

SCOPE OF WORK

1 Purpose of the Project:

- A. Remote** monitoring and control of Teesta Barrage and Head Regulator Gates of two off-taking canals at both ends comprising design planning supply installation testing trial commissioning, operation, training and five years extended O & M warranty through a state-of-the art communication based Supervisory Control and Data Acquisition (SCADA) systems including repair, maintenance & overhauling of electro-mechanical barrage components, rust removal treatments and epoxy painting of gates and other structural steel members located at Gazoldoba within P.S Mal & Rajgunj in District Jalpaiguri of West Bengal under Teesta Barrage Project, Irrigation & Waterways Department, Government of West Bengal.”

A real-time, computer-based SCADA system and a state-of-the art communication network with all necessary hydraulic intelligence shall provide remote and automated control & operation of the gates for their logical reliable and precise operations.

- B. Safety, Security, Operation, Training & Maintenance** of entire Automation system within initial defect liability guarantee period of 12 months from date of commissioning which is to be continued for a further five years as extended warranty of automation equipments and installations including operation, maintenance & security.

The concept of implementation on which the present technical specifications and special conditions are based intends to combine the advantages of modern data collection platform, data storage, processing and data communication technologies with the requirements of high availability and sustainability. Preference will be given to robust, reliable technology. Some data collection sites may be located in remote areas and shall require annual maintenance only, so the selection of equipment and civil design shall consider this aspect. The cost of servicing a real time data network shall exceed the cost of the purchase several times over the life of the network. It is, therefore, of central importance to the Authority that the network will have the greatest possible reliability, thus minimizing the maintenance to the extent possible. Special protection against environmental factors is often justifiable, even at high initial costs.

2 Background:

Teesta barrage structure is located at village Gazoldoba across river Teesta at 9.6 mile (15.5 km) downstream of Sevoke Railway bridge, under Block & P.S Mal on the left bank and Block & PS Rajganj in District Jalpaiguri, in the State of West Bengal. (Latitude: 26°45'7.34"N, Longitude: 88°35'13.44"E)

River Teesta originates from a Himalayan glacier in the neighboring State of Sikkim which flows for about 138 km through a narrow gorge and then passes through further 171 km in the plains crosses international border to meet the river Brahmaputra in the district of Rangpur in Bangladesh.

Teesta Barrage Project (Phase-I) initially proposed creation of irrigation potential of 922 Thousand Hecter benefitting the five districts of Jalpaiguri, Alipurduar, Coochbehar, Darjeeling, Uttar Dinajpur along with power generation of 67.5 MW from canal falls, and also providing drinking water. Around 200 Thousand Ha of irrigation potential has already been created.

The Teesta Barrage main weir structure under Teesta Barrage Project Authority of Irrigation & Waterways Department was constructed in the year of 1984. M/S Hindustan Construction Company executed the civil works of the main Barrage portion and M/S Jessop & Co. Ltd. constructed the barrage proper, Head Regulator gates on both right as well as left ends, which have been made operational since 1985.

3. Teesta Barrage technical features:

Teesta Barrage has following components:

1. Spill way bays:-
 - (a) No of bays:- 33
 - (b) Width of each bay:- 18.25 M
 - (c) Crest Level:- RL+110.35 M (G.T.S)
 - (d) Super flood level- RL+116.30M (G.T.S)
 - (e) Designed flood discharge:- 20,100 Cumec
 - (f) Height of each vertical gate:- 5.50 M
2. Under sluice bays without silt excluder:-
 - (a) No of bays:- 8
 - (b) Width of each bay:- 18.25 M
 - (c) Crest Level:- RL+109.00 M (G.T.S)
 - (d) Height of each vertical gate:- 6.85 M
3. Under sluice bays with silt excluders :-
 - (a) No of bays:- 4
 - (b) Width of each bay:- 18.25 M

- (c) Crest level of the top of the tunnel:- RL+110.825 M (G.T.S)
 - (d) Height of the vertical gate :- 6.85 M
4. Silt excluder tunnels:-
- (a) No of tunnels per bay:- 6
 - (b) Opening size of each tunnel: 2.50 M (wide) x 2.05 M (height)
 - (c) Floor level of the tunnel:- RL+109.00 M (G.T.S)

Details of right bank main canal (Teesta Mahananda Link Canal Head Regulator)

Crest Level: RL+111.25m
Width of each vent: 6.1m x 4.55m
No. of vents: 13
F.S.L.: 114.00m
B.L.: 110.114m
Design discharge: approx. 300.00 cumec
F.S.D.: 3.886m

Details of left bank main canal (Teesta Jaldhaka Main Canal Head Regulator)

Crest Level: RL +111.25m
Width of each vent: 6.1m
No. of vents: 4
F.S.L.: 113.90m
B.L.: 110.20m
Design discharge: approx. 84.29 cumec

Barrage Bridge

Length: 924m
Width of roadway: 7.3m
Footpath on both sides: 1.5m
Top level of road: 119.60m

Capacity of Gantry crane: 20 MT
Capacity of Monorail crane: 4 MT
Lifting speed of gate: 0.3m/min

As per **Teesta Barrage Operation Manual** (To be modified by the Teesta Barrage Project Authority in due course), for passing river discharge above 2125 cumec, the entire spillway and under sluice gates will be opened fully. For discharge below 2125 cumec the following principles will govern operating of Teesta barrage gates:

- 1 At very low discharge, the all the barrage gates will be closed to keep the pond level at RL-114.30 M, to maintain required supply in the off-taking canals, TMLC and TJMC.
- 2 With the increase in discharge, first the silt excluder tunnels will be opened to pass on surplus water beyond the requirement of the canals.
- 3 As the discharge increases the spillway gates and the under sluice gates are opened gradually to pass on the surplus water beyond the canal requirements.
- 4 When the discharge reaches 2125 Cumec all the barrage gates will be fully opened.
- 5 For partial opening all the gates are operated simultaneously.
- 6 The operation of spill way and under sluice gates are to follow the pattern required to guide the downstream out flow to act for river training purpose.

The rating curves of the following for different water levels on the upstream side and for different gate openings are furnished in the operation Manual of Teesta Barrage (To be modified by the Teesta Barrage Project Authority in due course)

- (a) For Head Regulators.
- (b) For Spillways
- (c) For Under Sluice gates without Silt Excluder
- (d) For Under Sluice gates with Silt Excluder
- (e) For Silt excluder tunnels

Teesta barrage gates are operated 24 X 7 for 365 days with critical operations required to manage flood season, feeding of irrigation canals on both banks by diversion of discharge through Teesta Jaldhaka Main Canal and Teesta Mahananda Link Canal for Irrigation, Hydrel Power generation and drinking water supply through TMLC. The operation of barrage gates have assumed a critical proportion after construction of a series of NHPC Teesta Hydrel project Low dams on the upper reaches resulting in wide fluctuation in inflow over short intervals. The river outflow release data provided by NHPC at TLDP-IV is to be integrated with the Master Controller server for display in monitor on real time basis through GPS/GPRS communication.

