

(Press Notice)

NIT No: CWC/SHD/2011-12/1

**NOTICE INVITING TENDER
CENTRAL WATER COMMISSION**

The Executive Engineer, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla, Himachal Pradesh – 171009 invites ,on behalf of President of India ,sealed tenders comprising of technical and financial bids in separate sealed envelopes from experienced manufacturers and authorised dealers for the work “**Supply, Installation, Testing, Commissioning and Maintenance of real – time data acquisition network at 12 stations in SUTELJ, GANGA, YAMUNA, CHENAB AND BEAS river basins**” on turnkey basis for collection, transmission and processing of snow-hydro meteorological data, measuring equipments, satellite based telemetry and associated systems including hardware, software and peripherals, with a comprehensive warranty of two years and maintenance for eight years after the expiry of the warranty period.

Estimated Cost (Rs. in Crore)	Earnest Money Deposit (Rs. in Lakh)	Cost of Tender Document (Rs)	Period of completion
2.04	4.1	1500/-	180 days

1. Tender forms alongwith Terms and Conditions can be purchased from the office of the undersigned between 19.01.2012 to 15.02.2012 on all working days between 11.00 Hrs to 16.00 Hrs on payment of **Rs. 1500/-** through A/C payee Demand Draft (non - refundable) drawn on any scheduled bank in favour of the Executive Engineer, Snow Hydrology Division, CWC, Shimla payable at Shimla.
2. Technical bids will be opened at 16.00 Hrs on 17.02.2012.
3. Those interested tenderers may also download the tender document and other details from the tenders' page on the CWC website at <http://www.cwc.nic.in> and also at <http://eprocure.gov.in/cppp/> the Central Public Procurement Portal of Government of India. However, their tenders shall only be accepted on receipt of the cost of tender document as specified, on or before submission of the tender document. Tender forms requested by post will be dispatched by speed post/registered post on payment of an extra amount of Rs.250/- However, the Department shall **not** be held responsible for any postal delay.

Sd/-
Executive Engineer

**GOVERNMENT OF INDIA
CENTRAL WATER COMMISSION**

NOTICE INVITING TENDER

Tenders are invited on behalf of the President of India in two bid system – one containing technical bid and the other containing financial bid from the approved and eligible manufacturers and authorized dealers having sufficient experience of similar works for **Supply, Installation, Testing, Commissioning and maintenance of real – time data acquisition network at 12 stations in SUTELJ, GANGA, YAMUNA, CHENAB AND BEAS river basins** as listed in the schedule of quantity on turnkey basis for collection, transmission and processing of snow -hydro meteorological data, measuring equipment, satellite based telemetry and associated systems including hardware, software and peripherals in various river basins with a comprehensive warranty of two years and maintenance for eight years after the expiry of warranty period. The work is estimated to cost at **Rs. 2,04,43,312/-** (Rupees Two Crore and Four Lakh Forty Three Thousand Three Hundred and Twelve only). This estimate, however, is given merely as a rough guide.

1. Only Original Equipment Manufacturers, their authorized dealers acting singly or in consortium with other such manufacturers/ dealers, having sufficient experience of similar works, shall quote for the works. Similar works are defined as those works involving installation of equipments/ sensors of the same type of technology in the field of hydro-meteorological observations integrated with data acquisition and satellite based transmission systems. The tenderers shall produce proof from the appropriate authorities of having satisfactorily completed similar works during the last ten years, where the systems installed by them are working satisfactorily in at least two alluvial river basins for two years and the same could be inspected.
2. A prospective bidder may apply singly or in a consortium with other partners each one being EITHER an Original Equipment Manufacturer (OEM) or an Authorized Agent/ subsidiary having sales and full service facilities located in India. For authorized dealers, the submission of a certificate to the effect from the OEM being represented by him shall be obligatory.
3. In case of a consortium, the agreement in original between various partners will be submitted with the bid clearly identifying the parts and components of the system for which the concerned partner is responsible for execution. However, each of the partners of the consortium will be jointly and severally responsible for execution and completion of the works.
4. One of the partners of the consortium will be identified as a lead partner and will be authorized to execute the contract with the purchaser. All financial transactions and liabilities shall rest with the lead partner.
5. The qualifying criteria will be applicable to each of the partners of the consortium with a limited scope of works for which the concerned partner is responsible as a member of the consortium.
6. In case of consortium of manufacturers, authorized dealers, contractors for the major components of the works, such as telemetry, etc. the qualifying criteria will be applicable to each partner separately for the specific portion of the project which are to be the direct responsibility of the partner.
7. Agreement shall be drawn with the successful bidder on prescribed Form CPWD-8 which is available as Government of India Publication; Bidder shall quote his rates as per various terms and conditions of the said form, which will form part of the agreement.

8. The time allowed for carrying out the works shall be 180 days from the 31st day after the date of written orders to commence the works.
9. The site for the work is available.
10. Receipt of applications for issue of tender forms will be stopped by 16.00 hrs on 14.02.2012. Issue of tender forms will be stopped by 16.00 hrs on 15.02.2012.
11. Tender documents consisting of specifications, the schedule of requirements of the various items of work to be executed and the set of conditions of contract to be complied with by the contractor whose tender may be accepted and other necessary documents can be examined in the office of the *Executive Engineer*, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla, Himachal Pradesh – 171009 between hours of 11:00 hrs to 16:00 hrs on all working days. Tender documents, excluding standard form, will be issued from his office, during the hours specified above, on payment of Rs.1500/- through A/c payee Demand Draft drawn in favour of *Executive Engineer, Snow Hydrology Division,, CWC, Shimla payable at Shimla*. Tender forms requested by post will be dispatched by speed post/registered post on payment of an extra amount of Rs.250/-. However, the Department shall **not** be held responsible for any postal delay.
12. The tenderers shall enclose with the technical bid of the tender document the Income-Tax clearance certificate and a definite proof from the appropriate authorities of having satisfactorily completed at least one similar work during the last ten years and the installations at the specified work are functioning satisfactorily since last two years in at least two alluvial river basins.
13. The tenderers downloading the tender document from website shall enclose the cost of tender document i.e. Rs. 1500/- in the form of A/C payee Demand Draft (non - refundable) drawn on any scheduled bank in favour of the Executive Engineer, Snow Hydrology Division, CWC, Shimla payable at Shimla in a separate envelope along with the tender document at the time of submission.
14. Tenders, in two bid system, one sealed cover containing technical bid with earnest money and the other sealed cover containing financial bid and both the covers placed in another sealed envelope, with the name of work and due date of opening written on the envelopes, will be received by the *Executive Engineer*, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla, Himachal Pradesh – 171009 up to 15.00 hours on 17.02.2012 and technical bid will be opened by him or his authorized representative in his office on the same day at 16.00 hours. The Technical Bids shall be given a weightage of 60% (Technical score 'St') such that the Bidder scoring highest marks as per the evaluation criteria mentioned in "Additional Instructions to Tenderers" is given 100% weightage and Financial Bids shall be given a weightage of 40% (Financial score 'Sf') such that the bidder quoting the lowest rates is given 100% weightage. Financial bids shall be opened only of the bidders whose marks as per the evaluation criteria are above the minimum qualifying marks i.e., 60 marks. The date and time of opening of the financial bids shall be fixed subsequently and intimated to the technically qualified bidders in advance. The bidder getting the highest Total score 'T' (St + Sf) shall be Ranked I for starting the negotiations (not involving financial aspects) for award of the contract.
15. The technical bid shall include all the relevant technical literature, brochures and other documents supporting the technical competence of the offers and shall indicate by proper cross referencing with such supporting documents as to how the specification requirements are being met by their offer. Any additional information requested by the purchaser during the course of evaluation of the technical and financial bid shall be supplied within the time limits set by the purchaser.
16. The technical bid shall be accompanied by Earnest Money, (unless exempted) of Rs. 4,10,000/- (Rupees Four Lakh Ten Thousand only) as Demand Draft drawn on a Scheduled Bank in favour of *Executive Engineer*, Snow Hydrology Division, CWC, Shimla.

Contractor exempted from depositing earnest money in individual cases, shall attach with the tender an attested copy of the letter exempting him from depositing earnest money and shall produce the original when called upon to do so. If the technical bid of the tender does not contain specified earnest money the tender will be summarily rejected and their financial bid shall not be opened.

17. The details of the work are given under the Schedules, Special Conditions of Contract, Scope of Work and Technical Specification.
18. Detailed information pertaining to the works will be open for inspection by the tenderers at the office of the above-mentioned officer. Tenderers are advised to inspect and examine the locations where the telemetry system is to be installed and their surroundings and satisfy themselves before submitting their tenders as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their tender. The remote site has to transmit the data to the existing modeling centre at Shimla routed through the existing CWC ERS at Delhi, which are already connected by VSAT arrangement. A tenderer shall be deemed to have full knowledge of the site whether he inspects or not and no extra charges consequent on any mis-understanding or otherwise shall be allowed. The tenderer shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and other factors having a bearing on the execution of the work.
19. The competent authority on behalf of President of India does not bind itself to accept the lowest or any other tender, and reserves its right to reject any or all of the tenders received without the assignment of any reason. The competent authority on behalf of President of India reserves to himself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rates quoted.
20. The tenderer who wants purchase preference shall clearly indicate so in financial bid along with copy of the document based on which such claim is made. The competent authority reserves its right to allow to the Central Government Public Sector Enterprises a purchase preference with reference to the lowest valid price bid as per Government of India rules prevalent on the date of opening of bid.
21. All tenders, in which any of the prescribed conditions are not fulfilled or are incomplete in any respect are liable to be rejected.
22. Canvassing whether directly or indirectly, in connection with tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection.
23. The tenderer shall not be permitted to tender for works in the CWC Circle (responsible for award and execution of contracts) in which his near relative is posted as Divisional Accountant or as an officer in any capacity between the grades of Superintending Engineer and Assistant Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any gazetted officer in the Central Water Commission or in the Ministry of Water Resources. Any breach of this condition by the tenderer would render his tender liable to be rejected.
24. No Engineer of Gazetted rank or other Gazetted officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of one year after his retirement from Government service, without the previous permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a

person who had not obtained the permission of the Government of India as aforesaid before submission of the tender or engagement in the contractor's service.

25. The tender for the works shall remain open for acceptance for a period of Ninety (90) days from the due date of submission of tenders. If any tenderer withdraws his tender before the said period or makes any modifications in the terms and conditions of the tender which are not acceptable to the department, then the Government shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid.
26. This Notice Inviting Tender shall form a part of the contract document. The successful tenderer / contractor, on acceptance of his tender by the Accepting Authority, shall, within 15 days from the stipulated date of start of the work sign the contract consisting of:-
 - a) The notice inviting tender, all the documents including General Conditions and Special Conditions of contract, technical specifications, forms the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.
 - b) Standard C.P.W.D.Form-8.
27. A pre – bid conference shall be held at 11:00 hrs on 09.02.2012 in the Office of Director, Monitoring & Appraisal Directorate, Central Water Commission, Block-10, SDA Complex, Kasumpaty, Shimla, Himachal Pradesh-171009. The representatives of the tenderer who have purchased the tender documents and their associates (not exceeding a group of 4 persons) with a letter of authority shall be eligible to participate in the conference and take part in the discussions. A potential tenderer may send, by 16.00 hrs of 06.02.2012, the issues in writing on which clarifications are required. All the queries and clarifications required by them will be submitted in writing duly signed preferably prior to the convening of the conference and in any case not later than 1 hour after the conclusion of the conference. Only written requests will be responded to in the amendments/ clarifications issued by the purchaser after the pre-bid conference. All responses to the clarifications will be supplied to all the tenderer without identifying the individual tenderer who raised the request. For the tenderers purchasing the tender documents subsequent to the issue of the clarifications, the same shall be supplied with the tender documents and no additional queries/ clarifications will be entertained. The clarifications issued shall be treated as amendments to the tender requirements.

In this conference, the clarifications, if any, required by any prospective tenderer on the bidding documents would be discussed. If, for any reason, whether at its own initiative or in response to a clarification requested by the prospective tenderer, the purchaser modifies the bidding documents by an amendment, the same will be sent to all prospective tenderer who have received the bidding document. The modifications/amendments if any shall be put on CWC website <http://www.cwc.gov.in> after the pre-bid conference. The Tenderers have to confirm the same from the CWC website before submitting their tenders.

