel control switch gear, PLC unit, Communication unit, HMI Screen Panel, indication lamp, hooter, instruments, Auxiliary Relays, Signal Conditioners/isolators, etc shall be energized by control voltage of 24V -48V DC.	
D. Power Supply On/Off All the field instruments integrated with each remote PLC/RTU, shall be connected to the single power supply bus and energized with the control voltage supply of 24V-48 VDC. The PLC/RTU according to the application program (periodically) shall switch OFF the control voltage supply via the DC contactor, and Switch ON the control voltage supply after a programmable time delay by actuating the DC Power contactor and the use of programmable mechanical/electrical timer switch gear unit automatically to clear the memory and other floating memory locations errors, warning, faults, etc. Ultimately it shall Reset (Power-ON-Reset) the PLC/RTU.	

The Power Supply ON/OFF function command shall be activated manually locally, or from the remote central control room PLC and/or through timer fitted in PLC. The event shall be recorded in the database and suitable reporting system shall be implemented.	
E. **GPRS Communication Network** The proposed Intelligent GPRS communication unit shall have GPRS communication network capability. **Reliable Integration**: The modem should be tightly integrated with the PLC/RTU network. **Failure of Global System for Mobile Communications:** The PLC/RTU should store data in buffer memory of at least 2MB if unable to transfer due to maintenance of Global Packet Radio Service of the service provider or power failure in the cell towers etc. Data shall be transferred to central location in secure manner. i.e. No data loss in case of no connectivity.	
F**. PLC / RTU:** The PLC should have inbuilt RTU functionality with a support for USB/RS 485/RS232/Ethernet port Modem connection. The PLC/RTUs shall have minimum communication ports as follows:	
i) Two Ethernet ports for connectivity to Master Station	
ii) 1x RS232 ports for the PLC/RTU maintenance and configuration terminal. It shall be possible to increase the number of communication ports in the PLC/RTU by addition of cards, if required in future.	
v) PLC/RTU shall be designed with cyber security features based on IEC 62443-4-1 & shall have international certification (for ex. certification Level II or equivalent).	
vi) The access to the Server shall be restricted with passwords both at Windows level and at Application Level. Also, all the data should be stored in a separate file system which can be independently accessed by the Remote Network without disturbing the PLC/RTU operation and thereby maximizing the cyber security.	
v) The PLC/RTU should support for follow minimum features: • Should have the facility for the Force Simulation • Facility of Forcing Input /output variables when the physical devices are not functional • Should have user access with pass word protection • Should have the facility to program the PLC/RTU for all the different phases a) Startup phase b) Normal operation phase c) Shut down phase	
• The PLC based SCADA system should have the facility of the Web Server, the same shall be audited by NIC & hosted by NIC server in order to minimize the cyber security issues.	
• The PLC/RTU should support firmware upgrades through network.	
• The PLC/RTU should have facility of storing intermediate variables	
• Program protection feature, network filter setup, Operation log function, function removal feature should be available	
• User authentication, user-based operation restriction, and CPU operation restriction should be available.	
• The CPU should be fast enough and capable of multi-tasking capabilities like running various tasks at different programmable cycle times.	
• The CPU should have minimum 1MB RAM to cater to current and future program additions.	
• The PLC/RTU shall support all the file operating functions so that CSV file log can be stored in the basic CPU memory/buffer memory of GPRS modem for maintaining the log in case of network connection failure.	

• The PLC /RTU shall be designed to a modular concept, with separate modules for each function. The modules shall be rack mounted and may be quickly exchanged for field repair. It shall not be necessary to remove field wiring in order to exchange a module. The PLC/RTU shall support a wide range of input /output signals including status inputs, pulse (accumulator) inputs, analogue inputs, analogue outputs, and control outputs. The PLC/RTU shall support any combination of the above I/O points.	
• It shall be possible to add PLC/RTU's and software enhancements in the future, without taking the system out of service. The design and physical layout of the PLC/RTU equipment shall be on a modular basis, so that extra facilities, such as an increase in the number of status points or analogues, may be added with minimum of disturbance.	
• The PLC/RTU shall be expandable by simply adding I/O modules to the system bus. Other than user-friendly configuration of the new modules, no additional PLC/RTU software or firmware shall be required.	
• The operational status of the PLC/RTU shall be indicated on the front panel of the processor module by means of LED lamps. In addition, each I/O card shall have LED status indication.	
• Modbus TCP/IP on Ethernet /Profibus (IEEE 802-3) communication shall be provided for PLC/RTU network interconnection towards Master station.	
• SCADA System is to be capable for configuring and programming of PLC/RTU remotely, from Control room.	
G. Microprocessor /Microcontroller Module (CPU) • Built-in minimum 1 MB RAM should be available for storing Data and log records as files. Memory Card of minimum 4 MB is supported for storing data, programs and log records as files Built-in Ethernet port should be available;	
• In addition to normal scanning, CPU module should have an independent multiple constant scan function capable of a maximum scan speed i.e fast response should also be achievable.	
• CPU should have a compact body	
• CPU should have facility to be programmed in minimum 4 different languages like Ladder, Function Block, Sequential Flow Chart, Instruction List	
• Large-capacity programs and large device sizes should be supported to cope with advanced, complex control applications	
• A rich set of functions should be provided to facilitate program debugging and maintenance. For example, a forced SET/RESET function independent of program processing results.	
• PLC/RTU shall employ solid-state technology and use an industrial standard, suitable for operation in an aggressive environment with high levels of temperature, humidity and dust being common. It shall operate correctly up to a temperature of 50 degrees Celsius and up to 95% non-condensing humidity.	
• On-board battery backed Real Time Clock (RTC) is required. The RTC will operate on the battery power even when the main power is lost.	
• The PLC shall have a separate watchdog circuit independent from the main processor, which will reset the system if the firmware program fails in any way. The watchdog circuit shall be capable of being enabled or disabled by means of a jumper or by software.	
H. **Communications Interfaces** • Communication interfaces shall correspond communications between the central PLC and distributed PLC/RTU units, via hardwired OFC cable and GPRS wireless technology.	
• Adequate number of process Bus (Profibus/Modbus over ethernet TCP/IP) Communication Ports shall be configured for communication interfacing to intelligent Instrumentation. Serial communication RS232 Port/Ethernet for local laptop connection shall be available as well.	
• The RTU/PLC at gates shall be communicating to BCR primarily through Optical Fiber Cable (OFC). It should possible to remotely program RTU/PLC from the control room. Industrial grade optical fiber convertor shall be housed in each RTU/PLC at gates for optical communication between RTU/PLC and central controller.	
I. **PLC/RTU I/O Facilities**	