45 no. of vertical main Gates of Teesta Barrage, 13 no. of Head Regulator Gates of Teesta Mahananda Link Canal (TMLC) and 4 no. Head Regulator Gates of Teesta Jaldhaka Main Canal (TJMC) are at present operated electrically with rope drum hoist system with added provisions for operating manually by lever handles through chain socket mechanism as and when required.

With the advent of modern technology, time is ripe to upgrade the operational methodology of this strategically located Teesta Barrage, which may be utilized to regulate release of Teesta Water through sophisticated and precise automated operation and control system of downstream barrage outflow as well as suitably divert discharge of river through Head Regulator gates of Teesta Jaldhaka Main Canal (TJMC) & Teesta Mahananda Link Canal (TMLC) for irrigation, hydel power generation at Lichupukri and drinking water usage.

Thus considering the hazards of manual operation of approx. 1 km long Teesta barrage, it is proposed that the Barrage and Canal Head Regulator gates be operated through a state-of-the-art **Supervisory Control and Data Acquisition (SCADA)** system of reputed brand/make/manufacturer with all hardware and software having necessary hydraulic intelligence and other features required for the Project customized by suitable discrete PID controller such as the **Programmable Logic Controller (PLC)** by the Contractor to monitor and solely operate & control (Master Controller) from adjoining **Teesta Barrage Control Room (BCR)** already existing (to be upgraded into SCADA-PLC:BCR) on right end of Teesta Barrage bridge to ensure correct, precise and scientific operation on a real time basis and successfully meet all ends.

4. Broad objectives of the project:

- A. The implementation concept of the specifications is primarily to seize advantage of the advancements made in latest reliable technologies of data processing, flow measurement techniques, information management (to provide final outputs from all inputs), data storage, communication and telemetry with the operational requirements of Teesta Barrage and head regulator gates. The automation is to develop ability to detect extreme situations, faster access to data and response time, consistency and objectiveness in measurement, and ability to perform automatic quality monitoring. Preference shall be given to robust and reliable established reputed manufacturer's technology suitable and sustainable against vagaries of nature protected against environmental factors and that the data acquisition network has the greatest possible reliability and maintainability which to be customized by the bidder to the Project specific need.
- B. Mechanical and electrical maintenance renovation and repair of all 45 no. of Teesta Barrage fabricated structural steel vertical gates, 13 no. of Head Regulator structural steel gates of TMLC (Teesta Mahananda Link Canal) and 4 nos. of Head Regulator structural steel gates of Teesta Jaldhaka Main Canal, including structural steel gantry cranes, mono rails and stop log Gate/s .
- C. Efficient real time operation control and monitoring of all 62 nos. of Gates for Teesta Barrage, TMLC & TJMC Head Regulators, whether individually or in groups using state-of-the-art SCADA technology with all necessary features and having required hydraulic intelligence to integrate all data and provide the logical final output as displays on monitors of real time gate positions, water levels and discharges and other relevant information at the Barrage Control Room (BCR), situated adjacent to the Teesta Barrage, and only for monitoring purposes without authority for operative control from two other monitoring work stations equipped with SCADA having same features at Siliguri and Jalpaiguri. The transition from manual to remote control system should not lead to any discontinuity in the measurement and records, and the process is to be specified and managed carefully prior to commissioning. It is also to be ensured that in case of failure of the new system, the existing old system shall remain operative.
- D. Each field data collection mode will measure and transmit data to the Barrage Control Room (BCR) every 15 minutes. BCR master sever shall collect all the field data and store it after quality controls. There shall be instantaneous indication on display on monitor as output of discharge through gate openings (Barrage & off-take canal Head Regulator gates), through appropriate hydraulic gate discharge equations to be provided.
- E. Display of gate opening positions of all 62 no. of gates, in absolute terms, in SI units, and in percentage terms, upstream and downstream water levels and silt content levels of river water at locations according to (C) and total discharge passing through the Barrage on the downstream, head regulator gates of TJMC and TMLC on lap top computer screens as well as on 110" LED video screen monitor display units at the Barrage Control Room (BCR). The actuators can be controlled manually or remotely from the Master Controller Server at BCR through the PLC based central control panel and viewed as final outputs as desired with suitable colour indicators. Three (3) no switches are also to be displayed for movements of gates, such as RAISE, LOWER or STOP with distinct night vision colours. Status of gate opening is simultaneously to be displayed on laptop computers and on the 110" LED video screen monitor display units at two other Monitoring work stations. There should be provision for computer Laser printing facility for generation of reports for all the three work stations.
- F. As mainly gate unit apparatus are to be connected to the BCR through cabled network, the design of cable network should involve minimum cable contents; i.e the local control panels may club up to four gates per RTU, a group of gates either for individual or up to four at a time for operation. Gate mounted end of travel limit switches shall be installed to provide contact closure on reaching gate fully open and gate fully closed positions. Switches at the fully open and fully closed positions shall be used to check the gate position measurement and to force correct indication when the gate is in the fully open and fully closed positions.

- G. The 110" LED screen-monitor display unit at BCR should provide the finally SCADA processed end results as outputs which are to also be displayed on 110" LED screen-monitor display units at other two dedicated Monitoring Control Rooms at Jalpaiguri (Central Flood Control Room) and at Siliguri (office of Chief Engineer, Teesta Barrage Project) through VSAT and GSM/GPRS telemetry redundancy for monitoring and both way communication purposes. Actual control and operation of Teesta barrage and both TMLC and TJMC head regulator gates are to be carried out solely from the BCR at Gazoldoba adjoining Teesta Barrage having the Master Controller Server. Currently, the manual operations are conducted solely from existing double storied Control Room building which would be upgraded to BCR.
- H. Here, application of VSAT Tele-metering is primarily for establishing three way both directional communications between two monitoring work stations at Siliguri and Jalpaiguri with that of the Master controller Work station at Teesta Barrage i.e BCR. The RF radio transmitter and the GSM/GPRS modem are the other important telemetry modules to be used in this Project. The equipments and pre-conditions for installation of the telemetry system in the Project shall include the design, manufacture, factory testing, deliver to site, installation including the associated interface wiring/termination, obtaining allocation of C or extended C band width licenses, WPC clearances as required for RF and VSAT, commissioning and site acceptance testing, supply of mandatory spares, training and documentation. PLC based control panels, monitoring system hardware and software, housings & enclosures shall interface and be fully integrated and tested with the all communication networks to be provided and established. The functional requirements are given in respect of each major component of the system. The contractor shall ensure that the fundamental requirements stated in this document are not compromised in any manner, whatsoever. Unlicensed wireless communication devices are required to be certified for use in India by the competent authority.
- I. Installation, commissioning of four PTZ Night vision Cameras with NVR GW Security 16CH independent PoE 10MP NVR 4TB Network at suitable points to view the entire Teesta Barrage and both end Head Regulator gates and connected with BCR and other two monitoring stations at Siliguri and Jalpaiguri for live and recorded video streaming through appropriate link.