**Executive Engineer,
Snow Hydrology Division,
CWC, Shimla**

ADDITIONAL INSTRUCTIONS TO TENDERERS

- 1) A prospective Tenderer requiring any clarification of the Tender Documents may notify the department in writing, which should reach the Executive Engineer at least seven (7) days before the closing date. Written copies of the department's response (including an explanation of the query) will be sent to all prospective Tenderers and the same shall also be put on CWC website which shall form part of the tender document.
- 2) At any time prior to the deadline for submission of bids, the department may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Tenderer, modify the bidding documents by amendment in writing, which will be binding on all the Tenderers.
- 3) The bid prepared by the Tenderer, as well as all correspondence and documents relating to the bid exchanged by the Tenderer and the department shall be written in English language. Supporting documents and printed literature furnished by the Tenderer may be in another language provided they are accompanied by an accurate translation of the relevant passages in the English language in which case, for purposes of interpretation of the Bid, the translation in English Language shall govern.
- 4) All corrections/ cuttings/overwritings in the tender document shall be initialed by the Tenderer.
- 5) The technical bid prepared by the Tenderer shall comprise the following components:
 - a) Technical specifications of the offered equipments with comparison sheet with the specifications as required in the tender documents. The specifications of the equipment shall include the brand name and manufactures details for each component;
 - b) The Technical specifications for Synthesized Down Converter and Digital Receiver/ BPSK Demodulator shall include the features indicated in clause-7.4 & 7.5 of Technical Specifications.
 - c) All the terms and conditions clearly indicating variation, if any, with tender requirements;
 - d) Documentary evidence to establish that the Tenderer is eligible to bid and is qualified to perform the contract if the bid is accepted:
 - e) Documentary evidence to establish that the goods and ancillary services to be supplied by the Tenderer are as per specifications and conform to the bidding documents;
 - f) Earnest Money Deposit in prescribed form; and
 - g) Original tender with schedule of quantities without any pricing information.
 - h) The Bio-data of the Engineers / Technicians in-charge of the work during execution as well as maintenance.
 - i) "Only such equipments or its upgrades shall be used which are working satisfactorily at least for the last two years". The Tenderer will furnish the definite proof to this effect from the user.
- 6) The financial bid shall comprise the following components:
 - a) Schedule of Quantities and Financial Bid Format duly completed.
- 7) Evaluation of Bids: The Technical Bids shall be given a weightage of 60% (Technical score 'St') such that the Bidder scoring highest marks as per the below mentioned evaluation criteria is given 100% weightage and Financial Bids shall be given a weightage of 40% (Financial score 'SF') such that the bidder quoting the lowest rates is given 100% weightage. Financial bids shall be opened only of the bidders whose marks as per the evaluation criteria are above the minimum qualifying marks i.e., 60 marks. The date and time of opening of the financial

bids shall be fixed subsequently and intimated to the technically qualified bidders in advance. The bidder getting the highest Total score 'T' = (St + Sf) shall be Ranked I for starting the negotiations(not involving financial aspects) for award of the contract.

The Technical Bids shall be evaluated for a Technical score (St) as per the following criteria.

S. No	Evaluation Criteria	Marking Criteria	Max. Marks
1	Nature of Business/ Overall experience (Consul. In Water Resources, Snow Hydrology)- No. of years of experience in Telemetry	More than 6 -15 2 to 6 -12 Less than 2 - 10	15
3	Financial Strength (Average Annual Turn Over of last 3 years) in Crore Rupees	More than 10 -10 5 to 10 - 8 Less than - 6	10
4	Present Organisation Strength (Total No.of Executives)	More than 50 -10 30 to 50 - 8 Less than 30 - 6	10
5	Experience in handling similar projects (no.of projects)	More than 5 -15 2 to 4 - 12 Less than 2 - 10	15
6	Experience in satellite data communication systems and their maintenance (in years)	More than 5 -10 3 to 5 - 8 Less than 3 - 6	10
7	Experience in the installation of similar systems in Hilly terrains or Remote areas (in years)	More than 5 -10 3 to 4 - 8 Less than 3 - 6	10
8	Experience in the field of Hydro-Meteorology (in years)	More than 5 - 10 2 to 4 - 8 Less than 2 - 6	10
9	Experience in the field of Snow Hydrology (in years)	More than 5 -15 3 to 5 -10 Less than 3 - 8	15
10	Capacity Building/ Training (in years)	More than 5 -5 3 to 5 - 3 Less than 3 - 2	5
		Total	100
		Minimum qualifying marks = 60	Ranking

Please Note: Bidders are requested to submit their technical bids with all the supporting documents in the above order only for the purpose of technical evaluation. Those bids not meeting this criteria shall be summarily rejected.

- 8) The prices quoted shall be F.O.R. Destination and inclusive of all duties and taxes including Custom Duty, Octroi, VAT, service tax, Entry and other taxes etc and no additional amount on the quoted prices shall be paid on account of such duties, taxes and octroi etc.

- 9) Fixed price. Prices quoted by the Tenderer shall be fixed during the validity period of the Contract and not subject to variation on any account. A Tender submitted with an adjustable price quotation is liable to be treated as non-responsive and rejected.
- 10) Prices shall be quoted in Indian Rupees only.
- 11) The Tenderer shall furnish, as part of its Tender, documents establishing the eligibility and conformity to the bidding documents of all goods and services, which the Tenderer proposes to supply under the Contract.
- 12) The documentary evidence of conformity of the goods and services to the tender documents may be in the form of literature, drawings and data, and shall consist of:
- a. A detailed description of the essential technical and performance characteristics of the goods.
 - b. A list giving full particulars, including available sources and current prices of spare parts, special tools, etc. necessary for the proper and continuing functioning of the goods for a period of fifteen years, following commencement of the use of the goods by the Department, and
 - c. An item-by-item comments on the department's technical specifications demonstrating substantial responsiveness of the goods and services to those specifications or a statement of deviations and exceptions to the provisions of the technical specifications.
- 13) For purposes of the comments to be furnished, the Tenderer shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers designated by the department in its technical specifications are intended to be descriptive only and not restrictive. The Tenderer may substitute alternative standards, brand names and/or catalogue numbers in its bid, provided that it demonstrates, to the department's satisfaction, that the substitutions ensure substantial equivalence to those.
- 14) During evaluation of technical bids, the department may, at its discretion, ask the Tenderer for a clarification of its bid or ask for field/office demonstration of the equipment, for which no charges shall be paid to the Tenderers. The request for clarification and the response shall be in writing and no change in prices or substance of the bid shall be sought, offered or permitted.
- 15) Tenders from Agents/dealers, without proper authorisation from the manufacturer, shall be treated as non-responsive.
- 16) Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If there is a discrepancy between words and figures, the amount in words will prevail. If the contractor does not accept the correction of errors, its tender will be rejected.
- 17) The department will evaluate and compare tender which have been determined to be substantially responsive and the financial tender shall be opened only of the Tenderers whose technical bids are found acceptable. The date and time shall be fixed subsequently and intimated to the technically qualified Tenderers in advance.
- 18) The evaluation of Financial Bids shall include:

- a. The cost of equipment including the taxes, octroi, levies etc. as applicable at final destination and installation, testing, commissioning, maintenance and training and any other services essential for completion of works;
 - b. Cost of essential spares/consumables as specified in Technical specifications para 16.0, required for running & maintenance of all the equipments for two years; and
 - c. Cost of Annual Maintenance Contract for all the equipment including replacement of defective material for next Eight (8) years beyond warranty period.
- 19) The Tenderer shall not contact the Department on any matter relating to its bid, from the time of the bid opening to the time the Contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Department, it should do so in writing.
- 20) An affirmative determination will be a prerequisite for award of the work to the contractor.
- 21) The department reserves the right at the time of contract award to increase or decrease by up to 10% the quantity of goods and services originally specified in the Schedule of Quantities & Financial Bid Format without any change in unit price or other terms and conditions.
- 22) Attention of the tenderers is drawn to the Clause 1 and Clause 1(A) of Standard Contract Conditions under CPWD Forms 7/8 regarding the deduction of security deposit.

**GOVERNMENT OF INDIA
CENTRAL WATER COMMISSION**

STATE : Himachal Pradesh
 ORGANISATION : Indus Basin Organisation, Chandigarh
 CIRCLE : M & A Directorate, Shimla
 DIVISION : Snow Hydrology Division, Shimla

Tender & Contract for Works

Tender for the work of **Supply, Installation, Testing, Commissioning and maintenance of real – time data acquisition network at 12 Stations SUTELJ, GANGA, YAMUNA, CHENAB AND BEAS river basins** on turnkey basis for collection, transmission and processing of snow-hydro meteorological data, Measuring Equipment, Satellite telemetry and associated systems including hardware, software and peripherals, with a comprehensive warranty of two years and maintenance for eight years after the expiry of the warranty period.

- i. To be submitted up to 15.00 hours on 17.02.2012 to Executive Engineer, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla – 171009.
- ii. To be opened in presence of tenderer(s) or their authorized representatives who may be present at 16.00 hours on 17.02.2012 in the office of Executive Engineer, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla – 171009.

Issued to _____
 (Contractor)

Signature of officer issuing the documents _____

Designation _____

Date of Issue _____

TENDER

I/We have read and examined the Notice Inviting Tender, Schedule A, B, C, D, E & F. Specifications applicable, Drawings & Designs, General Rules and Directions, General Conditions and Special Conditions of Contract, Schedule of Rate & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the President of India within the time specified in Schedule 'F', viz., schedule of quantities and in accordance in all respects with the specifications, designs, drawings and instructions with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

I/We agree to keep the tender open for Ninety (90) days from the due date of submission thereof and not to make any modifications in its terms and conditions.

A sum of Rs. ----- lakhs is hereby forwarded as Demand Draft of a Scheduled Bank as earnest money. If I/We, fail to commence the work specified, I/we agree that the said President of India or his successors in office shall without prejudice to any other right or remedy,

be at liberty to forfeit the said earnest money absolutely; otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, upto maximum of the percentage mentioned in Schedule 'F'.

I/we have already furnished security to the President of India in lieu of earnest money and have deposited with the Executive Engineer, Snow Hydrology Division, CWC, Shimla a lump sum security of Rs..... as earnest money in individual cases & I/We, therefore claim exemption in terms of the Bond executed by me/us and bearing no. _____ dt. ___/___/___ against the necessity of depositing earnest money in respect of the above tender for work. I/We agree that should the President of India or his successors in office decide to forfeit earnest money mentioned for this work, unless a sum equal to the earnest money is paid by us forthwith, the competent authority, for President of India may at his option recover it out of the deposit and in the event of deficiency, out of any other money due to me/us under this contract or otherwise.

I/We hereby declare that I/we shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/we am/are authorised to communicate the same or use the information in any manner prejudicial to the safety of the State.

I/We agree that should I/we fail to commence the work specified in the above memorandum, an amount equal to the amount of the earnest money mentioned in the form of invitation of tender shall be absolutely forfeited to the President of India and the same may at the option of the competent authority on behalf of the President of India be recovered without prejudice to any other right or remedy available in law out of the deposit in so far as the same may extend in terms of the said bond and in the event of deficiency out of any other money due to me/us under this contract or otherwise.

Dated.....

Signature of Contractor
Postal Address

Witness:

Address:

Seal

Occupation:

ACCEPTANCE

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the President of India for a sum of _____ Rs.
(Rupees _____)

The letters referred to below shall form part of this contract Agreement:

- i)
- ii)
- iii)

For & on behalf of President of India

Signature.....

Designation.....

Dated.....

SCHEDULES

- SCHEDULE 'A'**- Schedule of quantities (Enclosed at Table 1 & 1A)
- SCHEDULE 'B'** – Not applicable
- SCHEDULE 'C'** - Not applicable
- SCHEDULE 'D'** – Additional Conditions of Contract and Technical specifications.
- SCHEDULE 'E'** - Not Applicable

SCHEDULE 'F'

Reference to General Conditions of Contract as applicable for Tenders invited under CPWD Form 7/8.

Name of work: Supply, Installation, Testing, Commissioning and Maintenance of real – time data acquisition network at 12 Stations in SUTELJ, GANGA, YAMUNA, CHENAB AND BEAS river basins on turnkey basis for collection, transmission and processing of snow-hydro meteorological data, Measuring Equipments, Satellite based telemetry and associated systems including hardware ,software and peripherals, with a comprehensive warranty of two years and maintenance for eight years after the expiry of the warranty period.

1	Earnest money	Rs. 4,10,000/-
2	Performance guarantee	5% of contract value
3	Security Deposit	5% of contract value
	General Rules & Directions:	
4	Officer inviting tender	<i>Executive Engineer, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla – 171009</i>
	Definitions:	Additional definitions as per conditions of contract clause 1
5	Engineer-in-Charge	<i>Executive Engineer, Snow Hydrology Division, CWC, Block No.29, 1st Floor, SDA Complex, Kasumpty, Shimla, Himachal Pradesh – 171009</i>
6	Accepting Authority:	Director, M&ADte, CWC, Shimla/Chief Engineer (IBO), CWC, Chandigarh.
7	Percentage on cost of materials and labour to cover all overheads and profits.	Not Applicable
8	Standard Schedule of Rates	Not Applicable
9	Department:	Central Water Commission
10	Standard CPWD Contract Form	CPWD Form-8 as amended from time to time
	Clause 1	
i	Time allowed for submission of Performance Guarantee from date of issue of letter of acceptance	30 Days (No extensions to be granted)

ii	Maximum allowable extension beyond the period (provided in i) above	(No extensions to be granted)						
	Clause 2							
	Authority for fixing Compensation under clause 2	Director, M&ADte, CWC, Shimla /Chief Engineer (IBO), CWC, Chandigarh						
	Clause 2 A							
	Whether Clause 2 A is applicable	No						
	Clause 5							
	Number of days from date of issue of letter of acceptance for reckoning date of start	30 Days						
	Milestones	None						
	Time allowed for execution of work	180 Days						
	Clause 6 & 6A	Separate measurement and verification procedure as defined in clause No.15 in Special conditions of contract enclosed						
	Clause 7 Payment on intermediate certificate	Separate procedure as defined at clause No. 16 in Special Conditions of Contract						
	Clause 10 A	Not applicable						
	Clause 10 B(ii)	Not applicable						
	Clause 10C(a)	Not applicable						
	Clause 10 C(c)	Not applicable						
	Clause 11 Specifications to be followed for execution of work	Enclosed Technical Specifications						
	Clause 12	Deviated quantities of individual sensors shall be permitted to the extent of 10% of the total quantities of the specific type of sensors assessed by the Contractor and agreed in the contract. Change orders and amendments to be governed by clauses 18 & 19 of Special Conditions of contract.						
	Clause 16	As per clause 4.1 & 7.3 of Special Conditions of contract. The sub-standard work shall not be accepted.						
	Clause 18	Not applicable						
	Clause 36							
	Minimum qualifications & experience required for Principal Technical Representative	<table border="1"> <tr> <td>a) For works with estimated cost put to tender more than</td> <td></td> </tr> <tr> <td>Rs. 10 Lakhs for civil work</td> <td>Graduate or retired AE possessing</td> </tr> <tr> <td>Rs. 5 Lakhs for Elect/Mech Works</td> <td>at least Recognised Diploma holder</td> </tr> </table>	a) For works with estimated cost put to tender more than		Rs. 10 Lakhs for civil work	Graduate or retired AE possessing	Rs. 5 Lakhs for Elect/Mech Works	at least Recognised Diploma holder
a) For works with estimated cost put to tender more than								
Rs. 10 Lakhs for civil work	Graduate or retired AE possessing							
Rs. 5 Lakhs for Elect/Mech Works	at least Recognised Diploma holder							