a) **General**	
• PLC analogue and digital inputs and outputs shall meet the requirements of test voltage of class II of IEC 255-4 appendix E.	
• The PLCs should be of modular structure, equipped with separate I/O modules foreach type of I/O signals, as follows.	
b) **Analogue Inputs**	
• Analogue inputs shall be capable of accepting current signals of, (4-20) mA, with overrange capabilities and support for 2/4 wire communications.	
• All components used in measuring circuits that affect accuracy shall be of high stability and low temperature coefficient.	
• A/D conversion shall be provided on each analogue module. The module scan cycle shall be rapid so as to satisfy the overall analogue response time specified to the master workstations.	
• It shall be possible by means of the PLC/RTU configuring software, to modify the signal dead-band, so that fluctuating signals are not continuously reported to the Master Station.	
c) **Digital Inputs**	
• Digital input modules shall be optically isolated. Digital filtering to suppress contact bounce shall be provided. In addition, software filtering of two successive cycles shall enable confirmation of state.	
• To reduce data transmission, time tagging shall be selectively applied. Only some inputs shall be time tagged at the PLC/RTU, but other inputs shall be time tagged on arrival at the Master Station.	
d) **Digital Outputs**	
• The digital output modules shall support isolated outputs in, latched and BCD mode. Individual LEDs will indicate the status of each output. The outputs shall be isolated to at least 500VDC Controls transmitted between the control station and the PLC/RTU shall comprise a select, check-back, execute sequence (or other means of providing high message security). On receipt of a select message, the PLC shall prepare to operate the output relay, and then return confirmation of correct selection of the relay to the Control Station. This signal shall be obtained as far as possible and shall be generated locally, not derived from the incoming signal. On receipt of the execute command, the output relay shall operate and confirmation of execution shall be returned to the SCADA Control Station.	
• Not more than one digital output shall be possible at a time. Selection of two or more contacts simultaneously or in quick succession without one having been completed, shall result in cancellation of both requests and return an alarm to the Master Station.	
• Software interlocking schemes shall be applied with reference to process requirements.	
e) **Analog Outputs**	
• The PLC shall support analogue set point outputs. These may be used to issue controls directly to controllers, or to drive displays.	
• Analogue outputs shall generate (4-20) mA DC output signals into a minimum load of 500 Ohms at a nominal operating voltage of 24V DC.	
• Simultaneous operation of individual digital outputs shall be provided, where this facility is required. Set point outputs shall provide the security to ensure that false selection of controls is minimized, similar to individual digital outputs.	
f. **Dummy Control** To provide test facilities, a remote dummy control shall be provided. The dummy controls and associated status indications shall be allocated with discrete addresses and operate as if they are real equipment. To set up a dummy control a PLC with dummy control set up for training of operational staff shall be provided.	

J. **PLC/RTU Operation Features**	
a) **Operation with Control Station**	
• PLCs shall have their own unique address and not transmit information to the Control Station without the request. In order to reduce communications channel load, PLCs/RTU shall incorporate data transmission reduction methods. PLC/RTU shall reply to each interrogation on a "Report-by-exception" basis with the Control Station, also being fully updated on a regular basis. Digital input data shall only be transmitted when the status has changed since the last pool interrogation. Analog values shall be transmitted when a defined percentage change occurs from the last transmitted value. Each PLC/RTU reply shall automatically include the verification of the address in the response	
• Full details of the management of digital and analogue data input shall be submitted for approval.	
• PLC/RTU's shall be also available to be polled at any time from the Control Station, either on a periodic basis or on operator command. In case of polling, all inputs may be scanned.	
• Control messages from the Control Station, shall be capable of being initiated at any time to control the barrage, and shall have priority over all other messages.	
b) **Automatic Restart** Following power interruption and /or communications failure, the PLC/RTU shall be arranged to restart automatically. This may be accomplished by retaining memory in non-volatile store.	
K. **Local HMI Facilities** • The remote PLC/RTU system shall be equipped with adequate operator panel to enable monitoring and control for the operator at the barrage level. • The operator panel shall be preferably accomplished by means of LED/LCD backlit display of 7 inches or above at Local Control Stations & 12" at Central PLC. The graphical LED/LCD should be easily detachable such that its failure does not affect the PLC/RTU functionality.	
L. **PLC Programming** • PLCs shall be reconfigurable from either a locally connected portable programming device /laptop, or remotely over the communication links from the control station. • Configuration changes shall be protected by access codes. Option for download & reconfiguring of PLC/RTU software from control Station is required. • User-friendly designed PLC/RTU programming editor supporting all IEC 61131-3 programming languages shall be included in the set of engineering software. For local process control, the PLC shall support open PLC/RTU programming standard, according to IEC 61131-3, including five main programming methodologies:	
• Ladder Diagram (LD) • Function Block Diagrams (FBD) • Instruction List (IL) • Structured Text (ST) • Sequential Function Charts (SFC)	
• PLC/RTU application software shall be installed in contiguous PLC/RTU memory data area, in order to ensure sufficient PLC/RTU computing speed. The PLC memory shall be sized to ensure it is not more than 50% occupied and that maximum occupancy does not significantly slow down the computing functions.	
M. PLC/RTU Process Operation	
• PLC/RTU shall be enabled for effective SCADA monitoring, control and data transfer with control station, as well as for local PLC /RTU level closed loop process control, control logic and other local automation applications	
• The PLCs shall be controlled by application software making it capable of the following minimum functions:	
• Command outputs	
• Select before operate feature	
• Digital filter	
• Adjustable chatter frequency	
• Time-tagging of events	