- J **System Integration:** The bidder shall design, manufacture including make necessary procurements, install and complete the fully functional facilities in accordance with the EPC Agreement. On completion, the facilities should be entirely retrofitting for the purpose for which they are intended, as defined in the EPC Agreement.

It may be noted that system integration shall necessitate integration of hardware and software, system of 62 gates and related operational accessories, measuring instruments, SCADA software & hardware system, their remote monitoring and control. Contractor shall execute system integration for operations of Teesta Barrage Project, which necessitate integration of all supplied accessories and peripherals, hardware and software, communication networks, measuring instruments, interfacing SCADA, databases/historian, operational computational models, remote control, monitoring etc. The contractor shall have to accomplish all network requirements to ensure total compatibility, integration-ability, inter-change-ability and inter-operation-ability for various equipments and services for whole network installed.

The contractor shall submit detailed system integration configuration diagrams for SCADA and entire telemetry. The contractor shall specify system integration tests proposed to be carried out as a part of the technical bid submitted. The tests shall be such that the performance of the system as a whole commencing from the sensors and extending to the complete SCADA integration gets involved in the test plan. The System integration tests shall be carried out after completion of factory acceptance of the individual component. All those components that do not pass the system integration tests and undergo modifications shall be passed again through factory acceptance testing before using them for repeat system integrating tests.

- K. **System Redundancy:** PLCs/RTUs at Barrage will send the data through wired communication by Copper LAN wire and OFC or otherwise to the centralized Main SCADA server at Barrage Control Room (BCR). High availability system with appropriate redundancy provisions for critical components like, communication networks, I/O servers, Historians, RAID drives, application software shall ensure minimum down time as per 'WARM' Redundancy for the standby CPU at the Master controller server at BCR. It is proposed to have two such servers with redundancy so as to have uninterrupted operation in case of failures of hardware and/or software. The BCR will have an engineering workstation for entire SCADA system.

The redundancy arrangements in hardware and software shall ensure that entire automation, computing and communication systems operate smoothly and uninterruptedly during and after the occurrence of any disaster. Redundancy in hardware and software shall be applied so as to simultaneously address two aspects of disaster preparation – i.e. proactive prevention and reactive recovery. Before a disaster occurs, redundant components can mitigate the potential risks by working as backup facilities and thus preventing the disastrous consequences in advance. After the occurrence of a disaster, project operations can under WARM redundancy restore functions and process back to normalcy by substituting redundant components for the primary but disabled parts while they are being repaired and restored. A disaster recovery plan should be programmed with internal control and security that focuses on quick restoration of critical processes. When there are any sort of operational failures either due to natural or man-made reasons, the same shall be restored in consultation with Engineer-in-Charge before the system is considered as DOWN.

- L. **Post commissioning regular maintenance** shall be an integral part of contract that has the challenges of unattended operation in remote, exposed areas. The corrective maintenance will be required for data collection issues, whether they may be component failures, vandalism or due to environmental issues. The preventative maintenance is required for all system components as well as the infrastructure in place to house the data collection components.
- M. Data communication between three work stations should be through VSAT of appropriate Indian Satellite based on the crucial nature of the data. In case of temporary outage, the GSM/GPRS communication system would become operative, so that in any eventuality data no data is lost. Data from the remote stations would be transmitted through RF and GSM/GPRS telemetry. The RTU at Barrage and head regulator gates would be connected through wired cables. The contractor will be responsible for procuring all licensing arrangements required for VSAT of appropriate satellite, RF and GSM/GPRS. These include installation of VSAT ground stations for three work stations, RF transmission Tower at about 2.00 km upstream of Barrage to establish wireless RF communication between BCR and Flood Warning System and GSM/GPRS stations all of which shall be able to receive and transfer desired data and messages. This shall include the design, manufacture, factory testing, deliver to site, installation (including the associated interface wiring/termination), commissioning and site acceptance testing, supply of mandatory spares, training and documentation. Data Collection Platforms (DCP), monitoring system hardware and software shall interface and be fully integrated and tested with the VSAT Master Ground station to be provided and established. The Ground Station Antenna to receive earth observation products, rainfall etc with allied equipments and relevant software needs to be installed at BCR.
- N. **Telemetry-** The data communication networks to be actually employed on the SCADA system would be the most suitable combination of multiple technologies. All communications between gate sensor, RTU and PLC are proposed to be based on copper wire and OFC. The telemetry to establish communication with SCADA Master Controller at BCR and the remote station at 2 KM upstream of Barrage on River Teesta should be based on-line of sight RF, preferably, C or extended C band frequency wireless RF radio. The Water level sensors at Barrage would generally be of wired cable connections. The Remotely located nine Water level sensors in Teesta, Leesh & Gheesh may have GSM/GPRS telemetry or the wireless Radio slave. The communication between SCADA master controller station to monitoring stations at Jalpaiguri and Siliguri should be based on VSAT and GSM/GPRS technology providing redundancy. All WPC clearances and license fees including suitable frequency allocation permits are to be obtained by the contractor at their own cost on behalf of the Authority. Before actual installation the contractor is to undertake thorough survey to ensure that all these stations have had an in-situ radio path survey, where a mobile phone signal was detected, and/or a line-of-sight path to the VSAT. It will be the responsibility of the contractor to confirm uninterrupted radio path and mobile network coverage and adopt the most robust telemetry for the project. These recommended data communication technologies have been tentatively proposed here and actual selection is to be best suited to the requirements as per ground conditions in terms of general terms for the EPC-Agreement.
- P. **River Water Level (stage) and River Discharge Stations** – There will be in all up to 10 (ten) remote stations, one at the confluence of Rivers Leesh with Gheesh at about 2.00 km upstream of Teesta Barrage having RF transmitter and up to nine other water level sensors at various remote locations on rivers Leesh, Gheesh, Teesta with data loggers and power backups to independently communicate with the Master controller at BCR through suitable telemetry viz, GSM/GPRS or the wireless Radio slave. These data collection stations will measure river water levels (stage), discharge, and transmit this data to data center BCR, as case may be. These stations may use line of sight RF radio transmitter system as the RF transmission tower is fixed at 2.00 km upstream from Barrage. The contractor will provide all civil works for these stations, including gauge houses to protect the equipments from theft as well as environmental effects such as insect/rodent infestations or water intrusion. SH & NH crossing bridges may be utilized for Rader type sensors or in its absence suitable other mounts or bubbler type sensors or ultrasonic sensors to be used. River Water level recording stations will require a gauge house, defined as a suitable building/gauge house to provide the protection of the equipments from both the environment and tampering.
- Q. **Water Level and Outflow Discharge Stations** - This category describes data collection stations that will measure barrage pond water levels, both end canal water levels on downstream side mounted on any cross regulator or bridge and remote points in river and transmit this data to BCR. The Contractor will provide all civil works for these stations, including a Gauge House to protect the equipments from theft as well as environmental effects such as insect/rodent infestations or water intrusion. The water level measurement technology will be a Radar system non-contact type. The data of barrage gates, TLMC and TJMC canal water level and discharge flow measurement sensors need to be combined together if possible and common data collection point and communication system may be used.
- R. **Measurement of Teesta Barrage and Head Regulator Gate Openings**– Here the sensors is placed on gates of barrage and off-take head regulator canals are to measure gate openings. The measured gate opening will be used along with water elevation to determine accurate discharge past the gates. The contractor shall also be required to collect the information necessary to calculate discharge past the gates in real time. The Contractor shall propose measurement options for gauging such flows as an alternative to monitoring gate sensors. The Contractor shall be responsible for all civil works related to the installation of the sensor, though plans for civil work must be approved by the Authority prior to the acquisition, installation and commissioning of the sensor. Regardless of the sensor solution, the flow past the gates must be accurate to the actual flow.
- S. **TLMC and TJMC Canal Water Level (stage) and Canal Discharge Stations:** The discharge past the canal gates at head regulators of TMLC and TJMC or at immediate cross regulator or at head of regulator can be measured by providing gate sensors and level sensors at upstream and downstream of gates or the contractor shall propose