		For works with estimated cost put to tender More than Rs. 5 Lakhs but less than Rs. 10 lakhs for Civil work	Recognised Diploma holder
		More than Rs. 1 Lakh but less than Rs. 5 Lakh for Elect/Mech works	Recognised Diploma holder
		Discipline to which the Principal Technical Representative should belong	Electrical
		Minimum experience of works	5 Years
	Recovery to be effected from the contractor in the event of not fulfilling provision of clause 36	Rs. 20,000/- per month for Graduate Rs. 15,000/- per month for diploma holder	
	Clause 42	Not applicable	

SCOPE OF WORK

The contractor shall be required to provide all of the following services:

- i. Supply, Installation, Testing, Commissioning including all civil, mechanical, electrical works of real – time data acquisition network at various stations under the jurisdiction of the Executive Engineer, Snow Hydrology Division, CWC, Shimla and also establishment of Satellite based telemetry and associated systems. (Refer Table 2)
- ii. Performing on-site assembly, start-up of the supplied Goods and supervision.
- iii. Clearances and obtaining approvals/ permissions from various Govt. agencies for supply of goods and for operation of all the satellite transmission/ wireless equipment with necessary assistance from the purchaser for obtaining such clearances.
- iv. Supply of Data Downloading Machines (Laptops) (Refer Table A)
- v. Supply of tools required for assembly and/or maintenance of the supplied Goods;
- vi. Supply of detailed operations and maintenance manual in original along with four (4) copies of each for each appropriate unit of supplied Goods;
- vii. Supply of mandatory spares (Refer Table-B)
- viii. Training of the Department’s personnel at the stations to be decided by the purchaser.
- ix. Provision of Warranty services after handover of the entire system for a period of 2 years.
 - x. Performance or supervision or maintenance and/or repair/replacement of the supplied Goods, for a period of 8 years beyond warranty period, provided that this service shall not relieve the Contractor of any warranty obligations under this Contract.
- xi. Integration of the installed systems/remote sites with the existing CWC ERS at Delhi duly addressing the compatibility issues, if any, with successful data transmission to the CWC modeling centre at Shimla. The compatibility issues that would arise and their smooth resolution have to be assessed and ensured by the supplier.
- xii. VSAT link between Shimla and Kol Dam (NTPC) through SCPC connectivity along with SATELLITE bandwidth.

SPECIAL CONDITIONS OF CONTRACT

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1. Definition:

- 1.1. In this Contract, the following terms shall be interpreted as indicated

“The Contract: means the agreement entered into between the Purchaser and the Contractor, as recorded in the Contract Form signed by the parties, including all amendments, attachments and appendices thereto and all documents incorporated by reference therein.

“The Contract Price” means the price payable to the Contractor under the Contract for the full and proper performance of its contractual obligations.

“The Goods” means all of the equipment, machinery and / or other materials which the Contractors are required to supply to the Purchaser under the contract.

“The Services” means those services ancillary to the supply of the Goods, such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training, warranty, annual maintenance and other such obligations of the Contractor covered under the contract.

“The Purchaser/Purchaser/Department” means Central Water Commission through Executive Engineer, Snow Hydrology Division and any other specifically designated Officers of Central Water Commission purchasing the Goods.

“The Tenderer/Bidder/Contractor” means the individual or firm supplying the Goods and Services under this contract.

“The Project Site” where applicable, means the place or places named in Conditions of Contract.

“Remote Station/Site” as listed in the schedule of requirements (Table 2) where the sensors, data logger and transmission facilities are to be installed.

“Modeling Centre” the office location where the data transmitted by the remote sites is to be received using existing VSAT network i.e, CWC, Shimla.

“Day” means calendar day.

2. **Applications:** These conditions shall supplement / modify the General Conditions of the Contract.

3. **Country of Origin**

3.1 For purposes of this Clause, “Origin” means the place where the Goods were mined, grown, or produced, or from which the services are supplied. Goods are produced when, through manufacturing, processing, or substantial and major assembly of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.

3.2 The origin of Goods and Services is distinct from the nationality of the Contractor.

4. **Standards**

4.1 The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standards appropriate to the Goods’ country of origin. Such standards shall be the latest issued by the concerned institution.

5. **Use of Contract Documents and Information Inspection and audit by the Government of India**

5.1 The contractor shall not, without the Purchaser’s prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample or information furnished by or on behalf of the Purchaser in connection therewith, to any person other than a person employed by the Contractor in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance.

5.2 The contractor shall not, without the Purchaser’s prior written consent, make use of any document or information enumerated in Clause 5.1 except for purposes of performing the contract.

- 5.3 Any document, other than the contract itself, enumerated in Clause 5.1 shall remain the property of the purchaser and shall be returned (all copies) to the purchaser on completion of the Contractor's performance under the contract if so required by the purchaser.
- 5.4 The contractor shall permit the authorised representative of the Purchaser to inspect the contractor's accounts and records relating to the performance of the contractor and to have them audited by auditors appointed by the Purchaser if so required by the Purchaser.
6. **Patent Rights:** The contractor shall indemnify the purchaser against all third party claims of infringement of patent, trademark, or industrial design rights arising from use of the Goods or any part thereof in the Purchaser's country.
- 7 **Inspections and tests**
- 7.1 The purchaser or its representative shall have the right to inspect and / or test the Goods to confirm their conformity to the contract specifications at no extra cost to the purchaser. The technical specifications shall specify what inspections and tests the purchaser requires and where they are to be conducted. The purchaser shall notify the contractor in writing, in a timely manner, of the identity of any representatives retained for these purposes. TA/DA of the inspection team will be borne by the purchaser.
- 7.2 The inspections and tests may be conducted on the premises of the Contractor or its subcontractor(s), at point of delivery, and / or at the Good's final destination. If conducted on the premises of the Contractor or its subcontractor(s), all reasonable facilities and assistance, including access to drawings and production data, shall be furnished to the inspectors at no charge to the purchaser.
- 7.3 Should any inspected or tested Goods, fail to conform to the specifications, the purchaser may reject the Goods and the contractor shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the purchaser.
- 7.4 The purchaser's right to inspect, test and, where necessary, reject the goods after the goods' arrival in the Purchaser's country shall in no way be limited or waived by reason of the Goods having previously been inspected, tested, and passed by the purchaser or its representative prior to the Goods shipment from the country of origin. Nothing shall in any way release the Contractor from any warranty or other obligations under this contract.
- 7.5 The inspection of the Goods shall be carried out to check whether the Goods are in conformity with the technical specifications attached to the contract agreement and shall be in line with the inspection/test procedures laid down in the Technical Specifications. Complete hardware and software as specified in the contract should be supplied, installed and commissioned properly by the contractor prior to commencement of acceptance tests.
- 7.6 In the event of the hardware and software failing to pass the acceptance test, a period not exceeding two weeks will be given to rectify the defects and clear the acceptance test, failing which the purchaser reserves the rights to get the equipment replaced by the contractor at no extra cost to the purchaser.
- 7.7 Before the goods and equipment are taken over by the Purchaser, the Contractor shall supply operation and maintenance manuals together with drawings of the goods civil works and equipment. These shall be in such detail as will enable the Purchaser to operate, maintain, adjust and repair all parts of the works as stated in the technical specifications.
- 7.8 The manuals and drawings shall be in the ruling language (English) and in such form and numbers as stated in the Technical specifications
- 7.9 Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purpose of taking over until such manuals and drawings have been supplied to the Purchaser.

- 7.10 For the System software & other Software's, the Contractor shall provide complete and legal documentation of hardware, all subsystems, operating systems, compiler, system software and the other software. The Contractor shall also provide licensed software for all software products, whether developed by it or acquired from others. The contractor shall also indemnify the purchaser against any levies/penalties on account of any default in this regard.
- 7.11 Acceptance Certificates: On successful completion of acceptability test, receipt of deliverables etc, and after the purchaser is satisfied with the working on the system, the acceptance certificate will be issued as under:
- 7.12 Acceptance Certificate for a Remote station shall be issued on successful completion of site acceptance tests specified at 13.0 of the technical specifications by the concerned Junior Engineer.
- 7.14 Acceptance Certificate for the whole work shall be issued on receipt of acceptance certificates of all the remote stations, successful completion of all acceptance tests, handing over of all documentation pertaining to the work as specified at 14.0 of technical specifications and after conduction training programme as specified at 19.0 of technical specifications and hand over of component of spares for the organization to the designated representative of the Engineer-in-charge.
- 7.15 The training as specified in the Technical specifications for each hardware and software component installed shall be provided to the personnel designated by the Purchaser to enable them to effectively operate the total system. The training shall be conducted on the dates mutually agreed upon and within six months from the date of acceptance of supply.

8 Packing

- 8.1 The contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit, and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods final destination and the absence of heavy handling facilities at all points in transit.
- 8.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the contract, including additional requirements, if any, specified in clause 8.3, and in any subsequent instructions ordered by the Purchaser.
- 8.3 Packing Instructions: The Contractor will be required to make separate packages for each Consignee. Each package will be marked on three sides with proper paint/indelible ink with the following:
(i) Project; (ii) Contract No.; (iii) Country of Origin of Goods; (iv) Contractor's Name; (v) Packing List Reference number.

9 Transportation & Delivery

- 9.1 The Contractor is required under the Contract to transport the Goods to a specified place of destination defined as project site. Transport of Goods to such place of destination including insurance, shall be arranged by the Contractor, and the related cost shall be included in the Contract Price.
- 9.2 Arrangement for secure storage of the goods at designated location near the project site prior to installation shall be responsibility of the Contractor. The Purchaser may, if

available, provide such unsecured accommodation as may be available for the purpose on a specific request from the contractor.

- 9.3 Delivery of the Goods shall be made by the Contractor in accordance with the terms specified by the Department in the Notification of Award.
- 9.4 Contractor shall be responsible till the entire stores ordered for arrive in good condition at destination and are installed, tested and commissioned.

10 Site preparation and installation

- i. The Purchaser will provide details of the installations sites before the scheduled installation date to allow the Contractor to perform a site inspection and construction of suitable structures before the installation of the hardware.
- ii. The location of telemetry tower and sensors for snow parameters, river water level, meteorological sensors and rainfall will be decided by the respective Site Engineer - in - Charge depending on the site and river flow conditions etc.
- iii. The contractor should complete the required works at the site for proper installation of the equipment before receipt of the equipment.

11. Incidental Services

The contractor shall be required to provide any or all of the following services:

- a. Performance or supervision of the on-site assembly and/or start-up of the supplied Goods;
- c. Furnishing of appropriate hardware, system design and programming services required for development and /or maintenance of the supplied goods;
- d. Furnishing of tools required for assembly and/or maintenance of the supplied Goods;
- e. Furnishing of detailed operations and maintenance manual for each appropriate unit of supplied Goods;
- f. Performance or supervision or maintenance and/or repair/replacement of the supplied Goods, for a period of eight years beyond warranty period, provided that this service shall not relieve the Contractor of any warranty obligations under this Contract;
- g. Software updates and bug fixing services for the software originally developed by the Contractor during the period of warranty and subsequent maintenance. For the third party software packages supplied the updates shall be provided during the warranty period.
- h. Training of the Department's personnel, in assembly, start-up, operation, maintenance and/or repair of the supplied Goods at the stations to be decided by the purchaser.
- i. The travel, boarding, lodging and other payment to his staff for erection, installation and maintenance at the sites shall be the responsibility of the Contractor.

12. Spare parts

- 12.1 The Contractor is required to provide any or all of the following materials, notifications and information pertaining to spare parts manufactured or distributed by the Contractor.
- a) Such spare parts as the Department may elect to purchase from the Contractor, providing that this election shall not relieve the Contractor of any warranty obligations under the Contract; and
 - b) In the event of termination of production of the spare parts ;
 - i. Advance notification to the Department of the pending termination, in sufficient time, to permit the Department to procure needed requirements; and

- ii. Following such termination, furnishing at no cost to the Department, the blue prints, drawings and specifications of the spare parts, if requested.

12.2 The Contractor shall carry sufficient inventories to assure ex – stock supply of consumables and spares in the country. Contractors shall ensure the availability of after sales service for a period of at least fifteen years including warranty period.

13. Warranty

13.1 The Contractor warrants that the Goods supplied under the contract are new, unused, of the most recent or current models and that they incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The contractor further warrants that all Goods supplied and all civil works undertaken under this Contract shall have no defect, arising from design, materials, or workmanship (except when the design and / or material is required by the Purchaser's specifications) or from any act or omission of the Contractor, that may develop under normal use of the supplied Goods in the conditions prevailing in the country of final destination.

13.2 This warranty for the whole system, in respect of stations which have been accepted as a part of the acceptance certification, shall remain valid for twenty four (24) months from the date of signing of the Complete Acceptance Certificate after successful completion of the Completion Acceptance Test. The contractor shall, in addition, comply with the performance guarantees specified under the contract. If, for reasons attributable to the contractor, these guarantees are not attained in whole or in part, the contractor shall, make such changes, modifications, and /or addition to the goods or any part specified in the contract at its own cost and expense and to carry out further performance tests in accordance with Clause 7 as above.

13.3 The purchaser shall promptly notify the contractor in writing of any claims arising under this warranty.

13.4 The purchaser shall notify Contractor of any errors and malfunctions, which occur and noticed when equipment are in use, by fax/telephone/e-mail/special messenger directly or through his Service Engineer(s) at his office address during normal working hours or at their residence after normal office hours and/or on holidays.