• Alarm handling		
The PLC shall be of Industrial grade with the IEC Certifications		
4.7 1KVA UPS for each remote RTU/PLC as a power back up		
1 KVA Ups shall be installed in each Local PLC/RTU panel to provide a power back up of minimum 2 hours, with following minimum specifications:		
Make & Model No.		
Features	**Value**	
Capacity	1000VA / 600W	
Voltage Range	140VAC-290VAC	
Compact Size	YES	
Boost and buck AVR for voltage stabilization	YES	
Auto restart while AC is recovering	YES	
Simulated sine wave	Modified sine wave	
Off-Mode charging & Cold start function	YES	
INPUT-		
Nominal Voltage	230Vac	
Frequency Range	50Hz	
OUTPUT-		
AC Voltage Regulation (Batt. Mode)	230VAC ± 10%	
AC Mains Frequency (Batt. Mode)	50Hz ± 1%	
Transfer Time	Typical 4-8ms	
Waveform (Batt. Mode)	Modified sinewave	
BATTERY-		
Battery Type	12V/ 7Ah x2	
Minimum Backup Time	2 Hour	
Typical Recharge Time	Shall be less than 8 hours up to 90% capacity	
INDICATORS-		
Battery Mode	Yellow flashing	
AC Mode	Green lighting	
ALARM-		
Battery Mode	Sounding every 1 minute	
Low Battery	Sounding every second	
Overload	Sounding every 1 second	
Fault	Continuously Sounding	
Output Sockets	India output	
ENVIRONMENT-		
Humidity	0-90% RH @ 0-40degC (non-condensing)	
4.8 RTU/PLC Enclosures / Housing boxes of protection protocol of IP54 and above		
A. Enclosure for PLC/RTU		
• Factory fabricated to requirements, lockable doors, dead-front, self-supporting.		
• Cabinets shall consist of a rigid self-supporting structure constructed of not lighter than 2 mm thick, cold rolled, stretcher levelled sheet steel, braced rigidly where required with structural members. Panels and doors shall be constructed of the same weight and type of material as the housing. Housings, including doors and panels, shall show no evidence of warping, weaving, or distortion upon completion of installations.		
• All cable entry in to the panel shall be form bottom using cable glands of adequate size.		
• The panel shall be provided with forced fan cooling system as a standard		
• The internal panel layout must be designed considering proper approach to the PLC/RTU, instruments, relays, terminals and other accessories for maintenance		
• The Cubicles should be in sheet steel construction, free floor mounting with front and back access. The doors and side covers should be of 2- mm thick sheet and all load-bearing members are 2 mm thick.		
• Arrange doors with minimum 90-105 degrees open position and with stops. Construct doors so that they neither weave nor warp; provide stiffening members where necessary to ensure rigidity.		
• Provide ample duct space for adding and removing wiring from the top.		
• Dimensions – As per site requirement & as approved by Engineer-in-charge		
• Lock System: Slam lock /Screw Fixed - with common key or unique key		
• The cabin shall be provided with power distribution units with sufficient number of sockets to provide power to equipment's hosted inside the cabin.		
• Provide channel base for mounting.		

B. Equipment Arrangement:	
• Wiring ducts to provide easy access for inspection and maintenance.	
• Design and arrange ducts and terminal blocks to accommodate bottom entry to cabinet for control, alarm, status, power, and instrumentation cables, as required.	
C. Ground Bus • Provide continuous copper bar ground bus, size not less than 6 mm by 25 mm along the full length at the rear of the panel.	
D. Nameplates • Engraved 20-gauge metal/baked enamel or phenol plastic, black background/white letters, drilled for screw mounting with round head screws. • Provide nameplates for all equipment, instruments, power supplies, relays, circuit breakers, fuses and other devices furnished and mounted in the cabinet. Provide nameplates for each device on panel interior door. • Submit size, type, and wording for Authorities approval. All nameplates shall be in English.	
E. Terminal blocks • Terminal blocks for switchboard control wiring shall be rack mounted/ screw clamp type. • Provide white or other light-colored markers to the terminal block, for terminal designations. • Make no more than two connections at each terminal point. • Confine switchboard internal wiring to one side only of the terminal block. The other side shall be reserved for incoming leads. • Twenty percent of terminal points in each panel section shall have no connections and shall be designated as spare terminals. • Form control wire bundles without sharp bends and support adequately.	
F. Indicating Lamps The indicating lamp assemblies shall be a heavy-duty type with color caps. Indicating lamps shall be suitable for AC/DC power supplies, utilizing long life incandescent type lamps.	
G. Lighted Pushbuttons Each lighted pushbutton shall be mechanically interlocked, illuminated type. Lighted buttons shall be the recessed guarded type to preclude inadvertent operation. Gate control lighted pushbuttons shall be furnished with a flasher so the lamps will blink at a 1-second on and off rate when the maintained pushbutton is operated.	
H. Push Buttons Each unit shall be a maintained contact type. Pushbuttons shall be the recessed guarded type to preclude inadvertent operation.	
I. Relays / contractor **Auxiliary relays**: The auxiliary relays shall be in accordance with IS standards and shall be industrial type. The relays shall have convertible contacts and shall be self-resetting. A minimum of two spare contacts shall be furnished on each relay.	
J. Special Tools The bidder shall furnish any special tools that may be required to allow proper connections of wiring to devices and all terminal blocks.	
K. Surface Finish Cabinet has to be Nano-Ceramic/Epoxy Powder coated with RAL 7035 after proper pretreatment as per the best industry practice with thickness 80 to 120 Microns.	
L. Test Procedure After the cabinets are completely assembled and wired, perform the following tests and procedures. • Dielectric test on all circuits in accordance with standard test requirements. Instruments or other devices that cannot withstand test voltage shall be disconnected. • Circuit continuity test to verify connections. • Functional tests of all control switches and indicating lamps. • Verify operation of Operator Interface Unit on cabinets. • Temperatures testing to ensure that operational temperature of all equipment's are maintained	
4.9 VFD Starter Panels	

Make & Model No.	
3Phase VFD Starter panel shall consists of S.P.P, MCB, OLR, Timer, Main Switches of reputed makes including wiring and Electronic Digital Indicator etc. The control module must be able to drive motors with the following control modes: linear, parabolic and parameterizable V/f characteristic, V/f characteristic with forward/reverse current control, linear and parabolic V/f characteristics with eco mode for additional power saving, vector control without sensor, torque control without sensor. The drive system must be protected through thermal motor protection, thermal converter protection, monitoring for under voltage and overvoltage, overloading, grounding, short circuiting, stalling and blocking of the motor. All digital and analogue inputs and outputs must be freely parameterizable and assigned to a specific function in the factory setting. To parameterize the drive, an integrated USB interface for PC/Laptop connection is needed, saving and loading parameter records and firmware updates must be possible by a memory card. The terminals have to be identified by replaceable labelling strips for individual marking.	
4.10 Equipment's at BCR Hardware at BCR shall be provided by bidder which will mainly comprise of following major items: a) Main Server and Server as Workstation (operating Station) b) Necessary data switch, router, Static IP, and fire wall for System c) 3KVA online UPS with 4 hours backup time d) External memory for data storage of 8TB for 5 years. e) A3 size Color printer f) 110" LED display/video wall/(70",2X1) DLP based system g) Master PLC Controller	
4.11 Central Control Panel (Main PLC Controller at BCR)	
Make & Model no.	
The central controller shall be based on modular PLC with firm ware based hot redundancy. Main and Redundant CPU shall be mounted in two separate racks. Event-driven synchronization method shall be provided for fast and bump less changeover to the redundant CPU in the event of a fault, without any loss of information and control. When a CPU is replaced, all the current programs and data are automatically to be synchronized by master CPU with standby CPU.The central PLC controller & SCADA shall be of the same make/manufacturer as the PLC/RTU controller in the remote station. The central controller & the PLC/RTUs shall be able to exchange data with each other freely & seamlessly, without requirement of any intervening hardware, apart from Optical convertors. The central controller shall have a 12" HMI colored screen for indicating the diagnostic & other information. It should be possible to view detailed information by using buttons on the screen, to drill-down to the appropriate page.	
The remote PLC/RTU shall pass-on all the I/O information directly to the central controller, and shall act as a slave.	
The controller should be able to communicate over an open protocol such as Profibus / Modbus over ethernet TCP/IP and GPRS wireless technology etc. The communication should be integrated in the CPU and should not require any additional cards or gateways. It should be possible to view, control & troubleshoot the PLC without requiring any additional software apart from SCADA software. Data logs should be stored inside the CPU and should be downloadable in CSV format using a web browser. It should be possible to increase the I/O handling capacity of the PLC, without changing the CPU, by the addition of appropriate I/O cards. The central controller should have a non-volatile memory of at least 4 MB & with 16 MB RAM memory card and should be tested for operation from region to region change in temperature range of 0 to 50 degrees Celsius. The central controller shall have high immunity to electro-magnetic interference according to IEC 61000-6-2 and vibrations according to EN 60068-2-6.	
4. 12 Computer Servers Server shall be industrial grade PC with USB, RS232/RS485, Ethernet Ports, OS Windows 8 or higher compatible to SCADA System. BCR shall have Master server with SCADA Software. 110" LED display/ (70", 2X1) DLP based System/video wall Unit to be connected to server with separate USB Port/ Ethernet Port. There will be two servers with monitors required (one as work station), with the Master Controller (PLC) placed at the BCR. These Computer servers are expected to operate the SCADA software as well as all software required for the project. The computer servers will be managed and operated	