measurement options for gauging such flows as an alternative to monitoring gate sensors by providing side looking ADCP or combination of water level sensor and ADCP.

- T. Barrage Control Room (BCR) as Master Controller Server-** The objective of establishing of the Master Controller Data Center at BCR is to ensure that the high quality data collection, compilation, processing and analyses are available for producing high quality logical output data by installation of Industrial grade computer work station (BCR) comprising the Master Controller Server to interface with discrete PID controllers such as Programmable Logic Controller to acquire data from the remote station Data Loggers, RTU of Barrage and Head Regulator gates and operator/ remote control panel equipments from master controller on an open protocol such as MODBUS and PROFIBUS with desired high speed - Master Controller Server at the Barrage Control Room at Teesta Barrage at Gazoldoba with the System should be capable to run state of the art having all parameters of hydraulic intelligence branded reputed industrial grade manufacturer's customized SCADA software with all maximum potential functionalities with interface terminal for operator control and monitoring system. Master controller should have the facility for storing the data in local drive and communicated through suitable communication devices with antenna and tower for VSAT/ RF Radio and GSM/GPRS to remote locations and BCR. Up to 110 inch LED (one single screen) monitoring screen/video wall interfaced with master controller to view the all the parameters and status of the system in text and graphical display, One laptop (i7 4th Gen) with all allied software and hardware accessories, Windows 10 or compatible Operating system integrated by SCADA, Laser digital scanner/printer, UPS, Modem, Routers/Ethernet switches, RAM and Hard Disc Drive. Antenna, USB ports other accessories etc complete.
- (1) All the three work stations will record automatically pond level/river data/canal data/water level data every 15 minutes polling time and other measurements every 30 minutes and transmit the data to BCR master controller server. It will store this observed data in its memory and then transmit it in self timed manner in its prescribed time slot every 15 minutes. Thus polling time for all water level sensors, gate opening sensors, Digital ARG, ADCP shall also be 15 minutes unless otherwise specified separately.
 - (2) The data will be brought into an application server(s) which will perform quality control processing, data visualization function, as well as passing the data off to the reputed make highly intelligent programmed customized SCADA. The transfer to the SCADA will entail creating XML data files in real time and placing them on a network directory.
 - (3) The application server(s) will also function as a tool to determine data collection points that are in need of maintenance and repair. Software will provide station outage reports and a summary of total hours of station outage for each station as well as the entire network, by day, month and year or any period of time of interest to the project Authority.
 - (4) A licensed Firewall (till end of extended warranty) will be provided to prevent unauthorized access from the INTERNET and will be located between the public web portal and the application server(s). The application main or central server would have no connection with outside world except to transmit data to monitoring stations at Jalpaiguri and Siliguri. All remaining parts/ports on the server must be closed for security purpose.
 - (5) Adequate protection against lightnings by installation of towers/mast, suitable earthing protection equipments to safe guard all installations at the master controller, equipments telemetry of desired IP, international protection marking.
- U. Installation** - Installation of all data collection points, sensors and data center components shall be provided by the contractor. The contractor will be required to devise acceptable mounts for sensors, as sensor placement should abide by WMO convention as applicable or by standard hydrological practices, so as to ensure a good measurement as well as adequately securing the sensor from tampering and/or vandalism. The project Authority may inspect some or all equipments prior to installation to assure the products meet specifications. The Authority may also delegate this activity to a third party. Each station shall be commissioned by the Engineer-in-charge upon inspection of complete installation and functioning data collection activities. Installation shall be considered complete after System Performance and Acceptance Test (SPAT).
- V. Operation and Maintenance** - The scope of work of the project comprises operation and providing security of all automation and related equipments and spares etc., initial defect liability guarantee (automation, electrical, mechanical, instrumentation, civil and all other subcomponents for a period of next one year (12 months) from the date of commissioning of the project. At the end of the afore said period, the contractor shall be bound to provide further extended warranty of all automation and related equipments and spares etc. only for a period of five calendar years (60 months). Provision is required to be kept in the automation system so that the installed SCADA software and hardware systems can be repaired or upgraded by other agencies and companies (transfer of technology of maintenance to be made before the defect liability period of contract is over.

This operation and maintenance support contract shall refer to the complete real time data collection network, proper functioning of all equipments and control systems at BCR, all telemetry i.e VSAT, GSM/GPRS, RF, wired cable connections, Internet broadband, data collection sensors, ground station antenna and data center including the hardware and software components. Assistance and troubleshooting will be provided for all necessary maintenance, servicing, testing and recalibration operations. The contractor will intervene with his personnel within the agreed dates, on site in case of damages or malfunctioning of equipment or software and will proceed to the investigation of the cause and search for a prompt solution to ensure proper working of the system. The contractor will provide all equipment/computers, transportation and internet connectivity, necessary to maintain the network. Emergency maintenance shall be performed immediately upon notification of a motor/sensor/station outage. Preventative maintenance will be provided twice per year, once just prior to the monsoon season and once just after the monsoon season. The Supplier will provide monthly maintenance reports during the course of the maintenance period. The monthly maintenance reports will cite station and sensor outages, including the amount of time stations/sensors have been out of operation or incorrectly reporting.