13.5 The Contractor shall ensure proper functioning of all equipment installed at all the remote stations and satisfactory data transmission from all the remote stations and data receipt at the existing CWC modeling centre at Shimla routed through the existing CWC's ERS at Delhi by the existing VSAT arrangement.

13.6 The maximum response time for a complaint from any of the destination specified in the schedule of requirements i.e. time required for contractors maintenance engineers to restore the data acquisition from the remote station after a request sms/ fax /e-mail is made or letter is written shall not exceed 72 hours. Upon receipt of such notice, the Contractor shall, visit the site and repair or replace the defective Goods or parts thereof, without cost to the Department within 72 hours.

13.7 A remote site shall be treated as faulty if it fails to respond or transmits erroneous data during three consecutive pre-programmed observation cycles. The decision of Engineer-in-Charge about errors in data shall be final and binding. If a remote site continues to remain "fail" for more than 6 hours in excess of the maintenance time schedule of 72 hours. The contractor is liable to pay penalty @ Rs. 1500/- per Day/ remote site. The Day for the purpose of penalty shall be taken as failure period of 24 hours or part thereof for a particular remote site.

- 13.8 The Contractor shall, at his own cost, carry out repair of the defective equipment or parts thereof, to the satisfaction of the Purchaser and return the equipment after satisfactory repair within 90 days from the date of written complaint/request made. All charges towards collection, transportation of defective equipment, return of equipment after repair including cost of repair defective equipment or parts thereof, shall be borne by the Contractor and no charges on this account shall be paid by the Purchaser.
- 13.9 If the Contractor fails to replenish the spares or return the equipment after satisfactory repairs within 90 days from date of complaint made, this will be considered as failure of a remote stations and a penalty @ Rs. 1500/- per Day/ item shall be applicable.
- 13.10 If the Contractor, having been notified, fails to remedy the defect(s) within the time specified in clauses 13.7 to 13.9 the purchaser may proceed to take such remedial action as may be necessary, at the contractor's risk and expense as specified in clause 13.7 to 13.9 and without prejudice to any other rights which the purchaser may have against the contractor under the contract.
- 13.11 If the Contractor fails to rectify the defects or fails to return the equipment after satisfactory repair within the permitted time frame, he shall be liable to pay the penalty at the rates indicated in clauses 13.7 to 13.9 of this contract. The period of penalty shall be calculated from the time effective from the time of expiry of the time schedule allowed for fault rectification / return of the equipment after satisfactory repair.
- 13.12 The amount of penalty as indicated in the above clauses will be subject to maximum 10% of the tendered amount. The amount of penalty will be recovered from balance 10% amount withheld [clause 16 (ii) (d)]/Security Deposit/ Performance Guarantee during warranty. The Department may also proceed to take such remedial action as may be necessary, at the Contractor's risk and expense and without prejudice to any other rights which the Department may have against the Contractor under the Contract.
- 13.13 The authority to decide and review the penalty shall be Director, M & A Directorate, CWC, Shimla/.

14. Maintenance Service

- 14.1 Free maintenance services for equipments as well as civil works and other related accessories like cables etc shall be provided by the contractor during the period of warranty. After warranty period, annual maintenance and repairs of the entire system (comprising of those components and group of remote stations forming part of the acceptance certificate) consisting of equipments and civil works including supply of spares etc. for next 96 months will be done by the contractor on quarterly blocks basis.
- 14.2 For the remaining remote stations, which have not been accepted as a part of the complete acceptance certification for the system as a whole, the Annual Maintenance services shall be provided for the balance part of the block period of the Annual Maintenance Contract in which the station completes its warranty period on a pro-rata payment basis. Thereafter, such stations shall be incorporated in the group of the remote stations as per 14.1 above for the successive blocks of the Annual Maintenance Contract.
- 14.3 Contractor shall set up a site office at Shimla equipped with all requisite infra structural facilities at his own cost and notify its office and residential addresses to the Engineer-in-charge, to handle the complaints within 15 days from the date of signing this contract.

- 14.4 Contractor shall provide services of a original manufacture certified engineer having Diploma/Degree in Electronics, at Shimla. He should have sufficient experience of working upon and troubleshooting with the equipment installed.
- 14.5 The Annual maintenance charges shall be quoted for a block of two consecutive years for the entire period of eight years following warranty period of two years.
- 14.6 The Annual maintenance charges during any block shall be payable on pro-rata basis on the basis of actual quantities of components being covered under AMC.
- 14.7 The Purchaser reserves the right to terminate the contract in full or in part at the end of any of the two-year blocks.
- 14.8 If during operation, the real minimum time between failures (MTBF) of any piece of equipment or component thereof does not prove to be more than 90% (ninety percent) of the specified MTBF, the contractor shall replace the unit component with another of at least the same performance quality at no cost to the purchaser.
- 14.9 It is expected that the average downtime of an item will be less than half of the maximum downtime (i.e. defined as number of days for which an item of equipment is not usable because of inability of the contractor to repair it). The maximum downtime for any item is taken as 90 days. In case an item is not usable beyond the stipulated maximum downtime the contractor will be required to arrange for an immediate replacement of the same till it is repaired. Failure to arrange for the immediate repair/ replacement will be liable for penalty of Rs. 1500/- per day per item which shall be recovered from the security deposit/performance guarantee.

The maintenance Services shall be governed by the “Additional conditions of contract during maintenance period” enclosed at Annexure – I.

- 14.10 Without limiting the generality of the foregoing, Licenser further represents and warrants:
- 14.10.1 That the Hardware and Software shall not be abnormally end or provide invalid or incorrect results as a result of date data, specifically including date data which represents or references different centuries or more than one century.
- 14.10.2 That the Hardware and Software shall manage and manipulate data involving dates, including single century formulas and multi-century formulas, and will not cause an abnormally ending scenario within the application or generate incorrect data.

15 Measurement

- 15.1 The measurements shall be carried out as per procedure.
- 15.2 Engineer-in charge shall designate a Junior Engineer in respect of each Station who will be responsible for recording the measurements and forwarding the same to Engineer-in-charge.
- 15.3 The Junior Engineer shall acknowledge the receipt of Goods subject to further verification and settlement at the time of installation at site by way of signing the delivery challan in triplicate and shall handover two copies of the same to Contractor.
- 15.4 The Contractor shall transport required goods for installation at project site and shall unpack and get the individual components, equipments, consumables and spares verified in terms of their numbers and quantities by the Junior Engineer.

- 15.5 The Contractor shall carry out all civil, mechanical, electrical and fabrication work at Project site and shall get the quantities of major items of work recorded in the measurement books of the Junior Engineer.
- 15.6 The Contractor shall also demonstrate performance of the installation as a whole at the project site in a mutually agreed manner so as to enable the Junior Engineer to fill up the check list provided by the Engineer-in-charge for ensuring acceptable performance of the project site.
- 15.7 The Junior Engineer shall issue an Acceptance Certificate in respect of each of the project site on demonstration by the Contractor towards satisfactory acquisition of the data by the DCU from all the sensors and satisfactory storage of the same in its internal memory. The performance of the solar panel and battery pack shall also be included in the Acceptance Certificate.
- 15.8 The Engineer-in-charge shall issue a Completion Certificate in respect of each station on demonstration of satisfactory acquisition, transmission and receipt of data from all the remote stations at modeling center server for a continuous period of 7 days and completion of all training modules and handover of all documentation.
- 15.9 The records generated at para 15.3 to 15.8 shall be provided by the Junior Engineer to Engineer-in-Charge for releasing the payments against such measurements as per Stages provided in the payment clause.

16 Payment

The method and conditions of payment to be made to the Contractor under this Contract shall be as follows.

- 16.1 Payment shall be made in Indian Rupees only. The payment will be released through a crossed account payee cheque/draft in favour of the Contractor drawn on State Bank of India, Shimla.
- 16.2 Payment of Goods and services excluding AMC.
- 16.3 Advance Payment towards mobilization charges: **Twenty (10%)** percent of the Contract value excluding AMC charges paid after the signing of the Contract, and on submission of claim and a bank guarantee for equivalent amount valid until the Goods are delivered and in the form provided in the Tender documents or another form acceptable to the Purchaser. Bank guarantees for advance payment shall be released not later than 30 days after the date of receipt of goods at their final destination.
- 16.4 **Twenty (20) %** of the Contract value excluding AMC charges on receipt of Goods by the Junior Engineer on production of the delivery challans. In case of part supply, the amount to be paid under this clause, shall be decided on pro-rata basis and decision of Engineer-in-Charge in this regard shall be final and binding on the contractor.
- 16.5 **Forty (40) %** of the Contract value excluding AMC charges shall be paid after the issue of Completion Certificate.
- 16.6 **Twenty (20) %** of the Contract value excluding AMC charges shall be paid after one snow season (October to March).

- 16.6 The remaining **Ten (10) %** of the Contract value excluding AMC charges shall be released after the completion of warranty period.
- 16.7 Payments for annual maintenance services and service tax at the prevailing rates as agreed shall be paid in equal quarterly installments and after successful maintenance of the system during the quarter.
- 16.8 Deductions from the bill:
- 16.8.1 Security Deposit shall be deducted as per Clause 1 and Clause 1(A) of Standard/General Contract Conditions under CPWD Forms 7/8.
- 16.8.2 The Income tax as applicable shall be deducted at source from the bill.
- 16.8.3 Sales Tax as applicable shall be deducted at source from the bill.
- 16.8.4 Certificate on account of taxes payable/paid to the Government shall be given to the contractor.
- 16.8.5 No other certificate for claiming any other tax exemptions shall be given.

17 Prices

Prices payable to the contractor as stated in the contract shall be firm and not subject to adjustment during the performance of the contract. Prices quoted shall be inclusive of all taxes and duties levied at the country of origin or in India.

18 Change Orders

The Purchaser may at any time, by a written order given to the Contractor, make changes within the general scope of the contract in any one or more of the following:

- 18.1 Drawings, designs, or specifications, where Goods to be furnished under the contract are to be specifically manufactured for the Purchaser;
- 18.2 The method of shipment or packing;
- 18.3 The place of delivery; and / or
- 18.4 The Services to be provided by the Contractor.
- 18.5 If any such change causes an increase or decrease in the cost of, or the time required for, the contractor's performance of any provisions under the contract, an equitable adjustment shall be made in the Contract Price or delivery schedule, or both, and the Contract shall accordingly be amended. Any claims by the Contractor for adjustment under this clause must be asserted within thirty (30) days from the date of the Contractor's receipt of the Purchaser's change order.

- 19 Contract Amendments:** Subject to Clause 18, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the parties.

20 Assignments

The contractor shall not assign, in whole or in part, its obligations to perform under this Contract, except with the Purchaser's prior written consent.

21 Sub-contracts

- 21.1 The Contractor shall notify the Purchaser in writing of all sub-contracts awarded under this contract if not already specified in the tender. Such notifications, in the original tender or later, shall not relieve the contractor from any liability or obligation under the contract.
- 21.2 Sub-contracts must comply with the provisions of Clause 3 of General Conditions of Contract.

22 Delays in the contractor's Performance

- 22.1 Delivery of the Goods and performance of Services shall be made by the Contractor in accordance with the time schedule prescribed by the Purchaser in the Schedule of Requirements.
- 22.2 If at any time during performance of the Contract, the Contractor or its sub-contractor(s) should encounter conditions impeding timely delivery of the Goods and performance of Services, the Contractor shall promptly notify the purchaser in writing of the fact of the delay, its likely duration and its cause(s) As soon as practicable after receipt of the Contractor's notice, the purchaser shall evaluate the situation and may at its discretion extend the Contractor's time for performance, with or without liquidated damages, in which case the extension shall be ratified by the parties by amendment of the Contract.
- 22.3 Except as provided under Clause 25, a delay by the Contractor in the performance of its delivery obligations shall render the Contractor liable to the imposition of liquidated damages pursuant to Clause 23 unless an extension of time is agreed upon pursuant to Clause 22.2 without the application of liquidated damages.

23 Liquidated Damages

Subject to Clause 25, if the Contractor fails to deliver any or all of the Goods or to perform the Services within the period(s) specified in the Contract, the purchaser shall, without prejudice to its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to the percentage specified of the delivered price of the delayed Goods or unperformed Services for each week or part thereof delay until actual delivery or performance, upto a maximum deduction of the percentage specified . Once the maximum is reached, the purchaser may consider termination of the Contract pursuant to Clause 24. The applicable rate is 1.5% per month and the Maximum deduction is 10% of the contract price.

24 Termination for Default

- 24.1 The Purchaser, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Contractor, may terminate this Contract in whole or in part—
- 24.1.1 if the Contractor fails to deliver any or all of the Goods within the period(s) specified in the Contract, or within any extension thereof granted by the Purchaser pursuant to Clause 22.2;
- 24.1.2 if the Contractor fails to perform any other obligation(s) under the contract.
- 24.1.3 if the Contractor, in the judgment of the Purchaser has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

For the purpose of this clause:

“Corrupt practice” means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution.

“fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Purchaser, and includes collusive practice among Tenderers (prior to or after tender submission) designed to establish tender prices at artificial non competitive levels and to deprive the Purchaser of the benefits of free and open competition.

- 24.2 In the event the Purchaser terminates the Contract in whole or in part, pursuant to Clause 24.1, the Purchaser may procure, upon such terms and in such manner as it deems appropriate, Goods or services similar to those undelivered and the contractor shall be liable to the Purchaser for any excess costs for such similar Goods or Services. However, the contractor shall continue performance of the Contract to the extent not terminated.