by the successful bidder and his skilled trained experienced operators/engineers till the end of 5 years warranty period. The minimum specifications for the servers are given in Table below:		
Features	**Value**	
Make & Model no.		
Form Factor	Rack Mount Server	
Processor	Intel XEON ES-2440 or higher compatible configuration	
DIMM Memory	Speed: 1600MT/s RDIMMS or higher compatible configuration, 8GB RDIMM, 1600MT/s, Low Volt, Dual Rank or higher compatible configuration	
Hard Drive	RAID 5 Software or Hardware Controller compatible 5-1TB 7.2K RPM Near-Line SAS 6Gbps 2.5in Hot-plug Hard Drive or higher compatible configuration	
Network Adapter	2 GB or higher compatible	
Power Supply	Dual, Hot-plug, Redundant Power Supply/Solar Power and battery backup as compatible configuration	
Electrical Supply	220V AC and supply from AC distribution, DC of DG Set	
Devices	Soft touch Keyboard, Optical Mouse, Monitor (23" TFT) 110" LED screen (combination of more than one permitted) monitors/Video Wall/(70", 2X1) DLP based.	
Software	SCADA compatible as per specification and OS Windows 8 or higher compatible.	
Additional Memory Rack	Additional memory Rack of minimum 8TB that shall be suitable for data logging for a period of at least 5 years.	
Accessories	Power Cord, Rack Rail with cable management system Power Points as needed	
Computer Rack and related parts The bidder is required to procure full height Server racks that will hold the servers and UPS system.		
4.13 Laptop		
Make & Model No.		
Laptop (i7 5th Gen) with all allied software and hardware accessories, for programming & configuration & monitoring of SCADA system shall be provided by bidder with 4 licensed version client SCADA software		
4.14 Color A3 size Printer		
Make & Model No.		
i. Functions: Print, Copy, Scan ii. Printing Up to 20 page/minute iii. Black Print Speed (ppm) -12 Color Print Speed (ppm)-8 iv. Up to 8000 pages printing v. Recommended monthly page volume: 250 to 2000 vi. Processor speed: 600MHz vii. Connectivity: e print capability **Paper Handling: -** viii. Paper handling input, standard: 100 sheet input trays ix. Paper handling output, standard: 100-sheet face-down bin x. Maximum output capacity (sheets): Up to 100 sheets xi. Duplex printing: Manual (Driver support provided)		
4.15 Uninterruptible Power Supply Systems (3 KVA UPS System)		
Make & Model No.		
i) **General Design** • The UPS System shall be Single Phase LVAC 50Hz output with the charger and inverter normally supplying the load. • The charger shall be of thyristor-controlled type. The battery shall be of Nickel Cadmium/ SMF type. The inverter shall be of the Pulse Width Modulated (PWM) type, providing a		

single-phase output. Configuration with galvanic isolation transformer at the mains supply shall be supported. • UPS 3 KVA minimum capacity and all its consisting elements shall cover the required Station load, together with 20% spare for future use. ii) **Operation Requirements** • UPS charger shall continuously supply the load via the UPS inverter, while simultaneously maintaining the battery charge in the float charge mode. In the event of interruption or depression in the AC mains voltage to the charger, the battery shall supply the load requirements via inverter. • Upon restoration of the AC mains voltage, the UPS charger shall take over the power supply of the load via the inverter, while simultaneously recharging the battery. • UPS shall be capable of energizing the load within the permissible tolerances, without the battery connected.	
iii) **Charger and Battery** • The charger shall operate according to the constant voltage, current limiting principle, and shall incorporate a soft- start feature to gradually accept load on initial energizing. • UPS charger output characteristic shall provide an output voltage regulation of + 1%, for load changes 0-100 % and mains voltage supply and frequency within the tolerance ranges. Automatic compensation feature related on battery temperature shall be provided in case if lead-acid battery is installed.	
iv) **Inverter** • The UPS inverter output voltage shall be maintained to + 1% of the nominal value for load changes 0-100 % and mains voltage supply and frequency within the tolerance ranges. The dynamic output voltage variations shall not exceed + 10% of the rated output voltage under any circumstances of instantaneous load changes	
v) **Readings/Instrumentation and Alarms** • The following readings /instrumentation/LED indication shall be supplied as a minimum: Battery voltage UPS output voltage • The following alarms/LED Indication shall be supplied as a minimum: Charger fails Inverter input voltage high /low Inverter fails	
vi) **UPS Distribution** • The distribution system shall be designed for incoming and outgoing AC supplies. Double pole miniature or moulded case circuit breakers complying to IEC 60157 shall be supplied, fitted with auxiliary contacts that operate when the circuit breaker trips. MCBs shall be rated to meet the load requirements and shall be labelled with the destination of the load.	
4.16 Display Units The 110" industrial grade LED video wall/ (70", 2X1) DLP based to be provided by Bidder in BCR for monitoring of SCADA system. The Workstation shall be connected to the screen LED /DLP display panel through communication bus. All the required information from the PLC panel shall be continuously updated in the screen LED/DLP display panel. The screen LED/DLP display panel shall map and display the vital information like, all reservoir levels, discharge, panel status, power availability, energy meter reading, Motor data etc.	