The annual operation and maintenance charges shall be quoted on a year-by-year basis for the five year maintenance period. The project "Authority" reserves the right to terminate the contract in full or in part at the end of any one year maintenance period. On hand over of the complete system to the Project Authority at the end of the 5 year operation & maintenance period, the contractor shall supply a manual specifying all faults experienced by the system together with an account of how such faults have been rectified. The objective is that the personnel of Teesta Barrage Project Authority will know from lessons learnt during the 5 years operation & maintenance period.

- W. Training** - Training shall be provided by the contractor in several phases. The training shall be provided for the installation of equipments/main master controller station/sensors as well as operation and maintenance of the monitoring stations, Master Controller, Video wall monitor, servers, sensors and complete telemetry. The training shall include both classroom and field trainings for running operation use and maintenance of ADCP, Silt level Transducers and ARG. The Project Authority officials shall also be trained on the operation of the VSAT Station, GSM station, RF Transmission, Ground Station Antenna and data center, along with the data quality control computer. There shall be one week of training on the data collection platforms, communications, sensors etc. There shall also be field trainings which will include on-site training at Teesta Barrage site. There shall be one week of training on the operation and maintenance of the VSAT, RF wireless radio, Broadband Internet, GSM/GPRS data collection station with a combination of classroom and hands-on training. There shall be one week of training for the data control computer function.
- X. Gate operation through SCADA-PLC system and maintenance contract for a further period of 5 (Five) years and after initial defect liability guarantee period of one year from the date of commissioning of the project including extended warranty of all equipments and spares etc. till that period and also maintain safety and security of such equipments.** Provision is kept in the automation system so that the installed SCADA-PLC system can be repaired or upgraded by other agencies and companies (transfer of technology of maintenance to be made) within the extended warranty contract period. Provision for suitable up gradation of the utilized SCADA-PLC system, modifications required due to change in guidelines of gate operation in future, along with for further expansion through adding more SCADA features and more sensors and RTU is to be kept open in the system. Storage of data in encrypted data base and secured network, protected from all viruses and malwares in a secured server /cloud or any other secured suitable device for at least 50 years data retention. All equipments shall conform to Indian standards and specifications and the electro-mechanical component and epoxy painting shall confirm to BIS specifications. The contractor shall provide O&M manuals in four sets after commissioning of the project. The SCADA-PLC system should be installed in such a manner so as not to create any hindrance to the periodical mechanical & electrical maintenance works of Teesta barrage and both end canal head regulator gates.

5 Broad requirements of mechanical & electrical works included in the Project:

- A) Maintenance of one no. central gear box and two no. end gear boxes of each of the 45 no. barrage main gates and 17 no. head regulator gates including cleaning of gears & pinions bearings and lubricating with requisite quantity of grease, gear oil seals, supply fitting fixing of Driving Shafts, 1st & 2nd Reduction Gears, replacement of bearings and oil seals as per BOQ.**
- Opening the central gear box cover removing the existing gear oil and cleaning the gear pinion shaft, bearing and all other ancillary components etc. by suitable means/ media to remove old gear oil/ grease, rusts and other foreign contaminants. Greasing all the bearings with suitable volume pump with the supply of 3.00 Kg Servo Gem EP-2 or equivalent grease, maintain proper oil level by adding required quantity of Servo Gear HP 140 or equivalent, refitting the cover in proper alignment including replacement of damaged nuts, bolts & washers etc.
 - Opening the end gear box cover removing the existing gear oil and cleaning the pinion, shaft bearing, and all other ancillary equipments etc. by suitable means collecting the existing gear oil from the gear box housing for reuse (if suitable). Greasing all the bearings with suitable volume pump with the supply of 6 Kg. (approx.) Servo Gem EP-2 or equivalent grease refitting end gear Box housings with application of Servo Gear HP 140 or equivalent to proper level cleaning and refitting the gear box cover with proper alignment including replacement of damaged nuts, bolts & washers etc.
- B) Maintenance of rope drums along with rope by applying rope compound, replacement of nuts and bolts, grease nipples, gland packing ropes, bearings as per BOQ for each of the 45 no. barrage main gates & 17 no. Head Regulator gates.**
- Opening each rope drum cover and through cleaning the rope drum hoisting and bearing and entire rope from gate hinge to drum with necessary safety measures by adjusting the gate height and greasing with supply of approximate 2.0 Kg Grease (**Servo Gem EP-2**) or equivalent per rope drum end and cleaning thoroughly foreign particles and contaminants from entire wire rope with adequate thinners and coatings with Servo Coat 140 or equivalent and refitting the same in proper alignment including replacement of bearings, gland packing, nuts, bolts & washers etc. Work should be completed including cost of labour, scaffolding Servo Gem EP-2, Servo Coat 140 or equivalent, and Thinner etc.

C) Maintenance of guide & side load rollers and repairing of bogie frame of each of the 45 no. barrage main gates.

- Maintenance and repair of load roller after dismantling from bogie frame of the Barrage gate which should be cleaned properly by removing dust, rust, old grease and other foreign components with appropriate and greasing, shaft pins, sleeves, rings ,covers, nuts, fittings for spacers,, oil seals, grub screws, spring wires, grease nipples, roller bogie frame, maintenance of the gate components with suitable volume pump to make it perfect operating condition including supplying of requisite quantity of Servo Gem EP-2 or equivalent grease complete including scaffolding after necessary.

D) Replacement of load roller bearings (32224 Z type) of damaged guide roller bearing with new one of each of the 45 no. of Barrage Main Gates.

- Replacement of the Barrage gate load roller which should be replaced properly against damaged or broken bearing with replacement of oils seal / O-ring to make it perfect operating condition including supplying of requisite quantity of Servo Gem EP-2 or equivalent grease complete including scaffolding after necessary replacement of old and damaged bearing (32224) with proper necessary tools like bearing puller etc. and supplying & refitting of new approved make bearing in place properly.
- Replacement of damaged gate guide roller bearings with a new one guide roller bearings.

E) Complete Maintenance of Equalizer Pulley in each of the 45 no. barrage main gates & 17 no. Head Regulator Gates including replacement of 40mm dia. steel wire ropes.

- Repair and maintenance of the Barrage main gates @4 nos. per gate and H/R gates equalizer pulley which should be cleaned thoroughly by removing dust, rust, old grease and other foreign components with appropriate and greasing the gate components with suitable volume pump to make it perfect operating condition including application of requisite quantity of Servo Gem EP-2 or equivalent grease complete including scaffolding after necessary adjustments as per drawing.

F) Replacement and refitting of rubber seals for 45 no. Barrage main gates & 17 no. Head Regulator gates.

- Supply, fitting and fixing with all nuts and bolts of neoprene bottom rubber seal as per IS code of Teesta Barrage Gates as per drawings after removal of old and damaged rubber seals including disposal as directed by E.I.C from gate bottom plate with a painted seal plate by required size of nuts and bolts, plates, fixtures.
- Supply, fitting and fixing with all nuts and bolts of L Type neoprene side rubber seals as per IS code of Teesta Barrage Gates as per drawings after removal of old and damaged rubber seals from gate side plate(two sides) with painted a seal plate by required size of nuts, plates and bolts etc.