25 Force Majeure

- 25.1. Notwithstanding the provisions of Clause 22, 23 and 24, the Contractor shall not be liable for forfeiture of performance security liquidated damages or termination for default if and to the extent that its delay in performance or other failure to perform the obligations under the Contract is the result of an event of Force Majeure.
- 25.2. For purposes of this Clause, “Force Majeure” means an event beyond the control of the Contractor and not involving the Contractor’s fault or negligence and not foreseeable. Such events may include but are not restricted to, acts of the Purchaser in its sovereign capacity, wars or revolutions, fires, epidemics, quarantine restrictions, and freight embargos.
- 25.3. If a Force Majeure situation arises, the Contractor shall promptly notify the Purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Contractor shall continue to perform its obligations under the contract as far as reasonably practical, and shall seek, all reasonable alternative means for performance not prevented by the force Majeure event.

26 Termination for Insolvency

The Purchaser may at any time terminate the Contract by giving written notice to the Contractor if the Contractor becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the Contractor, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the Purchaser.

27 Termination for Convenience:

- 27.1 The Purchaser, by written notice sent to the Contractor, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Purchaser’s convenience, the extent to which performance of the Contractor under the Contract is terminated, and the date upon which such termination becomes effective.
- 27.2 The Goods that are complete and ready for shipment within thirty (30) days after the Contractor’s receipt of notice of termination shall be accepted by the Purchaser at the Contract terms and prices. For the remaining Goods, the Purchaser may elect:
- 27.2.1 to have any portion completed and delivered at the Contract terms and prices; and/ or

- 27.2.2 to cancel the remainder and pay to the Contractor as agreed amount for partially completed Goods and Services and for materials and parts previously procured by the Contractor.

28 Resolution of disputes

- 28.1 The purchaser and the Contractor shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them and or in connection with the Contract.

- 28.2 If, after thirty (30) days from the commencement of such informal negotiations, the Purchaser and the Contractor have been unable to resolve amicably a Contract dispute, either party may require that the dispute be referred for resolution to the formal mechanisms specified. These mechanisms may include, but are not restricted to, conciliation mediated by a third party, adjudication in an agreed national forum.

- 28.3 Settlement of disputes

The rules of procedure for arbitration proceedings pursuant to settlement of disputes shall be as follows:

- 28.3.1 In case of dispute or difference arising between the Purchaser and a domestic contractor relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996. The arbitral tribunal shall consist of 3 arbitrators one each to be appointed by the Purchaser and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties and shall act as presiding arbitrator. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding Arbitrator shall be appointed by the President of the Institution of Engineers (India).
- 28.3.2 If one of the parties fails to appoint its arbitrator in pursuance of sub-clause (a) above, within 30 days after receipt of the notice of the appointment of its arbitrator by the other party, then the President of the Institution of Engineers (India), shall appoint the arbitrator. A certified copy of the order of the President of the Institution of Engineers (India), making such an appointment shall be furnished to each of the parties.
- 28.3.3 Arbitration proceedings shall be held at Director, M&A Dte, CWC, Shimla/CE (IBO), CWC office at **Chandigarh** and the language of the arbitration proceedings and that of all documents and communications between the parties shall be English.
- 28.3.4 The decision of the majority of arbitrators shall be final and binding upon both parties. The cost and expenses of Arbitration proceedings will be paid as determined by the arbitral tribunal. However, the expenses incurred by each party in connection with the preparation, presentation etc. of its proceedings as also the fees and expenses paid to the arbitrator appointed by such party or on its behalf shall be borne by each party itself.
- 28.3.5 Where the value of the contract is Rs. 10 million and below, the disputes or differences arising shall be referred to the Sole Arbitrator. The Sole Arbitrator should be appointed by agreement between the parties; failing such agreement, by the appointing authority namely the President of the Institution of Engineers (India).

29 Governing Language

The Contract shall be written in the English language. The version of the Contract written in the specified language shall govern its interpretation. All correspondence and other

documents pertaining to the Contract which are exchanged by the parties shall be written in the same language.

30 Applicable Law

The contract shall be interpreted in accordance with the laws of the Purchaser's country, unless otherwise specified.

31 Notices

31.1 Any notice given by one party to the other pursuant to this Contract shall be sent to the other party in writing or by cable, telex or facsimile and confirmed in writing to the other party's address specified.

31.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

Annexure-I**ADDITIONAL CONDITIONS OF CONTRACT
DURING MAINTENANCE PERIOD (AMC)****1. SCOPE OF WORK DURING MAINTENANCE PERIOD:**

- a) The maintenance services to be provided by the contractor under this contract shall be for entire system, in accordance with the terms and conditions laid down in the contract, of the telemetry equipment / system, all accessories and attachments of the equipments / systems installed at Remote Stations as per the details given in Tables 1 and 2 of the tender document including providing of all required consumables, additional spare parts, repair of the defective equipment or units/parts thereof, orientation of antenna whenever required due to any change(s) in position of the satellite and imparting training to the officers of the Central Water Commission about operation and maintenance of telemetry system.
- b) Contractor shall maintain his site office at Shimla. Equipped with all requisite infrastructural facilities at his own cost and notify its office and residential addresses to the Engineer-in-charge, to handle the complaints.
- c) Contractor shall provide services of a original manufacture certified engineer having Diploma/Degree in Electronics, at Shimla. He should have sufficient experience of working upon and troubleshooting with the equipment installed.
- d) Purchaser shall notify Contractor of any errors and malfunctions, which occur and noticed when equipment are in use, by fax/telephone/e-mail/special messenger directly or through his Service Engineer(s) at his office address during normal working hours or at their residence after normal office hours and/or on holidays.
- e) Contractor shall provide maintenance services and correct the defect(s) reported by the Engineer-in-Incharge, within a period of 48 hrs on receipt of the complaint.
- f) Contractor shall provide maintenance services to the Purchaser at Data Acquisition Sites (DAS) and correct the defect(s) reported by the Purchaser, within a period of 72 hrs on receipt of the complaint.
- h) The Contractor shall ensure proper functioning of all equipment installed at DAS and satisfactory data transmission from all DAS and data receipt at the existing CWC's ERS at Delhi by utilizing the spare parts available at designated places and by providing additional spare parts for which no additional cost will be paid by the Purchaser. Such designated locations will be mutually agreed at the time of commencement of work.
- i) The Contractor shall, at his own cost, carry out repair of the defective equipment or parts thereof, to the satisfaction of the Purchaser and return the equipment after satisfactory repair within 90 days from the date of written complaint/request made. All charges towards collection, transportation of defective equipment, return of equipment after repair including cost of repair defective equipment or parts thereof, shall be borne by the Contractor and no charges on this account shall be paid by the Purchaser.

2. PENALTY CLAUSE:

Upon receipt of notification of defect in the system from Purchaser, if Contractor fails to take immediate corrective measures to rectify the defect, within the stipulated maximum response time stated above, the contractor is liable to pay penalty for unsatisfactory performance of maintenance services, in accordance with the criteria laid down below:

- a) A remote site shall be treated as faulty if it fails to respond or transmits erroneous data during three consecutive pre-programmed observation cycles. The decision of Engineer-in-Charge about errors in data shall be final and binding. If a remote site continues to remain “fail” for more than 6 hours in excess of the maintenance time schedule of 72 hours. The contractor is liable to pay penalty @ Rs. 1500/- per Day/ remote site. The Day for the purpose of penalty shall be taken as failure period of 24 hours or part thereof for a particular remote site.

The maximum limit of the total penalty in a year on this account shall be limited to the 50% of the value of maintenance contract for corresponding year.

- b) The contractor shall ensure all that all the compatibility issues, if any that may arise are addressed successfully while integrating the installed remote stations with the existing CWC’s ERS at Delhi and satisfactory receipt of data at the CWC’s existing modeling centre at Shimla. If still no data is received at CWC’s existing modeling centre at Shimla through the CWC’s existing ERS at Delhi, it will be treated as “fail” and if such a failure continues for more than 48 hours, the contractor is liable to pay a penalty as specified above. However, non-receipt of data at the existing CWC’s ERS at Delhi due to any other failure not attributed to the installed remote stations or for any other reason beyond the control of the contractor, the penalty shall not be imposed.

The maximum limit of the total penalty in a year on this account shall be limited to the 50% of the value of maintenance contract for corresponding year.

- c) If the contractor fails to replenish the spares or return the equipment after satisfactory repairs within 90 days from date of complaint made, this will be considered as failure of Remote Stations and a penalty @ Rs. 1500/- per day per item shall be applicable. The maximum penalty in a year, on this account, shall be limited to the 50% of the value of maintenance contract for corresponding year.
- d) If the Contractor fails to rectify the defects or fails to return the equipment after satisfactory repair within the permitted time frame, he shall be liable to pay the penalty at the rates indicated in clauses 2.1, 2.2 and 2.3 above of this contract. The period of penalty shall be calculated from the time effective from the time of expiry of the time schedule allowed for fault rectification / return of the equipment after satisfactory repair.
- e) The authority to decide and review the penalty shall be Director, M&A Directorate, CWC, Shimla.
- f) The total penalty in a year shall be limited to the value of maintenance contract for the corresponding year.

3. TERMS OF PAYMENT:

- a) Any taxes and/or other Governmental levies as applicable or becoming applicable later due to or under any law shall be deducted from the bill.
- b) The maintenance and repair cost shall be paid quarterly, on satisfactory performance of maintenance services.

- c) The payment shall be made by Account payee cheque/draft only in Indian Rupees.

4. OTHER TERMS AND CONDITIONS:

a) Renewal of agreement

This agreement could, thereafter, be renewed for successive periods as mutually decided from time to time.

b) Access to Purchaser's site/Contractor's office & Records relates to past experience of such equipment in India.

The Junior Engineer/authorized representative of Engineer-in-Charge shall provide free access to the sites where the defect has occurred. E.g. Remote Station equipment may be under lock & key for which the Junior Engineer/authorized representative of Engineer-in-Charge shall make sure that free access to such sites are made available for necessary actions at contractors end. He will also arrange for the security clearance, wherever required in advance to ensure that contractor's engineers get the access to site immediately.

c) Spares/Equipments

The mandatory as well as recommended spares/equipment available with the Department for maintenance as per list given in Table – B, shall be given free access to contractor to be used as standby. Excluding the above mentioned spares/equipment maintained by the Department any import/purchase of any of such components as required during the maintenance, the same shall also be the sole responsibility of the contractor. If the contractor fails to repair the equipment/spare due to non availability of the spare / technological changes the same may be replaced by the contractor with equivalent equipment / spare of same specification and reputed make with prior permission of Engineer-in-charge and the costs involved in this process shall be borne by the contractor. Non-returning of the defective spares/equipment after due repair within stipulated time as specified above shall attract the penalty as per clause-2 of this contract.

d) Consumables

Contractor shall be responsible for, providing & replacement of consumable items like and including DCP Batteries, Batteries of UPS, cables, tubes, silica gel connectors and other similar items.

e) Periodical routine services

Periodical routine services shall be provided by the Contractor on Bi-monthly' basis in addition to pre-snow season and post-snow season and pre-monsoon and post-monsoon services.

f) Change of Satellite

- (i) Changes required for realigning the system at central stations and remote stations due to the change in operating satellite for this project shall be done by the Contractor at his own cost. Equipment required to undertake this change will be arranged by Contractor.
- (ii) The contractor is responsible for managing the activities of its personnel or sub-contracted personnel and will hold itself responsible for any misdemeanors.

- (iii) The contractor is responsible for managing the activities of its personal or sub-contracted personnel and will hold itself responsible for any misdemeanors.
- (iv) The contractor will treat as confidential all data and information about the Department, obtained in the execution of his responsibilities, in strict confidence and will not reveal such information to any other party without the prior written approval of the Department.

SCHEDULE OF QUANTITIES

TABLE 1

S. No	Name of item	Total in Numbers
1	Establishment of Remote Station Type A (Rain fall) including all civil, mechanical and fabrication works along with data transmission from remote site to CWC existing ERS at Delhi to Modeling Centre, Shimla complete in all respects.	1
2	Establishment of Remote Station Type D (River water level, Rain fall and Meteorological parameters consisting of Temperature, Humidity, Evaporation, sunshine and Wind Instruments(AWS)) including all civil, mechanical and fabrication works along with data transmission from remote site to CWC existing ERS at Delhi to Modeling Centre, Shimla complete in all respects.	1
3	Establishment of Remote Station Type E (Snow precipitation / rainfall, snow depth, snow density/snow water equivalent and Meteorological parameters consisting of Temperature, Humidity, Evaporation, sunshine and Wind Instruments (AWS)) including all civil, mechanical and fabrication works along with data transmission from remote site to CWC existing ERS at Delhi to Modeling Centre, Shimla complete in all respects.	9
4	AWS with Satellite Transmitter works along with data transmission from remote site to CWC existing ERS at Delhi to Modeling Centre, Shimla complete in all respects.	1
5	Data down Loading Machine (Laptop) on site for the remote sites.	1
6	Comprehensive annual maintenance charges including replacement of material & consumables for 8 years after warranty period of 2 years along with data transmission from remote site to CWC existing ERS at Delhi to Modeling Centre, Shimla complete in all respects.(S.No. 1 to 4)	1 Job
7	Spare parts.	1 Set

8	Provision for emergency lights.		12
9	Provision, installation and connectivity of inverter (3KVA) at the CWC premises, Shimla.		1
10	Training (both for remote station and VSAT) for officers & staff.		3
11	VSAT system equipment at Modeling Centre, Shimla and at Kol dam site (including installation and commissioning etc) for data communication between Kol dam, NTPC to Modeling Centre, Shimla complete in all respects. VSAT equipment shall be compact and operate in XC band. VSAT equipment shall consist of (i) Antenna of size (diameter) 1.2 m/ 1.8 m with firm support mounting accessories and having full duplex operation. (ii) Indoor unit (IDU) shall have in-route throughput of 128 kbps, out-route throughput 8 Mbps to 34 Mbps or more, in-route access of TDMAS/ FDMA / FTDMA// DVB_RCS and modulation of QPSK or better. Indoor unit shall support standard protocol communication compatible to digital recording system for transmitting data to the Earth station. The equipment set shall be with power supply, cable and other necessary accessories.		1 Link
12	Bandwidth charges for VSAT data transmission (2+8)yrs.		10 years
13	VSAT AMC charges for 8 yrs after 2 yr warranty.		1 Job