Specifications as below or better for 110” LED/ video wall/DLP based system shall be provided		
Display Unit for 110” LED/Video Wall/DLP based System		
Features	**Value**	
Make		
Model no.		
Each Screen Size	55” class (54.64” diagonal)	
Native Resolution	1920 x 1080 (FHD)	
Pixels (H x V x 3)	6,220,800	
Brightness	700 cd/m^2	
Contrast Ratio	1400:1	
Viewing Angle	178°/178°	
Running Time	24Hr	
Orientation	Portrait & Landscape	
INPUT		
HDMI	Yes	
RS232C IN	Yes	
RJ45	Yes	
IR Receiver	Yes	
USB (USB3.0, USB2.0)	Yes	
OUTPUT		
DP Out	Yes	
Audio Output	Yes	
RS232C Output	Yes	
SPECIAL FEATURES		
Temperature Sensor	Yes	
Check Screen	Yes	
Embedded Template	Yes	
Set ID Setup	Manual, Auto	
Password Change	Yes	
Intelligent Auto	Yes	
Digital Audio Input	Yes	
Local Time Auto Setting	Yes	
Sync Mode	Time sync, Content sync	
Calibration Mode	Yes	
Internal Memory	8GB (System 4GB + Available 4GB)	
Brightness/Contrast /Backlight	Yes	
Energy Saving	Yes, Off / Minimum / Medium / Maximum / Screen Off	
Auto Config/Phase	Yes	
Basic	Remote Controller, Power cable, DP Cable, Manual, IR Receiver, RS-232C Cable, LAN Cable, Guide Bracket, Screw	
POWER		
Power Supply	100–240V AC 50/60Hz	
ENVIRONMENT CONDITIONS		
Operation Temperature	0 to 50 degrees Celsius	
Operational Humidity	10% to 90%	
4.17 SCADA SYSTEM FOR BARRAGE AUTOMATION		
Make		
The Barrage control room will have two servers (one as a workstation), Monitor with internet connection with static IP & firewall system in combination with router. The Customized SCADA software will accept information sent by all the remote PLC/RTU, store the information in a data base, display the information in appropriate mimic displays, analyze past data and trends, will have the authentication feature by way of user name and password for operating the software; Updating of parameters of the PLC/RTU along with instrument can be done interactively from this software. **The development of software has to be customized with end user**. The control room will have main PLC system with IOs, main SCADA system, GPRS Modem, gateway software etc.		
The control system along-with SCADA Software shall be provided in the Barrage control room (BCR) and the information available at control room (BCR) should also be available on any other PC/Laptop and on mobile located at any place through web. The Data provided in BCR should be displayed in complete explicit way and can be extracted in different formats.		

In Head Office located at Salt Lake, Kolkata three sets of laptops installed with licensed version client SCADA software, internet (4G/3G dongles) shall be provided by bidder for monitoring of system by Executive engineer, SE office, CE office in Salt Lake.	
The local control and computing system for the gates shall be able to calculate the actual spillway discharge depending on reservoir water level and gate opening.	
The local computing system shall be interconnected with the latest industrial grade Server with monitor and LED video wall not less than 110" size / (70", 2X1) DLP based system via master PLC Controller in the BCR, from which the command for the necessary discharge, to spillway gates shall be provided. All signals shall be sent and received to/from the BCR. Operating system shall be based on Windows server 2008 or latest.	
A master controller shall define the required total gate opening. The PLC/RTU shall compare the required value with the total actual opening found by adding up the individual opening values, if the deviation of one or more gates from the required value is large enough, an 'Open'- or 'Close'-instruction shall be given to the respective gate(s). However, to prevent hunting of hoist the deviation should be beyond the preselected tolerance band.	
In a selection circuit the 'open'- instruction shall be transferred to that gate, which at the time of the comparison controls the smallest opening. Similarly, a 'close' - instruction shall be given to the gate controlling the largest opening.	
For the gate selection, only the gates shall be considered, of which the manual switches are in the 'Automatic 'position, and where no alarm signal has been received from, the 'open'- or 'close'-instruction shall remain with the selected gate, unless any of the following conditions is met: • The required and actual openings agree and the positioner cancels the instruction, or • The gate had previously reached its limit position, or, • The max. Permissible deviation (pre-set difference in position between controlled gate and average of all gates available) has been reached previously. • The selected gate is not in operating condition.	
In the event of major changes in required size of opening, the gates shall be moved successively one step each, i.e. after re-setting all gates again agree within the pre-set margin in size of opening. After all available gates have reached their limit positions a corresponding signal shall be given.	
At any time, individual gates shall be allowed to be switched over from the automatic mode to manual mode of operation, and vice versa, however, the operation from the local panel cannot be overruled by the remote/automatic operation stage. Adjustments made manually are to be automatically compensated for with the other gates by the automatic control system.	
Manually adjusted gates shall, when returned to automatic mode of operation, be adapted to their normal functioning in the automatic mode. The automatic system shall work independent of the number of available gates with the same characteristic. If all gates have been changed over to MANUAL, the master controller shall be reset so as to permit a smooth switching-over to AUTO operation.	
The system is to be designed to monitor the duration of the instruction. The monitoring is to prevent, that an instruction is maintained over a period, that is longer than a pre-select e.g. in the event of a malfunction of a gate selected by the controller, if the monitoring system is actuated, the particular gate is to be cancelled from the group of gates available for selection.	
Electronic attenuation is to be included to provide against unsteady level signals. The system should be compatible with flood fore-casting system to be provided by the employer for the monsoon period.	
B. Functions/ Features of SCADA Software	
• Normally Dynamic Gate Operation Scheduling Program will decide position of each Gate depending on the Water Discharge requirement. • Development of Dynamic Scheduling Program is included in the scope of work. • Operator in Control room should be able to control movement of individual gates via. SCADA software. This is needed for testing and emergency handling. • The customized, with life time licensed version SCADA software shall be designed, developed, Supplied, installed & commissioned by bidder based on the inputs provided by Engineer-in-Charge which shall have following minimum features:	

i. It will accept information send by all the remote locations /sites ii. Stores the information in a data base iii. Display the information in appropriate mimic displays iv. Will have a provision to analyse past data and trends v. Will have the authentication feature by way of user name and password for operating the software. vi. Updating of parameters of the PLC/RTU along with instrument can be done Interactively from this software. vii. SCADA software shall be of at least 5000 tags & screens shall be provided as per user requirement. viii. Automatic alarm generation ix. Automatic report generation x. Auto e mail and SMS with Web server facility	
SCADA Software should mandatorily provide Graphical User Interface from Main menu with: 1. Parameterization and configuration setting of Sensor 2. Programming of PLC/RTU. 3. Real time data monitor on GUI and LED display. 4. File creation and Storage controller. 5. External Data transmission controller. 6. Burglar and alarm warning system controller. 7. Power status monitor and logging. 8. Motor status monitor and logging. 9. Data exporting features 10. Integration of rating curves 11. Manual data entry and input programmes 12. Printing graphical and tabular data	
The Successful bidder shall upgrade all such developed software during the O & M period on need basis and provide the latest versions of all such software including Source Codes, while handing over the facilities to Authority. In addition, it shall be possible to export SCADA data to Hydrological Information System (HIS) To be developed under National Hydrology Project in Future.	
4.18 Tele-metering and Supervisory Control The bidder shall provide Broadband with minimum internet speed of 8mbps for uploading and downloading along with necessary router with modem, static IP, firewall system & switches for GPRS communication. The bidder shall also provide the digital transmitters and their indications via the bus system. The SCADA System software should have the facility to track the non-functional sensors on daily basis and display on the web.	
i) Tele-metering Items • Digital type gate position indications. • Digital type water level indication. • Digital type discharge indication of spillway. • Automatic weather station	
i) Supervisory Items Alarms & Indications shall be provided at BCR. These shall include, but not limited to, the following: • A.C. fault • Common Alarm • Over Load & Trip • Open • Close • Stop • Remote/Local	
4.19 Solar Power System for Dataloggers	