G) Complete Maintenance and repair of guide springs for each of the 45 nos. of barrage main gate and 17 no. Head Regulator gates.

- Supplying and fixing of guide spring after removal of old broken guide springs from gate plate and painting of seal plate along with the nut bolts.

H) Maintenance and repair of Plummer blocks for each of the 45 nos. of Teesta barrage main gates

Opening the plumber block cover of the main driving shaft cleaning the same to remove dust, rusts etc. by suitable means including changing the damaged felt, brass bush, oil seals, refitting the cover after refitting the Servo Gear H.P 140 or equivalent to desired level.

I) Replacement of damaged oil seals for Teesta Barrage Main Gates & Head Regulator gates.

- Dismantling the driving shaft from central gear box to end gear box and taking out driving pinion shaft after dismantling the end gear box cover and all other components as required including supplying of labours etc.
- Taking out the old and damaged oil seals & Bearing 6217 from the pinion shaft after dismantling flange coupling fitted with the pinion shaft with the help of heavy duty Jack/ Hydraulic Jack or any other means (This work should be done in a well equipped workshop).
- Refitting the special double leaf type new oil seal & Bearing (2 Nos. 6217), if necessary, and flange coupling with the pinion shaft after inserting one packing and polishing of seal journal of the shaft in proper position and alignment.
- Reassembling the pinion (after fitting new oil seal & bearing) shaft after including jointing of the driving shaft, end gear box cover and any other accessories to complete the job.
- Supply of Oil Seal for End Gear Box.

J) Replacement of complete sets of bearings for each gate with supply fitting and fixing for, Rope drums, central and end gear boxes as per BOQ.

Bearing No. 21318 EK/C3 (SKF/ FAG Make) for Rope Drum
Bearing No.6308 N/C3 (SKF/ FAG Make) for Motor of Central Gear Box
Bearing No. 6218 N/C3 (SKF/ FAG Make) for Central Gear Box
Bearing No. 6310 N/C3 (SKF/ FAG Make) for Central Gear Box

K) New supply of shop manufactured 4 no. of segments (2 no. bottom segment and 2 no. other) of fabricated structural steel stop logs as per drawing including installation, painting and maintenance of existing 31 nos. of stop logs for the Teesta barrage main gates with paintings, rubber seals fitting fixing etc complete.

- Complete repair of the each segment of 31 no. stop log & changing complete surface patchwork, painting, repair of resting channels, fitting fixing scaffolding T&P complete as per drawing.
- Supply and fixing of neoprene bottom rubber seal (Flat type) as per IS: 14566 : 2004 of Stop Logs (size 20.0 M (L) x 89 mm (W) x 24 mm (T)) after removal of old and damaged rubber seals from gate bottom plate with painting of seal plate.
- Supply fabrication at workshop with materials tools & plants including transportation from workshop/ carriage to site and erection of eight new structural steel segments comprising one unit of stop log of Barrage including complete rubber seal fittings, preparation painting, fixing of grooves and rests, installations complete.

L) Complete Replacement of wooden blocks for stop logs (4 no. of each existing units) of barrage main gates.

- Supplying of seasoned Sal Wooden block at Teesta barrage stop logs with complete M.S nut & bolt with washer for fixing the wooden blocks at Stop Log units.
- Supply fabrication with materials tools & plants including transportation from fabrication yard to site and erection of one segment of existing stop log including removal of damaged submerged segment of stop log.

M) Chequered plate units

- Dismantling and removal of damaged or worn out chequered plate as and where required over the trestle bridge and supplying, fitting & fixing of new plates with painting after thorough repair, restoration including replacement of 6MM thick MS Chequered Plates on Hoist bridge of Teesta Barrage as per BIS

N) Repair and rewinding of gantry crane main motor and complete repair works of Gantry crane of Teesta Barrage

- Varnishing, and heating the motor with supply of 3.0 litre varnish/ per motor. After dismantling the motor from its plate and refitting the same after proper overhauling in position and checking the motor operation at load. This work includes replacement of damaged nuts, bolts & washers (if any), connecting the motor with its panel board and carriage of motor to Companies workshop and back to site.
- Repairing of Wheels of Gantry crane and replacement of damaged bearing rewinding of 6.5 HP Hoist Motor at Teesta Barrage Site.
- Supplying, fitting and fixing of the 5mm transparent acrylic sheet for windows for the crane operator cabin of gantry crane.
- Supplying, fitting and fixing of steel wire rope of 13 mm diameter, construction of 6x37, steel core, 1960 tensile designation, conforms to IS specification 2266:2002(Table no-3).
- Complete rewinding of the burnt out motor of Teesta Barrage Gantry Crane after dismantling the damaged motor from its original position, Removal of burnt out stator winding of the same, rewinding of the motor by supplying of copper wire of adequate gauge, heat varnishing the same, and re-fitting it to its original position maintaining all safety precautions.
- Supplying and fitting fixing of New Gantry Crane Carrier in place of old one at Teesta Barrage as per drawing and design
- Supply and erection of new Panel Boards for Gantry Crane of Teesta Barrage including replacement of old damaged contactor panels, Main Switches, Push button Switches, Drum Controller System and all other necessary components for smooth operation of Gantry Crane and testing it in no load and full load conditions including tightening of all electrical joints checking of cables for smooth operation as per design and drawing

O) Overhauling and complete servicing of driving motor, supply and fixing of limit switches, ACEM brake system for Teesta barrage 45 nos. main gates and head regulator 17 nos. gates

- Repair and maintenance of rotary type limit switch including supply of copper strips as per sample, and filling with the required quantity of Transformer Oil (Askaral or equivalent) and electrical connection after repairing, testing the limiting operation i.e. stop the motor at lowest point and highest position of the gate during lower & upper movement

P) Supply, laying, fitting, fixing complete copper power cables and optical fibre cables including connections to all equipments local control panels, motors including ducts, casings, housings, boxes, power cable tray, individual gate panel cable from DB Box to gate panel with four core PVC insulated copper wires to complete the entire connectivity of Teesta barrage and Head regulator gates connections at BCR

- Supply & Installation of Power junction boxes, Power DB, cable accessories and hardware
- Supply, laying & installation with all civil works, Housing etc of Copper power cable and control cable along with Optical Fiber cable/ Ethernet cable with suitable IP protocol

- Supply, laying & installation with all civil works, Housing etc of Copper power cable and control cable along with Optical Fiber cable/ Ethernet cable with suitable IP protocol as per Technical Specifications & Standards with connector for installation and data transmission system

Q) Auto transfer system with three source changeover switches from three phase AC power supply to DG power supply

- Auto-Transfer system with 3 source change over from 3-Phase AC power supply of WBSEDCL to newly procured DG set power and existing DG Set by installation of converter, suitable change over switches including all necessary sub-components retrofitted commissioned.