TABLE 2
Details of Remote Stations

S. No	Station Name	District/State	River Basin	Type of station
1	Pandowa	Shimla/Himachal Pradesh	Satluj	D
2	Naldera	Shimla/Himachal Pradesh	Satluj	A
3	Kol Dam	Bilaspur/Himachal Pradesh	Satluj	AWS
4	Chillatop	Doda/Jammu & Kashmir	Chenab	E
5	Gulabgarh	Doda/Jammu & Kashmir	Chenab	E
6	Tandi	Lahul& Spiti/Himachal Pradesh	Chenab	E
7	Kothi	Kullu/Himachal Pradesh	Beas	E
8	Barshaini	Kullu/Himachal Pradesh	Beas	E
9	Hanumanchetti	Uttarkashi/Uttarakhand	Yamuna	E
10	<u>Jubbal</u>	Shimla/Himachal Pradesh	Yamuna	E
11	Harshil	Uttarkashi/ Uttarakhand	Ganga	E
12	Auli	Chamoli/ Uttarakhand	Ganga	E

FINANCIAL BID FORMAT

Table-A

(The rates may be quoted in Indian Rupees only)

S. No	Name of item	Quantity	Unit	Rate	Amount	
					In figures	In words
1)	Establishment of Remote Station Type A (as mentioned in schedule of quantities)	1	No.s			
2)	Establishment of Remote Station Type D (as mentioned in schedule of quantities)	1	No.s			
3)	Establishment of Remote Station Type E (as mentioned in schedule of quantities)	9	No.s			
4)	AWS with Satellite Transmitter (as mentioned in schedule of quantities)	1	No.s			
5)	Data down loading machine (Laptop) (as per the technical specifications)	1	No.s			
6)	Comprehensive annual maintenance charges including replacement of material & consumables for 8 years after warranty period of 2 years details to be given in separate table as specified below (Total cost to be given here and break up in Table-C)	1	Job			
7)	Total Cost of spares and consumables (Details to be given in Table-B)	1	Set			

8)	Emergency Lights	12	No.s			
9)	Provision, installation and connectivity of inverter (3KVA) at CWC premises, Shimla.	1	No.s			
10)	Training (both for remote station and VSAT) for officers & staff	3	No.s			
11)	VSAT system equipment (as mentioned in schedule of quantities)	1	Link			
12)	Bandwidth charges for VSAT data transmission (2+8)yrs	10	years			
13)	VSAT AMC charges for 8 yrs after 2 yr warranty	1	Job			
				Total Cost of Bid		

Table-B
Details of Spares and Consumables
(Rates may be quoted in Indian rupees only)

S.No.	Spare Name/Description	Quantity	Unit	Rate	Amount
1	Data recorder	1	No.		
2	INSAT Transmitter	4	No.		
3	Satellite Antenna	4	No.		
4	Solar panel assembly	4	No.		
5	Complete bubbler apparatus for river gauges	1	No.		
6	Rain gauges with its accessories	4	No.		
7	Mother Board for DCU	4	No.		
8	Sensor for water level	1	No.		
9	Snow sensors: depth, precipitation, SWE	4 for each parameter	No.		

Table-C
Comprehensive annual maintenance charges
(Rates may be quoted in Indian rupees only)

S.No	Item	Unit	Rate for Block of 2 years			
			Ist block	2 nd block	3 rd block	4 th block
1	Remote Station Type A including all civil, mechanical and fabrication works	Per station				
2.	Remote Station Type D including all civil, mechanical and fabrication works	Per station				
3.	Remote Station Type E including all civil, mechanical and fabrication works	Per station				
4.	AWS with Satellite Transmitter	Per station				
5.	VSAT	Per link				
Total comprehensive maintenance charges						

TECHNICAL SPECIFICATIONS

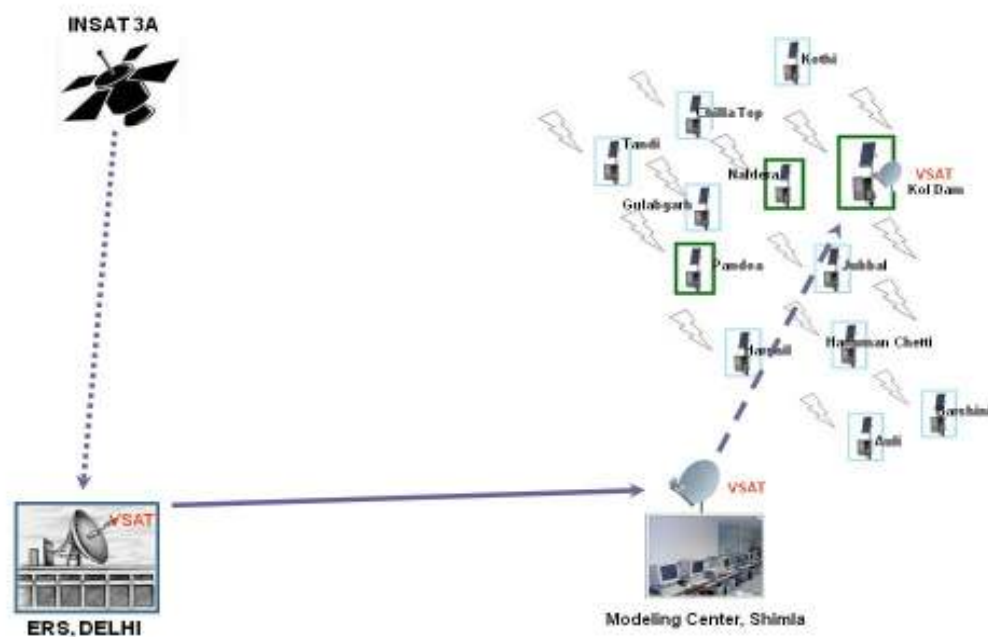
1.0 GENERAL

The Technical Specification covers the Contract for the installation of telemetry system in different river basins in the region as specified including Earth Receiving Station, which shall be able to receive data from INSAT/Kalpana (INSAT 3A) data relay transponder as well as DRT of future INSAT systems, instrumentation and associated Data Collection Units (DCU's). This shall include the design, manufacture, factory testing, delivery to site, installation (including the associated interface wiring/termination), commissioning and site acceptance testing, supply of mandatory spares, training and documentation. DCU's, Monitoring system hardware / software shall interface and be fully integrated and tested with the existing CWC's Earth Receiving Station (ERS) at Delhi. The functional requirements are given below in respect of each major component of the system. The contractor shall ensure that the fundamental requirements enunciated hereunder are not compromised.

2.0 OVERVIEW OF THE SYSTEM

Each remote station will transmit data to the existing CWC's ERS at Delhi on a regular interval of 60 minutes (data will be measured every 15 minutes for rainfall sensor and every 20 minutes for other sensors and would be telemetered once in every hour). The ERS shall collect the field data so transmitted by the remote stations (snow-hydro-meteorological data), store it and then pass the data to Modeling Center, Shimla for flood forecast/snowmelt runoff forecast formulation and long term data storage. The remote station shall hold the data at least for 180 days and shall record the latest data by replacing the oldest one. The remote stations shall be able to collect the data from the instrumentation/sensors and transmit these to the CWC's modeling centre at Shimla through the existing CWC's ERS at Delhi on a continuous basis even in extreme weather conditions.

One VSAT link between Modeling Centre, CWC, Shimla and Kol Dam (NTPC project site) only needs to be provided by the supplier.



Figure

2.1 Classification Of Remote Stations

Remote stations are to be established through out Sutlej, Beas, Chenab, Ganga, and Yamuna Basins. Four types of stations are to be installed as listed below.

S.No	Type of stations	Sensors (including satellite data transmitters)
1	Type A	Rain fall
2	Type D	River water level, Rain fall and Meteorological parameters consisting of Temperature, Humidity, Evaporation, sunshine and Wind Instruments(AWS)
3	Type E	Snow precipitation / rainfall, snow depth, snow density/ snow water equivalent and Meteorological parameters consisting of Temperature, Humidity, Evaporation, sunshine and Wind Instruments(AWS)
4	AWS	Meteorological parameters consisting of Temperature, Humidity, Evaporation, sunshine and Wind Instruments

Each station shall have appropriately configured Data Collection Unit (DCU) along with necessary communication facilities such that they are compatible and integrated with the existing system at ERS Delhi.

Each station shall be fully automatic and shall only require routine maintenance and inspection. Readings of various parameters (such as water level, rainfall, snow and other meteorological parameters) shall be automatically transmitted to the CWC existing Earth Receiving Station at Delhi at predefined intervals.

2.2 Functional Description of Remote Stations

2.2.1 Rainfall Stations (Type-A)

The station shall collect the rainfall data and transmit as per the schedule without fail. The rainfall inputs are very important in flood forecasting as they indicate the formation of the flood wave in the catchment. Rainfall station shall have the rain gauge connected to the data acquisition and transmission setup. For security considerations, the rain gauge and DCU may be mounted over a first floor level terrace also.

2.2.2 Water Level and Automatic Weather Stations (Type-D)

These stations will measure the water level and meteorological parameters such as rainfall, relative humidity, ambient air temperature, solar radiation (pyranometer), wind speed, wind direction and evaporation.

2.2.3 Snow Depth and Precipitation (Type-E)

These stations will measure the snow depth and snow precipitation / rainfall, snow density / snow water equivalent as well as other meteorological parameters such as relative humidity, ambient air temperature, solar radiation (pyranometer), wind speed, wind direction and evaporation.

3.0 EQUIPMENT ARRANGEMENT AT VARIOUS TYPES OF REMOTE STATIONS

3.1 Rainfall Station (Type-A)

The rain fall station shall be equipped with all necessary equipments and peripherals including the following:

- Data Collection Unit mounted inside an enclosure which will house the following items.
 - Data recorder logger
 - INSAT transmitter
 - Battery (supplied locally by the Contractor)Power
 - Pre wiring and configuration
 - Solar panel charger regulator
 - Connector interfaces with Surge suppression on all channels as well as INSAT transmitter
- Mast (tripod) to mount DCU at the site (alternatively, where walled enclosure is available, the same can be mounted on the wall).
- Mast (tripod) for solar panel & INSAT antenna (provided locally by the Contractor) Mast can be shared with the DCU mast also.
- Conduit for Raingauge (Provided locally by the Contractor)
- Civil works for mast and Raingauge (provided locally by the Contractor)
- Wire-mesh fencing and gate with lock (provided locally by the Contractor)
- Mounting stand for rain gauge (provided locally by the Contractor) will be mounted at WMO Specification 0.8 to 1m above ground.
- Antenna cables.
- Power cables.
- Grounding and lightning protection (provided locally by the Contractor)
All necessary hardware required for the system to operate properly.

3.2 Water Level And All Weather Station (Type-D)

Water Level and All Weather Station shall be equipped with all necessary equipments including bubblers and tubing as well as all peripherals. All the arrangements specified for rainfall and river/ reservoir gauging station would be provided for this type of station also. In addition, the following shall be provided.

- Appropriate mast (tripod) for mounting the sunshine, wind speed and wind direction sensors. The mast shall be capable of withstanding cyclonic wind speeds without any damage or shifting of mounting of the instruments.

3.3 Snow Fall / Snow Depth And All Weather Stations (Type-E)

Remote station shall be equipped with all necessary equipments including tubing as well as all peripherals. All the arrangements specified for rainfall station shall be provided for this type of station also. In addition, the following shall be provided.

- Appropriate mast (tripod) for mounting the sunshine, wind speed and wind direction, snow sensors etc. The mast should be capable of withstanding cyclonic wind speeds and sustaining weight of snow without any damage or shifting of mounting of the instruments.

4.0 INSTRUMENTATION AND DATA ACQUISITION HARDWARE AND SOFTWARE

4.1 General Specification/ features

- i. It is imperative that all instrumentation, other equipment shall operate effectively with the DCU's and the DCU's in turn shall operate effectively with the satellite equipment and other systems of ERS. In addition, the input/output protocols of individual items of equipment (gauges/snow stakes, DCU's, solar power arrangements, etc) shall interface accurately. For this purpose, the interfaces between the sensors and the DCU, DCU and transmission equipment are to be ensured to be compatible and trouble free.
- ii. The specific electrical, electronic and mechanical design parameters mentioned in case of individual sensors are indicative of a typical design and variations therein can be considered provided the output,

resolution, accuracy and ruggedness against environment are not compromised in any manner. In such cases where the supplier proposes to deviate from the specifications a full technical justification shall be provided. The Purchaser is not bound to accept such justification.