i) Supply, Erection and commissioning of Solar power system with all allied ancillaries for providing un interrupted power supply to dataloggers located at canal systems for Minimum 5 days Backup without sunshine. The Solar Panels shall be provided in anodized aluminium frame with batteries, Solar panel should conform to IEC- 61730, 61215 and 61701. ii) The Bidder shall supply a pole – mounted arrangement including a standard pole and necessary foundation and fixing arrangements. The location of solar power installation shall be indicated by the concerned engineer – in – charge. iii) The batteries required for the equipment above shall be maintenance free, rechargeable sealed batteries with Overcharge and deep discharge protection Leak-proof Easy handling, Excellent recharge ability. iv) The battery pack shall also include arrangements of charging through a standard AC power supply available at canal system and also from solar panels established as above. v) The power supply unit shall have audio or visual alarms for overcharging and deep discharging conditions. The sealed construction shall allow trouble-free, safe operation in any position. The battery case shall be high-impact, with sufficient resistance to shock, vibration, chemicals and heat. vi) The battery system shall be installed in the site building located near the Cross/Head regulator of Canal system vii) Successful bidder shall provide the necessary calculations to ensure the battery backup time of 5 days considering the transmission of data in every 30 minutes & event based.	
4.20 Standards The design, manufacture and testing of all works and installations shall strictly comply with the latest edition of the relevant IEC publications/IEEE/IS standards. All the instruments/ transmitters shall be UL/CE certified.	
4.21 Wiring/Cabling requirements Shielded OFC cables complying with IEC 60793-1-1 shall be used for external Cabling from the RTU/PLC to Master controller & for entire instrumentation system to ensure the reliable operation of the SCADA system with necessary conduiting/ cable trays as per site requirement. These are minimum requirements. Bidder is free to propose improved cabling technology which shall be subjected to approval from Engineer in Charge. The cabling system design criteria shall be as follows.	
i). The term cable shall always include necessary type of connectors at both the ends for connecting between two equipment. The connectors shall be properly anchored with protective sheathing of the cable in such a way that the loads due to pulling and twisting shall be borne by the protective sheathing and the conductors shall not be subjected to any stress.	
ii). The connectors shall be so fixed on the individual components of the system that the metal/ plastic connector shall always transfer the loads due to pulling and twisting directly to the protective body of the component and the internal interface cards/ connections shall not be subjected to any load.	

iii). Laying of necessary data and power supply cables for connecting various components and embedding them or protecting them with necessary conduits shall be carried out as per directions of engineer-in-charge.	
iv). Wherever the cables are to be laid indoors and the length of the individual cable run exceeds 1 meter, the cable shall be housed in a protective conduit made of electrical supply grade conduit of appropriate diameter and the conduit shall be fixed with the wall at a height not less than 1 meter above the floor surface. Whenever the indoor cable is required to cross the floor, it shall be housed in a HDPE /GI flexible conduits pipe of 25 mm internal diameter and the pipe shall be fixed to the floor with suitable protective covering to avoid tripping of personnel using the area or disturbance to the pipe due to such movement.	
v). Wherever cables are to run through open ground including the public road and pathways, the cable shall be armoured and shall be water ingress proof up to static water pressure of 5 kg/cm2. All joints made in cable shall also meet the water proofing criteria. In addition, the cable shall be protected by housing the same in 25 mm galvanized iron pipe embedded at a depth of not less than 1.0 meter below the ground surface with a warning brick on the same. A sketch of the cable layout with respect to the identifiable marks of the area shall be prepared and handed over to the Engineer-in-charge for each such cable run on completion of the work of cable laying operation.	
vi). The joints in the cable connecting between the sensor and data collection unit shall be avoided by measuring the appropriate length of the cable required and attaching the same in one piece. If the cable joints become necessary, prior permission of the Engineer-in-charge shall be obtained before executing the same. The joint fabricated through a splicing and jointing kit shall be stronger than the parent cable.	
vii). The cable carrying data and electrical power shall be housed separately in different conduits separated by adequate distance to prevent leakage currents. The data cables shall also be laid out in such a way that the data integrity is not compromised due to mutual interference.	
4.22 Discharge Measurement	
4.23 Manufacturer Only CE/UL certified Sensors, RTU/PLC shall be used. The Remote-Control system is to be sourced from a reputed designer cum manufacturer. Following names are given as reference for PLC/RTU & SCADA system a) Allen Bradley/Rockwell b) GE c) Siemens d) Schneider electric e) ABB f) Mitsubishi If the bidder proposes alternative sourcing from an equally reputed and expert Remote-Control System manufacturer, he can propose the same with complete details, references, lists of successful Remote-Control Systems supplied/installed for prior approval from Engineer-In-Charge before placement of order with any of the manufacturer. The Employer reserves the right to reject any or all of such proposed manufacturers including manufacturers named above.	
4.24 DIESEL GENERATOR SET 10 KVA	
Make & Model no.	

• Supply, Installation, Testing and Commissioning of Silent DG Set of 10 KVA for power supply to entire SCADA system in case of power failure for more than 2 hours. • Alternator shall be self-regulated with Standard Alternator protection (Over Voltage, Over Speed, Under Voltage, Under Speed warning & Shutdown). • Engine shall have industrial silencer, Electronic/Mechanical Governor, Manual & Electric Start, Batteries, Engine Instrument panel, AVM and with water proof powder coated Acoustic enclosure for DG Set.	
A. ENGINE • Vertical, 2 cylinders, four stroke cycle Air / Water cooled cold starting compression / ignition, diesel engine under NTP conditions as per BS: 5514. • The engine will have following standard accessories: Heavy flywheel Air cleaner dry type/Oil bath type. Governor mechanical type Starter 12 volts DC 12-volt Battery with leads Dynamo / Alternator Silencer Industrial (without piping) Fuel lift pump.	
B. Alternator 415V, three Phase, 50 cycles/ sec., 1500 RPM, self-excited, self-regulated screen protected drip proof alternator in accordance with BS: 2613.	
C. Arrangement The Engine and Alternator will be close couple mounted on a common fabricated base plate.	
D. **Control Panel** M. S. / CRCA Steel fabricated L.T. switchboard suitable for indoor floor / wall mounting installation & for controlling the above generating set. The control panel will be equipped with. • Digital Energy Meter • Main On/Off switch / MCB • Set of indicating lamps. • Set of instrument fuses. • Set of current transformers. • Over voltage Relay • Suitable MPCB The switchboard shall be complete with internal wiring, front cover, rust proof, powder coated paint and arrangement for receiving incoming and outgoing cables. The control panel shall have an automatic mains failure feature for remote automatic starting from the PLC based Control panel at the Field Station. Necessary equipment like solenoid coil etc. shall be provided for the same along with an IP54 or better panel.	
E. Fuel Tank Eight hours continuous running capacity, fuel tank complete with inlet/ outlet, air vent, drain plug, inlet arrangement for direct filling. The fuel tank level shall be displayed at the local panel and the RTU/PLC based control panel at the Field Station.	