R) Supply, Installation and commissioning of a new silent type DG set of 100KVA capacity at Teesta barrage power house

- Supply and installation of a new silent type DG set of capacity 100 KVA for entire power supply from Teesta Barrage Power House with all connections and wirings, casings, fittings complete commission and connected with auto transfer system change over switch as per direction and actual field requirement

S) Supply of new generator set for the gantry crane unit of Teesta Barrage

- Supply and installation fitting fixing complete of Generator set for Gantry Crane as per BOQ.

T) Repair & maintenance of driving motor for each of the 45 no. main gates & 17 no. of H/R Gates.

- **Heat Varnishing** and heating the following types of motor with supply of 1 litre varnish/ per motor. After dismantling the motor from its plate and refitting the same after proper overhauling in position and checking the motor operation at load. This work includes replacement of damaged nuts, bolts & washers (if any), connecting the motor with its panel board and carriage of motor to Companies workshop and back to site.
KW/HP: 2.2/3 Volt: 440Volt, Amp: - 6 Amp, 3 Phase, insulation: B, RPM: 720/750, Rating S1, Frame size: 132S

U) Repair and maintenance of limit switch for each of total 45 nos. of main gates and head regulator gates.

- Repair and maintenance of rotary type limit switch including supply of copper strips as per sample, and filling with the required quantity of Transformer Oil (Askaral or equivalent) and electrical connection after repairing, testing the limiting operation i.e. stop the motor at lowest point and highest position of the gate during lower & upper movement.

V) Repair and maintenance of electrical panel board for each of total 45 nos. of main gates and 17 no. of Head Regulator Gates.

- Replacement of old contactors from gate panel board including replacement of O/L contactor, On/ Off Switch, Fuses, Indicator Lamps, Raise & Lower Switches, Heater Coil etc. by Supplying and fixing New one as per proper rating, connecting them to the circuit and testing.

W) Repair and maintenance of Electro-Mechanical brake system for each of total 45 nos. of main gates and 17 no. of Head Regulator Gates.

- Repairing and maintenance of brake solenoid coil, brake plunger, and replacement of damage brake shoes with proper materials supply, fitting and fixing on existing frame.

X) Supply erection and commissioning of new panel boards for monorail crane of head regulators including switches drum control system and other accessories including cables for head regulators of TJMC and TMLC

- Supply and erection of new Panel Boards for Mono Rail Crane of Head Regulators including replacement of old damaged Contactor Panels, Main Switches, Push Button Switches, Drum Controller System and all other necessary components for smooth operation and testing it in no load and full load conditions including tightening of all electrical joints checking of cables for smooth operation as per design and drawing

Y) Entire electrical copper wiring of Teesta Barrage Control Room at BCR and two other Monitoring Work stations with all connections, switches, MCB, fuse, boards, plugs and sockets.

6 AUTOMATION & REMOTE CONTROL:

A. Objectives of Automation of Teesta barrage & Head Regulator Gates

The key feature of the Remote Control Automation of Teesta Barrage Gates, Head Regulator Gates of TMLC and TJMC through state of the art SCADA-PLC on an open protocol such as MODBUS and PROFIBUS to run the gates from control room located beside the Barrage structure also from local control panel located on top of the Trestle Bridge of barrage gate. The complete automation system could enable to monitor from remote stations i.e. Jalpaiguri and Siliguri on real time, viewed on monitors, even from Kolkata if required at a later stage through VSAT/GSM from Teesta Barrage Control Room. This effort is for Design, supply, installation, testing, commissioning and operation of SCADA system based upon Programmable Logic Controllers for following functions:-

- (i) Complete automation (Automation control of Gate operations) of Teesta Barrage and H/R gates of TJMC and TMLC with PLC and RTU for monitoring and control of Barrage discharge through Auto mode and manual

mode. In manual operation, control of gates will be through switch and starter from control room & also from local control panel on top of the Trestle bridge. **The manual option for operation of existing system should be kept alive for combating emergency operation in case of gross power failure at Teesta barrage site or otherwise due to sudden collapse of automated operation system.**

- (ii) Monitoring of river and canal discharge of different gates. Down looking boat mounted Acoustics Doppler flow measurement shall be performed at various points of the water course for updating the stage discharge relationship and calibration of barrage and head regulator gates. Where heavy siltation exists, river/canal profiles shall be determined using Acoustic Doppler Current Profiler (ADCP) at regular intervals of 10-15 days. Suitable side looking profiler ADCPs are proposed to perform these canal profiles.
- (iii) Each field data node shall have power supply (AC/DC/solar Power), data acquisition, data storage and transmission facility of PLC/RTU along with observation equipment. The data acquisition equipment shall have an interface with data communication equipment. The proposed data system shall have both data and voice communication with priority to data communication. Including transmission of data through SMS to the specified user. The canal gate automation software shall also provide actual water flow by as per example "FLOWCAL" or other suitable equivalent.
- (iv) The canal gate automation software shall also provide and will graphical display of all gate positions and discharge flowing. Application of graphical user interface shall enable display and generation of reports with statistical summaries.
- (v) The computer system installed at the BCR shall have facility to send flood emergency alarms, routine data as and when required by concerned authorities on VSAT/GSM telemetry.
- (vi) Display and Monitoring of various gate positions, barrage pond levels, and various discharge values shall be available at Siliguri monitoring station and Jalpaiguri Flood Control Room cum monitoring station.
- (vii) Monitoring of rainfall through Digital Automatic Rain Gauge fixed on top of BCR.
- (viii) Recording of above parameters and secured storage of records for analysis and availability of observed data for at least next 50 years and in web storage in Cloud or Red hat etc. on Internet .
- (ix) Real Time updating of acquired / calculated variables on web pages for information sharing with all authorised personnel.
- (x) Flood Alarm system with adequate time to response for Gate opening and operation.
- (xi) Monitoring the river Silt content levels near gates of barrage and both bank canals by transducers
- (xii) All above comprise the Automatic Reservoir Monitoring and Control type or equivalent Systems (ARMAC)

B. The main items for control & equipments are to be supplied and installed under this section comprise the following:

- (i) RTU based remote control system, complete in all respects located at Barrage Top, for Control and operation of spillway gates and silt excluder gates.(Offer of the Bidder shall contain complete PLC-Master Controller on an open protocol such as MODBUS / PROFIBUS – integrated in the CPU/Server at the BCR.
- (ii) Gate position, discharge (by say FLOWCAL Software or equivalent) indication and monitoring of all 62 gates.
- (iii) Calculation and display of total discharge through spillway gates, H/R gates of TMLC and TJMC.
- (iv) Radar based water level cum discharge measuring and indicating equipment along with warning System / Alarm at Barrage location.
- (v) SCADA system complete in all respects including printers, 110" LED single screen Video Wall etc.
- (vi) VSAT, GSM, RF, cabled communications modules with simultaneous backup, Redundancy in telemetry.
- (vii) One Silt measuring transducer as per specification.
- (viii) One Digital Automatic Rain Gauge as per specification.
- (ix) One Flood Alarm System at BCR as per specification.
- (x) 4 (four) PTZ night vision cameras as per specification.
- (xi) Two side looking ADCP for lined TLMC & TJMC and one down looking ADCP for Teesta River as per specification.