- iii. It shall be the Suppliers responsibility to ensure that the installation is robust and shall continue to work in extreme weather conditions.
- iv. Reliability of operation during normal and extreme weather conditions is imperative.
- v. The sensors and all accessories and facilities shall be fully compatible with the data acquisition and transmission system. The sensors and DCU's shall form a complete automated data acquisition storage and transmission system.
- vi. In case of any of the sensors, the equipment is supplied with certain optional features which are required to be ordered separately and are not included as a part of the offer; the same shall be clearly mentioned in the bid along with the functions of such features. The purchaser shall be provided with all necessary information which shall enable him to take an informed decision at the time of entering into the contract as to the ordering any such feature or otherwise.
- vii. The Contractor shall enclose technical literature in respect of all the sensors being quoted. The features which are mentioned in the literature but are not being quoted as a part of the current system shall be clearly brought out in the bid. In the event of failure of the Contractor to explicitly mention any such exclusion, it shall be taken as inclusion of all features mentioned in the bid as a part of the supply and the Contractor shall have to provide all such features/ accessories without claim of extra cost to the purchaser.
- viii. All accessories, tools and fixtures required for installation and dismounting/ remounting of the equipment shall be treated as a part of the supply for each type of sensors. One such kit shall be supplied.
- ix. Contractor shall give general lay out of all the installations including all civil works for types of stations and materials including that for the equipment at the time of bidding. Afterwards, the successful Contractor shall furnish the details of all the mounting arrangements, including civil works. Variations in typical designs shall be submitted with drawing and design calculations and shall have to be got approved from the concerned Engineer – in – charge before commencement of work and any changes suggested by the Engineer – in – charge shall be agreed to. Indian Standard codes of practice shall be followed for all civil works and mounting arrangements.
- x. The security arrangement provisions for sensors installed in the open ground like wire-mesh fencing, locking etc. shall also be provided by the Contractor.
- xi. Security of installed equipments against theft and vandalism shall be the responsibility of the Contractor till successful installation, commissioning, and two stages of site acceptance testing.
- xii. All fixings shall be non-corrodible.
- xiii. The Contractor has to specify how the calibration will be carried out and has to use his own calibration equipment during the period of warranty and AMC.
- xiv. Wherever the DCU or any of the instruments is mounted at a height of 2 metres or higher from floor or ground level, folding Aluminum Ladders of good quality also have to be provided.

4.2 Rainfall Measurements

- i. Rainfall shall be measured using the tipping bucket method and shall be able to record cumulatively.

- ii. The rain gauge shall be of such a design that it operates reliably and accurately under the prevailing environmental and weather conditions.
- iii. It shall be noted that some sites are prone to cyclonic winds.
- iv. The rain gauge shall be easy to operate and maintain.
- v. The rain gauge shall be supplied with the accessories as needed for effective deployment.
- vi. All materials on the rain gauge, regardless of the protective layer(s), shall be non-corrosive (e.g. galvanised or paint coated iron is not acceptable)
- vii. Sheet material shall not be part of the rain gauge.
- viii. The bucket design shall be inherently symmetrical, e.g. of moulded thermoplastic material.
- ix. All materials on the rain gauge that are exposed to sunlight shall be UV radiation resistant.
- x. The rain gauge shall be sturdy and shall withstand exposure to extreme climatic conditions.
- xi. The rain gauge shall withstand attack by fungi, insects, rodents and other small creatures. Wind screens for rain gauges are not required.
- xii. The rain gauge shall have a smooth and permanent surface finish to minimise evaporation losses.
- xiii. The height of the rain gauge shall be small enough to allow the collector opening to be installed at standardised heights in compliance with WMO standards.
- xiv. The minimum expected operational lifetime shall be 15 years without loss of functioning.
- xv. All openings of the rain gauge except the collector shall be covered with net to protect against any insects entering inside.
- xvi. Appropriate surface treated and corrosion proof mounting bolts with nuts and washers shall be supplied.
- xvii. The data logger shall feature in-built lighting protection.
- xviii. The rain gauge shall have leg adjusters to set the rim horizontally.
- xix. A spout filter shall prevent ingress of insects and debris.
- xx. A certified calibration test document shall be part of the delivery.
- xxi. IMD certification required

4.2.1 Tipping bucket Rain gauge specification

Base material	:	durable and rigid of cast metal, moulded thermoplastic, FRP or Equivalent. Conforming to WMO standards
Collector material	:	durable and rigid of thick metal, FRP or Equivalent. Galvanised iron sheet is not permitted.
Rim material	:	gun metal / brass or equivalent
Collecting funnel	:	close to 200 mm internal diameter
Bucket size	:	0.5 mm equivalent rainfall
Depth from rim to	:	≤ 175 mm
Weight	:	≥ 75 N
Range	:	0 – 100 mm
Resolution	:	0.5 mm
Accuracy	:	+2% of reading
Rainfall intensity	:	upto 1023 mm/hr.
Tip detector	:	reed switch
Output	:	pulsed output to DCU

4.3 Water Level Measurements

The river/reservoir level shall be monitored by using the specified equipment.

- i. The gauge shall be of such a design that it operates reliably and accurately under the prevailing environmental and weather conditions.
- ii. The proposed equipment shall be rugged, and water proof design.
- iii. The proposed equipment shall be designed for reliable low maintenance operation. High level of reliability will be demanded from the equipment.
- iv. The output of the gauges shall be accurate to the extent of the nearest centimetre

- v. The tubing from the gauge assembly to the bubbler tip shall be laid through a HDPE pipe as specified at the para 19.2.2-19.2.3. All runs of the pipe and tubing along the river bank slopes shall be protected adequately against exposure due to erosion.
- vi. The level readings made without a stilling well in a reservoir should be damped so as to avoid waves affecting the reading.
- vii. The minimum expected operational life time shall be 15 years without loss of functioning.
- viii. The equipment shall support adjustable specific gravity over a range of 0.95 to 1.05
- ix. Wherever the range of water depths to be measured are not explicitly specified in the tender, the range shall be taken as 0 to 30 m in case of installation for reservoir level measurements and 0 to 15 m for all the river gauging stations.
- x. Solar array with regulator, charger and batteries for 45 days backup.
- xi. All instrumentation including power connections as required at each location. The best available information on the availability of power within the vicinity is indicated.
- xii. In case of no possibility of co-locating the rain gauge/ weather measurement arrangements and the bubbler gauge assembly, any necessary cable/wireless data transmission systems from river gauge slave sites to nearby rain gauge/master DCU sites. These shall be constructed in accordance with the Technical Specifications. The purchaser's representatives will supervise the quality of all the components including the civil works.

4.3.1 Bubbler Type Water Level Sensor

The bubbler shall have a mercury free and nitrogen free bubbler apparatus designed for low maintenance water level measurement.

The signal converter shall be supplied in an IP55 indoors and to IP65 outdoors-minimum polycarbonate enclosure and shall comprise a base unit and a programming device. Local LCD display shall be used to indicate key programming features, settings and output conditions.

Power	:	12V/ 24V DC or 240/110V AC as needed for the bubbler
Outputs	:	Serial or 4-20 mA
Accuracy	:	0.1% at full scale
Resolution	:	0.0001 psi
Temperature range	:	0 ⁰ C to 50 ⁰ C
Humidity	:	0-100% Non-condensing
Range	:	0-15 m of static water head

4.3.2 Snow Measurements

4.3.3 Ultra Sonic Snow Depth

Sonic Ranger 50 KHz Module with connector, wire cable, mounting system, Transducer maintenance kit & mounting arm

- a) Temperature Range : -50 °C to +50 °C or better
- b) Accuracy : 0.25% of the range
- c) Resolution : 1.3 mm

4.3.4 High Precipitation Snow Gauge

This unit should provide the amount of snow precipitation. It should be rugged enough against Snow Bridge and should have no heating assembly.

- a) Capacity : Up to 75 cm
- b) Glycometh solution 60% : 12 Gallons
Methanol and 40% Ethylene Glycol

- | | | |
|------------------------------|---|--|
| c) Teflon Tapes for sealing | : | 02 with each |
| d) Plastic tapes for sealing | : | 02 with each |
| e) Accuracy | : | 0.5% full scale from -40 deg C to + 50 deg C |
| f) Sensitivity | : | 0.5 mm of precipitation |
| i) Protection | : | Built in for overflow |
| j) Output Connector | : | Compatible with the system |

4.3.5 Snow Density/ Snow Water Equivalent

The sensor shall be capable of measuring snow density of the fresh snow precipitated and snow water equivalent also

- The instrument shall be according to appropriate standards set by WMO, ISO or ISI equivalent
 - Supplier shall clearly specify the standard adopted
 - The sensors shall be unaffected by condensation and should be resistant to airborne pollution
- All the instruments & sensors should work properly in the range -40 deg C to + 50 deg C

4.4 Meteorological Parameters (AWS)

4.4.1 Air Temperature

The instrument shall provide electrical output signal proportional to the ambient air temperature. All parts shall be made of corrosion resistant material. It shall be unaffected by condensation and should be resilient to air borne pollution. The instrument shall be according appropriate standards set by WMO, ISO or BIS equivalent. Supplier shall clearly specify the standard adopted.

Sensor type	:	Platinum resistance or better or equivalent
Operational Range	:	-5 Degree Celsius to + 60 Degree Celsius
Accuracy	:	Within $\pm 0.1^\circ$ Celsius in the entire working range
Resolution	:	0.1 Degree Celsius
Response time	:	10 Secs or lesser
Self aspirated	:	To ensure continuous supply of air. Free from turbulence, water droplets and Radiation
Accessories	:	All accessories for mounting the instrument e.g. special cross arm clamps or flag, if any, shall be provided.

The sensor shall be unaffected by condensation and should be resistant to airborne pollution.

4.4.2 Relative Humidity

Range	:	0 – 100% RH
Accuracy	:	+3% or better
Resolution	:	1%
Sensor type	:	Capacitive/ solid state
Response time	:	10 Secs or lesser

4.4.3 Wind Speed And Direction

Wind Speed sensor with speed recording instrument shall provide electrical output proportion at the relative incident wind. All parts shall be made of corrosion resistant material. The instrument shall be according g to appropriate standards set by WMO, ISO or BIS equivalent. Supplier shall clearly specify the standard adopted.

Wind direction sensor with recording equipment shall provide electrical output proportional to the direction of flow. True north direction shall be considered as reference direction. All parts

shall be made of corrosion resistant material. The instrument shall be according to appropriate standards set by WMO, ISO or BIS equivalent.

Sensor Type	:	Ultrasonic (no moving part)
Range	:	0-60 m/s for speed & 0-360 degrees for direction or better
Accuracy	:	Better than 1% full scale
Resolution	:	0.1 m/s for speed and ± 5 degree for direction
Response time	:	Less than 1 second lag in operating range
Threshold	:	Less than 1 m / sec.
Averaging	:	To be introduced in DCU customizable by user
Mounting	:	All accessories for mounting the instrument e.g. special cross arm clamps or flag if any shall be provided.

4.4.4 Solar Radiation

The recorder is required to measure global solar radiation. The sensor made up of multi-junction copper thermopile. The instrument must be temperature compensated. Fitter domes should be replaceable for different transparency wave length range. The instrument shall be installed for best performance. The sun shine recorder and cards shall comply with IS7243-1974/WMO standards.

1.	Threshold	120 W/m ² of direct solar irradiance
2.	Sensor	Photo sensor/pyroelectric sensor
3.	Methodology	Alternate shading of sensor to account for sky radiation
4.	Resolution	1s of an hour
5.	Spectrum range	400nm to 1100 nm
6.	Response time	100 μ s
7.	Stability	Better than 2% over a year period
8.	Temperature dependence	Better than $\pm 2\%$ in the ambient range
10.	Error due to changing declination	Less than $\pm 3\%$
11.	Output	High for Sunshine (5 V) Low for No Sunshine (0 V)

4.4.5 EVAPORATION

The evaporation gauge sensor shall measure the evaporation rate from the surface and transmit the data. The instrument shall be properly encased to ensure uninterrupted working in exposed weather conditions. The material shall be of durable nature, properly machined and finished. The evaporimeter should be exposed to atmosphere as per specification/ standards set by WMO/ ISO,/BIS equivalent etc. The pan shall comply with IS: 5973-1970.

Pan Specification:

Operating temperature	:	-5 to 60 degree Celsius.
Diameter of the pan	:	1.2 m or more.
Accuracy	:	+/- 1%
Accessories	:	As required for complete installation of the sensors and Equipment

Measuring Cylinder:

Material	:	Clean cast seamless acrylic plastic tubing or brass sheet.
Platform	:	Rot resistant timber treated with creosote or other

Graduation : effective
Wood preservative.
in millimetre.

5.0 DATA COLLECTION UNIT AND TRANSMISSION EQUIPMENT

5.1 Datalogger Specifications

- 5.1.1 The system shall automatically collect the observations from attached sensors, process the same and store them into its memory as per the pre programmed procedure at every full hour UTC and data shall be transmitted to the INSAT-DRT in TDMA mode. Details of TDMA mode are provided in para 5.3. In-depth details of TDMA technique will be provided during the Design Review Committee Meeting which will be held with the successful bidder.
- 5.1.2 The DCU shall also continuously monitor the status of the instruments, power supply and communications. In the event of failure of an instrument or disruption of any of the power sources, an alarm shall be sent back to the ERS.
- 5.1.3 The number of analog/digital/ SDI channels in the data logger must be compatible to the sensors being supplied and also for other monitoring systems for battery, solar panel etc. At least four additional analog and digital channels each, extra RS-232, RS-485 and SDI -12 channels must be available to interface other types of sensors. The type and the number of extra channels provided in the data logger must be specified.
- 5.1.4 The sensor's signal conditioning unit should be an integral part of the system.
- 5.1.5 The system shall have provision to easily include and change the following information as mandatory requirements:
- Unique station identification code
 - Time of observation
 - Sensor identification.
- 5.1.6 The system shall have an integrated microprocessor based data acquisition and storage system having adequate hardware configuration and software support to serve as an interface between sensors and the communication link to perform tasks as stated below:
- 5.1.7 Providing necessary electrical power to the sensors and conversion of electrical output signals from the sensors into engineering values based on calibration equations stored in the memory. Full compatibility with all types of sensors provided in the packages shall be mandatory.
- 5.1.8 Storage of observed data along with time for all the parameters in the memory. Memory capacity to retain at least 180 days data is required. Data shall be available even if the power supply to the system has failed (RAM Backup battery) for one year.
- 5.1.9 The stored data shall be retrievable via serial port to a PC/laptop and a PCMCIA card or any other compact and commercially available solid state memory device.
- 5.1.10 The system should be stand-alone and all programming functions/set-ups to be carried out through system keypad and display independent of a PC/Laptop.
- 5.1.11 The system should be capable of continuous updating of the values of sensed weather parameters and post processing the instantaneous values into average values over a specified period of time for transmission to the DCU earth station.