SCHEDULE FOR BUDGETARY QUOTES-

Name of Work: Supply, installation, testing, commissioning, training, Operation and maintenance of SCADA based Automatic Operation of Durgapur Barrage

Contract No: WBIW/NHP/NIQ- 02 /2019-20

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

A. SUPPLY OF GOODS :-

Line Item No	Description of Goods	Quantity	Unit	Unit price EXW [excluding GST and other taxes if any]	Total EXW price per line item [excluding GST and other taxes if any] (Col.3X5)	Price per line item for inland transportation, insurance and other services required to convey the Goods to their final destination (ITB 14.8(a)(iii))	Total GST and other taxes payable per item if Contract is awarded.	Total Price per line item Excluding GST (Col.6+7)
1	2	3	4	5	6	7	8	9
	LOCAL CONTROL SYSTEM for Durgapur Barrage Control							
1	Supply of PLC/RTU system with software development of PLC/RTU, Control Panel with front door opening cabinet, fitted with Power buses, MCBs & GPRS modem. Suitable 24 V DC power supply to power up PLC/RTU panel, including suitable switch mode power supply (SMPS) with 1 KVA UPS for Power back up of minimum 2 hours, 7" or above HMI display & Industrial type electrical fitting & cabling with suitable conduits complete for all related field instruments, as per technical specification.	12	Nos					

2	Supply of Shaft Encoder based rotary position sensor with Digital Display & proximity limit switches type Gate Position Sensors for indication and monitoring of Spillway gates, Intake Gates, Silt flushing gates including cabling & integration with PLC/RTU as per technical specifications.	44	Nos					
3	Supply of Automated Water Level transmitter non-contact RADAR type having 30m range for measuring level & downstream discharge of barrage/rivers & head regulators, including all necessary cabling with suitable conduits & electrical fittings complete as per technical specification	9	Nos					
4	Supply of Datalogger of 2 channel input type with GPRS/Gsm telemetry for datalogging & transmission of Real time data from Level transmitters at Asansol in the downstream of Maithon dam, at Panchet and Maithon dam, to SCADA system , with all relevant mounting accessories. As per technical specifications	3	Nos					
5	Supply of solar panel, charger regulator, batteries, lightening arrestor with all connectors, cables and conduit for cables for providing uninterrupted power supply to dataloggers, as per technical specifications.	3	Nos					
6	Supply of 3 Phase VFD Starter of 3 Kw panel for each motor which shall consists of VFD, S.P.P, MCB, OLR, Timer, Main Switches including cabling & Electronic Digital Indicator complete as per technical specifications.	10	Nos					
7	Supply of 3 Phase VFD Starter of 2.2 Kw panel for each motor which shall consists of VFD, S.P.P, MCB, OLR, Timer, Main Switches including cabling & Electronic Digital	34	Nos					

	Indicator complete as per technical specifications.							
8	Supply of IP based Bullet Camera (Fixed Type)- Night Vision (I.R.) Outdoor Weather Resistant, 2 Mega Pixel ,72 LED Color Camera. 6 OR 8 or 12 MM (According to site suitability) 2 MP Auto Iris Lens in Elegant Metal Die Cast Housing. Outdoor weather resistant IP 66, for monitoring the gates operation complete as per technical specifications.	44	Nos					
9	Supply of Pan Tilt Zoom (PTZ) 36 X Optical and 12 X Digital Zoom; 2 Mega Pixel IP based (DIGITAL) Sensor, 500 mtrs. Night Vision (Multiple Intelligent Array system) in IP66 Weather Resistant Outdoor Metallic Housing. Outdoor weather resistant IP 66 including cabling required for Barrage monitoring. As per technical specifications	2	Nos					
10	Supply of Automated Weather Stations set which includes Rain Gauge, Air temperature, Air pressure, Relative humidity,Wind speed & Direction, Solar Radiation Sensors, & its accessories as per technical specification	1	No					
	Barrage Control Room Equipment's							
11	Supply of Main PLC Controller system with firm ware based hot redundancy which shall include software development of PLC, Control Panel with front door opening cabinet, fitted with Power buses, MCBs & GPRS modem. All the Electrical fittings will be Industrial Type. Including suitable switch mode power supply (SMPS),12" display & cabling with related remote PLC/RTU's, complete as per technical specification.	1	No					

12	Supply, engineering and development of customized SCADA software for complete Barrage automation with life time licensed version as per technical specifications.	1	No					
13	Supply of Master server which includes Server with server Rack and industrial grade monitor with USB, RS232/RS485, Ethernet Ports, OS Windows 8 or higher compatible to SCADA System complete as per technical specifications.	2	Nos					
14	Supply of NETWORK VIDEO RECORDER (NVR) 48 Channel 1080 P Full HD, Real time Recording and Reviewing in Compression Format. As per technical Specifications.	1	No					
15	Supply of IT Hardware which includes required Static IP, Router with modem, Switch, firewall system and A3 color printer as per technical specifications	1	No					
16	Supply of 110" LED Display/ Video wall/ (70", 2X1) DLP based System for monitoring of SCADA & surveillance system at Control Room as per technical specifications	1	No					
17	Supply of online 3 KVA UPS with Battery system for power back up of Barrage control room equipment's including all necessary cabling & electrical fittings complete as per the technical specifications	1	No					
18	Supply of laptops & 4G/3G internet dongles along with licensed version of Client SCADA software for remote viewing & monitoring of Barrage automation as per technical specifications.	4	Nos					
19	Supply of Diesel Generator Set 10 KVA with Earth Pits for earthling & all associated accessories as per technical specifications.	1	Nos					

Grand Total of GST	**Quoted GST in Words**			
Grand Total (A)	**Quoted Rate in Words without GST**			