C. All protocol to be used should be Open ended one so that any other intelligent device can include/ exclude or communicate with the system without any protocol communication.

The Project in itself shall be complete with all necessary auxiliaries such as primary elements (position transmitters, limit switches etc.), cabling etc., as well as frames, built-in and embedded parts including all spare parts and special tools required. All the equipment shall be of international & BIS specifications from well-known reputed manufacturers. Provisions for suitable up gradation of the SCADA-PLC system and modifications required in future due to change in guidelines of gate operation, along with for further expansion such as camera feed, adding more SCADA features and more sensors is to kept open in the system. Storage of data in encrypted data base and secured network from all viruses and malwares in a secured server of 50 years data retention is desired.

7 ANTI-RUST TREATMENT AND PAINTING.

Painting of Barrage Superstructure, Main Gates, Head Regulator Gates other structural components including embedded parts.

The life of barrage super structure, fabricated structural steel gates & other structural steel parts depend upon quality of protective coatings applied on it to protect it from seasonal weathering conditions. Superstructure of Teesta Barrage was

commissioned in the year of year 1985. Painting of gates was done on a few previous occasions and at this moment is urgently required. Direct exposure to weather actions, constant exposure to dry & wet condition, submergence in river water, atmospheric, pollutants, dust etc. has been responsible for continuous damage to the MS structural steel plates and members, connections and joints. Teesta Barrage super structure and mechanical components requires appropriate coats of painting. The super structural submerged gate portions are susceptible to corrosion due to continuous under water condition. So applying appropriate protective coating of epoxy paints on metallic structural portion in entirety would substantially increase the barrage super structure life.

Preparation of Steel surfaces for painting:

Surface preparation with proper protection as per specified standards laid down in BIS code IS-14177 by shot/sand blasting (SA:2.5 STD /requirements given in IS code by compressor air jets and where ever required manually, mechanical cleaning, power tool cleaning, and then preparation of surface and applying **zinc based primer** two coats by mechanized airless spraying machine. Also, manual intervention for rust removal is necessary for various components. Final Painting of all structural & other spares and parts and all gates, embedded parts, stop log, gantry etc including its structural steel appurtenants:

Applying by mechanized means over prepared surfaces within specified time & procedure as per BIS code appropriate thickness of **Epoxy Paints** of two coats both under water submerged portions and exposed portions.

Cost & hire of Tools & Plants, paints, equipments & scaffolding, skilled & unskilled workmen, safety measures, technical supervision etc to be included in the offer bid to be executed as per BIS /ISO Good Practice for Industries provisions.

The approximate total surface area of barrage steel structural portion is **39,628 Sq.m**, on which protective coating should be applied by appropriate epoxy based paint in two or if required additional coats wherever necessary after applying zinc phosphate/based primer, and

The approximately total surface area of barrage gates portion is approx **30,079 Sq.m**, on which protective coating should be applied comprising epoxy based paints in two or three coats where ever necessary after applying zinc based primer coats on prepared surface.

8 ANCILLARY CIVIL WORK & POWER DISTRIBUTION:

The contractor is required to suitably modify the Barrage Control Room into a modern well furnished exterior & interior decorated BCR as well as the other two Monitoring Stations inclusive of all civil works and procurement of necessary furnitures, fittings and fixtures, and also upgrade the electrical power distribution system for the Master Controller Server BCR at Barrage site and also at Jalpaiguri and Siliguri monitoring and control statuaries. The control panel at BCR would be provided with additional Solar Power Supply with battery with all masts, mounts complete in all respects.

9 EMERGENCY DISASTER MANAGEMENT & EXTENDED FIVE YEARS WARRANTY, O & M.

Electrical Power distribution system modernization with provision to tackle cable faults and tripping of power supply for automated Gate Operation.

1. Existing 3-phase AC Electric Supply distribution to be revamped, upgraded.
2. In case of any fault or short fall in transmission or distribution of electric power, backup power will be retrieved from 3 source automatic control switch.
3. In case of tripping of AC power supply, the D.G set to start functioning by auto switch (existing DG set as well as a new DG set is to be procured and commissioned under this Project).
4. Provision of circuit breaker to be provided to protect equipments for monitors of gates due to faults/short circuits.
5. Separate lighting arrangement for Barrage & SCADA Control Room (BCR) and dedicated distribution network for Barrage Gates with provision for Solar Power with battery as per specification.
6. Safety against lightening / earthing.

10. RESPONSIBILITY OF BIDDER

The preliminary design and details contained in the bid Documents are based on limited information, the Authority of Teesta Barrage Project in the Irrigation & Waterways Department, Government of West Bengal could gather at the time of preparation of the bidding Documents. The bidders will be responsible to verify/ refine / propose changes to the schematic details shown in the bid Documents based on his own investigations and/or additional surveys, if required, at his own cost only to improve further the performance.

The bidder shall be fully responsible for the detailed engineering of the remote monitoring and control system for Teesta Barrage operational network (Teesta Barrage automation) interfacing with supervisory control and data acquisition (SCADA) system, which also includes repair/retrofitting of existing 62 gates and instrumentation required for control of gate. All data utilized in preparation of the bid shall be presented indicating the source of the data and also the basis for assumptions, if any.

The contractor shall be fully responsible for Supply, installation, integration, Testing and Commissioning of Remote Monitoring and Control System for Gate operations covering O & M for five years, which will start from date of taking over of work / mutually agreed date.

The bidder shall provide a detailed approach and methodology for Design, construction, installation & commissioning, and O &M including a CPM based Networking program chart. The bidder shall take into consideration all aspects of the project as his scope of work at the time of bidding, namely, though not restricted to:

- Survey Investigation
- Design & Architecture of Hardware & Software
- Supply, installation and commissioning of remote monitoring and Control System for Gate operations.
- Installation, testing and commissioning of motors and instrumentation required for gate control and other relevant systems which are not functional / available at the time of award of contract. Organizing power supply through electricity board and/or DG set included in the project.
- Project Management
- Operation & Maintenance (O & M) of the remote monitoring a control system (Automation of Teesta Barrage) interfacing with SCADA system for a post commission period of five years.
- Quality control
- Environmental & social safeguards
- Security and risk coverage