B. **INSTALLATION :-**

Service No	Description of Services	Quantity	Unit	Unit price (Excluding GST)	Total GST and other taxes payable per item if Contract is awarded	Total Price per service Excluding GST (Col. 3X5)
1	**2**	**3**	**4**	**5**	**6**	**7**
	Installation of the systems including associated civil works which also include Performance and supervision of the on-site assembly and/or start-up of the supplied Goods					
	LOCAL CONTROL SYSTEM for Durgapur Barrage Control					
1	Installation, testing & Commissioning of PLC/RTU system with software development of PLC/RTU, Control Panel with front door opening cabinet, fitted with Power buses, MCBs & GPRS modem. Suitable 24 V DC power supply to power up PLC/RTU panel, including suitable switch mode power supply (SMPS) with 1 KVA UPS for Power back up of minimum 2 hours, 7" or above HMI display & Industrial type electrical fitting & cabling with suitable conduits complete for all related field instruments, as per technical specification.	12	Nos			
2	Installation, testing & commissioning of Shaft Encoder based rotary position sensor with Digital Display & proximity limit Switches type Gate Position Sensors for indication and monitoring of Spillway gates, Intake Gates, Silt flushing gates including cabling & integration with PLC/RTU as per technical specifications.	44	Nos			
3	Installation, testing & Commissioning of Automated Water Level transmitter non-contact RADAR type having 30m range for measuring upstream level & downstream discharge of barrage/rivers & head regulators. including all necessary cabling & electrical fitting & integration with PLC/RTU/Dataloggers complete, as per technical specification	9	Nos			
4	Installation, testing & Commissioning of Datalogger of 2 channel input type with GPRS/Gsm telemetry for datalogging & transmission of Real time data from Level transmitters at Asansol in the downstream of Maithon dam, at Panchet and Maithon dam, to SCADA system , with all relevant mounting accessories. As per technical specifications	3	Nos			

5	Installation, testing & Commissioning of solar panel, charger regulator, batteries, lightening arrestor with all connectors, cables and conduit for cables for providing uninterrupted power supply to dataloggers, as per technical specifications.	3	Nos			
6	Installation, testing & commissioning of 3 Phase VFD Starter panel of 3.0 Kw for each motor which consists of VFD, S.P.P, MCB, OLR, Timer, Main Switches including cabling, integration with PLC/RTU & Electronic Digital Indicator complete as per technical specifications.	10	Nos			
7	Installation, testing & commissioning of 3 Phase VFD Starter panel of 2.2 Kw for each motor which consists of VFD, S.P.P, MCB, OLR, Timer, Main Switches including cabling, integration with PLC/RTU & Electronic Digital Indicator complete as per technical specifications.	34	Nos			
8	Installation, testing &Commissioning & integration with NVR located at Barrage Control Room of IP based Bullet Camera (Fixed Type)- Night Vision (I.R.) Outdoor Weather Resistant, 2 Mega Pixel ,72 LED Color Camera. 6 or 8 or 12 MM (According to site suitability) 2 MP Auto Iris Lens in Elegant Metal Die Cast Housing. Outdoor weather resistant IP 66, for monitoring the gates operation complete as per technical specifications.	44	Nos			
9	Installation, Testing & Commissioning & integration with NVR Located at Barrage Control Room of Pan Tilt Zoom (PTZ) Cameras, 36 X Optical and 12 X Digital Zoom; 2 Mega Pixel IP (DIGITAL) Sensor, 500 mtrs. Night Vision (Multiple Intelligent Array system) in IP66 Weather Resistant Outdoor Metallic Housing. Outdoor weather resistant IP 66 including cabling required for Barrage monitoring complete in all respects as per technical specifications.	2	Nos			
10	Installation testing & Commissioning of Automated Weather Stations which includes Rain Gauge, Air temperature, Air pressure, relative humidity, wind speed & direction, solar radiation set, including associated civil works and integration with PLC/RTU as per technical specifications.	1	No			
	Barrage Control Room Equipment's					
11	Installation, Testing & Commissioning of Main PLC Controller system with firm ware based hot redundancy which shall include software development of PLC, Control Panel with front door opening cabinet, fitted with Power buses, MCBs & GPRS modem. Including suitable switch mode power supply (SMPS) ,12" display & cabling with Industrial grade type electrical fittings for related remote	1	No			

	PLC/RTU's, as per technical specification.					
12	Installation, testing & Commissioning of customized SCADA software for complete Barrage automation with life time licensed version as per technical specifications.	1	No			
13	Installation, Testing & Commissioning of Master server with SCADA Software which includes Server with server Rack and industrial grade monitor with USB, RS232/RS485, Ethernet Ports, OS Windows 8 or higher compatible to SCADA System complete as per technical specifications	2	Nos			
14	Installation, testing & commissioning of NETWORK VIDEO RECORDER (NVR) 48 Channel 1080 P Full HD, Real time Recording and Reviewing in Compression Format. As per technical Specifications.	1	No			
15	Installation, Testing & Commissioning of IT Hardware which includes required Static IP, Router with modem, Switch, firewall system and A3 color printer as per technical specifications	1	No			
16	Installation, Testing & Commissioning of 110" LED Display/ Video wall /(70", 2X1) DLP based System for monitoring of SCADA & Surveillance system at Control Room as per technical specifications	1	No			
17	Charges for high speed synchronous internet connection (min. 8 mbps upload and download speed) & Static IP for Five years.	1	No			
18	Charges for 4G/3G internet dongles for five years which is to be provided along with laptops having lifetime licenced version of Client SCADA software for remote viewing & monitoring of Barrage automation as per technical specifications	4	Nos			
19	Installation, Testing & Commissioning of Online 3 KVA UPS with Battery system for power back up of Barrage control room equipment's, including cabling & integration as per the technical specifications	1	No			
20	Installation, Testing and Commissioning of Diesel Generator Set 10 KVA with 04 Earth Pits for earthing, Starter Panel, Energy meter, cabling and all associated accessories Complete in all respects as per technical specifications.	1	No			

21	Five Years Operation & Maintenance and Comprehensive Warranty for SCADA based Barrage automation system as per Price schedule after final acceptance of SCADA & Surveillance system. This includes replacement of material & consumable as & when required at bidder's cost and also necessary upgradation of SCADA system. The cost of Communication for GPRS & SIM charges for data transmission & other related charges. Minimum One Service Engineer shall be placed at Barrage Control Room for Operation of SCADA & Surveillance system.	1	No			
22	Training of the purchaser's personnel at the supplier's plant and/or onsite in assembly, start up, operation, maintenance and/or repair of the supplied goods. Course topics will include sensor calibration, PLC/RTU & SCADA configuration, data downloading, data retrieval, collection, Trouble shooting, processing, maintenance requirements and procedure for equipment configuration, installation, site testing and commissioning including training kit containing course material in soft and hard copies.	8	Nos			
Grand Total of GST	**Quoted GST in Words**	**INR ……. Only**				
Grand Total **(B)**	**Quoted Rate in Words without GST**	**INR ……. Only**				
Grand Total (A + B) -						