- 5.1.12 Management of data transmission to DCU earth station through satellite, which shall include formatting of transmitted data with necessary preambles, station ID codes, parity checks etc. as per transmission methodology for transmission through satellite channel, scheduling and operating the DCU transmitter automatically.
- 5.1.13 Management of DCU transmitter to optimize the battery consumption.
- 5.1.14 The system shall provide a complete health status of the battery, transmitter and other components.
- 5.1.15 The health data shall be stored as a log record and shall be capable of being retrieved and displayed when required.
- 5.1.16 The system shall have in-built sensor simulation system options to conduct tests on the system for field installation, two-point calibration/re-calibration and maintenance of the sensors.
- 5.1.17 The system shall support the following functions:
 - 5.1.18 Easy programming set up.
 - 5.1.19 Multi tasking capability
 - 5.1.20 User friendly software programming.
 - 5.1.21 The system shall have self-diagnostic facility and be capable of displaying Station ID/Sensor ID codes and messages on the display panel for general identification of the fault. Facility to monitor these codes and other health status through an external lap top/PC.
 - 5.1.22 Setup shall be organised in a tree of menus and sub-menus. Protection of setup parameters and data through password should be supported by the system. In addition, the DCU shall support the manual entry of data through keypad and its display.
 - 5.1.23 Data including the setup and program files shall be transferable from the system via a serial port to PC and PCMCIA card or other suitable memory device and vice versa.
 - 5.1.24 The DCU shall be housed in a weather proof and temper proof housing of NEMA 4 type enclosure of steel or fibre glass (to be quoted separately). In case of steel enclosure the housing shall have 16 gauge steel body and 14 gauge door, external mounting feet, seams continuously welded, rolled lip around door to exclude liquids, oil resistant gasket, Hasp and staple for padlocking, grey polyester powder coating inside and outside. In case of fibre glass enclosure the housing shall have moulded fiber glass reinforced material, resist corrosion, seamless foam-in-place gasket, detachable mounting feet, moulded drip seals, type 216 stainless steel, quarter turn latch.
 - 5.1.25 Electronics units should have EMI protection and Enclosed in IP 65 enclosure.
 - 5.1.26 The DCU shall be located in a place specified by the Purchaser at each site and shall be generally one metre above Highest Flood Level (HFL) attained at that site. The DCU at each site shall be located in such a way it is easily approachable even in floods.
 - 5.1.27 The data logger shall be programmable locally via laptop PC. Twenty four such data downloading machines with latest configurations (Annexure) shall be provided for modeling centers (new as well as existing).
 - 5.1.28 There will be only one type of DCU with specification as given in this para at all sites.
 - 5.1.29 The surge suppression in form of fuse or other appropriate device shall be provided for all interfaces to protect the data logger from surges emanating from the sensors.

5.1.30 Numerical Specifications:

- | | | | |
|-------|-----------------------------|---|---|
| I. | Slots / Ports | : | PCMCIA and USB (preferable) |
| II. | Data Memory | : | 4 MB minimum |
| III. | Operating Temperature | : | -10 ⁰ C to +60 ⁰ C |
| IV. | Power Consumption | : | < 2 mA quiescent |
| V. | Analog inputs | : | 4 to 20 mA ; 100% over-range withstand |
| VI. | Analog to digital converter | | |
| | Resolution | : | 16 bit or better |
| | Conversion Accuracy | : | ± 1 LSB |
| VII. | System clock | | |
| | Stability Long-term | : | 1 ppm/year or better |
| | Stability (Temperature) | : | 3 ppm or better from -40°C to 55°C |
| VIII. | Battery Backup (internal) | : | Lithium Battery, storage: 2 years |
| IX. | Real-Time Clock | : | GPS synchronised |
| X. | Watchdog Timer | : | System Reset upon microprocessor failure |
| XI. | Sample Intervals | : | 1 sec. to 24 hr. in 1 second increments
(user selectable) |
| XII. | Keypad | : | 1 no. |
| XIII. | Visual display | : | 16 Character X 2 lines or more,
alphanumeric LED/LCD to operate in temp.
range -10°C to +55°C |
| XIV. | Power consumption | : | Average over an hour shall be less than 0.5 A
at 12V D.C. including that of sensors, GPS
and transmitter. |
| XV. | <u>Power Supply:</u> | | |
| | a) Battery | : | Single 12V chargeable maintenance-free
battery 65 AH capacity |
| | b) Charge controller | : | Internal or External |

5.2 DCU Transmitter & Antenna

The system transmitter should be an internal component of DCU. It should have necessary hardware and software to receive data from the data logger and transmit in TDMA mode as in para 5.3 The transmitter should have the capability to handle data transmission to the DRTs located on any of the INSAT series of satellites as given under para 5.4 The selection of frequency and mode of transmission shall be through software settings only. No hardware changes for switching from one satellite DRT to another are desirable.

5.2.1 Transmitter features

- | | | | |
|-----|------------------------|---|--|
| i. | Carrier Frequency Band | : | 402.0 MHz - 403.0 MHz Carrier frequency
402.658 MHz |
| ii. | Carrier Settability | : | In steps of 100 Hz from 402.0 MHz to 403.0
MHz |

iii.	Modulator	:	PCM/BPSK
iv.	Data bit rate	:	4.8 KBPS (User selectable)
v.	Data coding	:	NRZ(L)
vi.	<u>Frequency stability:</u>		
	a) Long term	:	Transmit frequency inaccuracy including aging of oscillator should not exceed ± 400 Hz per year. Oscillator/synthesizer should have provision to adjust for the long term drift
	b) for temperature	:	± 1 ppm or better (-40 to +55°C)
vii.	Signal Bandwidth	:	6.0 KHz maximum or better
viii.	Output Power	:	3-10 W (settable)
ix.	Power Stability	:	± 1 dB
x.	Spurious	:	-60 dB or better
xi.	Harmonics	:	-40 dB or better
xii.	Environmental Operating Temperature	:	-40°C to +55°C
xiii.	Environmental Relative Humidity	:	0 to 100% RH for out door equipments
xiv.	Operating power	:	Switched 12V D.C controlled by data logger.

5.2.2 Antenna features

- i. The bidder shall ensure compatibility of the antenna in the entire system and also ensure achievement of objectives given in the telemetry link calculations to be provided by the bidder.
- ii. The antenna should not allow accumulation of rain water, there by degrading its performance.
- iii. The antenna shall have a proper mounting and pointing arrangement suitable for transmission to any one of INSAT satellites based DRTs (located anywhere in the geostationary arc from 45°E to 115°E longitude). The bidder shall also provide suitable templates and fixtures/tools for reorienting of the antenna towards any satellite by the field personnel as and when required.
- iv. Proper lightning and surge protection shall be provided to protect all the equipment connected to the antenna from atmospheric hazards. This arrangement shall be in addition to the general arrangement already covered under general scope of the work.
- v. Antenna to be designed with an optimum size so that it could be easily transported to remote and inaccessible places. Mounting of antenna should take care of Azimuth and Elevation changes. Systems have to operate in harsh and saline conditions and adaptable to tropical conditions.
- vi. The following technical features shall be supplied by the bidder in addition to the technical information being provided by him as part of the bid.

a.	Polarization	:	LHCP and RHCP (Switchable in field)
b.	Gain	:	Minimum 11 dBi or better
c.	Center frequency	:	402.50 MHz
d.	3dB Beam width	:	40°
e.	VSWR	:	1.2 : 1
f.	Impedance	:	50 ohms

g.	Axial Ratio	:	To be specified by bidder
h.	Operating wind speed	:	250 kmph
i.	Wind Survival	:	300 kmph
j.	Material	:	Rust-proof and oxidation-proof for use in coastal and saline areas
k.	Connector type	:	To be specified by bidder
l.	Mounting	:	Should have engraved elevation angle marking
m.	Operating temperature	:	-40°C to +55°C
n.	Operating Relative Humidity	:	0 to 100% RH
o.	Weight	:	Light weight
p.	Size	:	Small, portable
q.	Operating rain rate	:	100 mm/hr and water proof

5.2.3 Certification

Transmitter and data logger must have certification from IMD for functional operation through INSAT/Kalpana satellites for either TDMA or PRBS (Pseudo Random Burst Sequence) type of transmission technique.

5.3 Time Division Multiple Access (TDMA) Scheme

Each TDMA type of transmitting system shall have a unique GPS synchronized time of transmission which must be stamped on the body of the system by the manufacturer. The burst data format is shown in Fig (1). However, CRC is added to the data frame and half rate convolution coded. It is then appended with CR & BTR preamble and UW and transmitted in TDMA mode. Burst duration is 186 milli sec.

The TDMA frame format is shown in Fig (2). TDMA technique is an open loop system with timing derived from GPS receiver which is part of AWS. TDMA frame duration is one hour. The one hour frame is divided into 6 time windows, each of 10 minute duration. Each AWS is assigned 1-second time slot in any of the 10-minute slot and the repeat transmission is after 10 minutes, which falls in the next time slot.

The one second frame is worked out taking into account the following details:

- 20 millisecond differential propagation delay over coverage area.
- RTC clock accuracy around 1 millisecond per day - GPS receiver updates RTC once every twenty four hours to conserve battery power of AWS.
- GPS receiver accuracy of less than 1 microsecond
- Guard time required in the present burst receiver at Hub station.

Features of ISRO TDMA transmission

Features of ISRO TDMA transmission scheme are provided for general guidance. However international norms applicable for TDMA may be followed.

- Total number of AWS that could be accommodated in a single carrier is 1800.
- By including CRC in the data frame, data validity could be ensured.
- With preserving BCH coding of SID, data quality could be checked and valid data retrieved even for the bad CRC.

- By preserving present SID (Station Identification Code) structure of IMD, SID for all users of DRT could be standardized. The SID consists of 21bits (9 bits for user type, 2 bits for priority, and 10 bits for Platform ID)
- With Forward error correction convolution coding, better data quality is ensured.
- With one repeat transmission, reliability of data reception is improved.

1	CRC CODE GENERATION	Polynomial: CRC-CCITT-16 $X^{16}+X^{12}+X^5+1$
2	DATA SCRAMBLING	Polynomial: $1+X^{-1}+X^{-15}$ Initial State: 6959 (Hex)
3	CONVOLUTION ENCODING	Convolution Coding $\frac{1}{2}$ Rate, Constraint Length K=7 Polynomial: G1=133(Octal), G2=171(Octal)
4	HEADER DETAILS	CR: 192 Symbols (all '0's) BTR: 64 Symbols (all '1's) UW: 64 Symbols (07EA CDDA 4E2F 28C2 (Hex)) Note: UW transmitted with LSB first of every byte, starting from 07EA. (See Fig.1)
5	RF DATA ENCODING	Differential coding (NRZ-L) is done for the entire burst (Preamble and the convolution coded bits) before RF modulation.

Fig. 1: Burst Transmission Format for TDMA Technique (4800 Symbols/sec.)

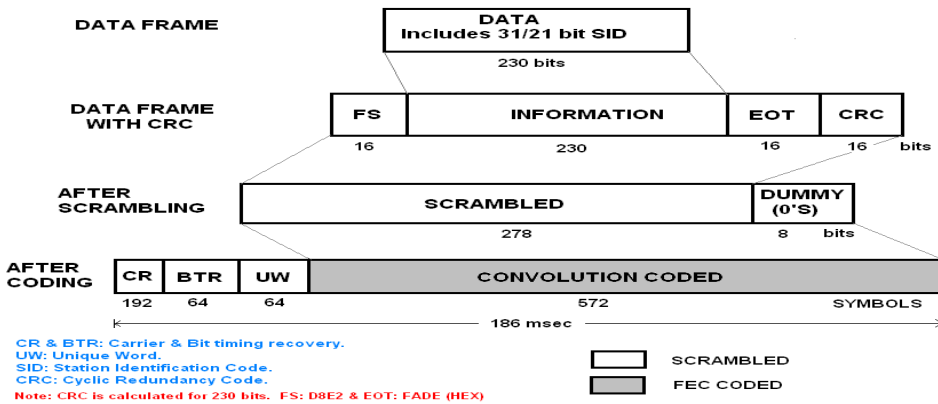


Fig. 2: TDMA Transmission Frame Format

Fig.1 may be referred to. CRC is calculated for 262 bits which include FS and EOT. It is then scrambled. 1byte, all '0's is added with the scrambled bits, after which the entire bits are convolution coded. Preamble (CR, BTR and UW) is appended with the convolution coded bits. The resulting bits are then differential coded and transmitted.

The system should have flexibility to accommodate more number of carrier channels by suitable changes in the TDMA transmission scheme.

More details will be provided at the time of the design review meeting which will be held with the successful bidder. However, it should be ensured by the bidder that the system configuration is flexible and accommodate more than 30 sensors without any additional cost.

5.4 INSAT DRT Specifications

For the purpose of data transfer from field AWS unit to AWS Data Receiving Earth Station at Pune, the Data Relay Transponder (DRT) on the different INSAT / KALPANA series of satellites shall be used and the specifications given below shall be treated as standard to be adhered by the offered telemetry system.

SATELLITE	KALPANA-1 74° E	INSAT-3A 83°E	INSAT-3D 82°E
RECEIVE FREQ. BAND	402.65 - 402.85Mhz	402.65 - 402.85Mhz	402.10 - 402.50Mhz
TRANSMIT FREQ. BAND	4500-4510Mhz band 4506.05Mhz	4500-4510Mhz band 4506.05Mhz	4500-4510Mhz band 4506.05Mhz
RECEIVE G/T	-19db/deg.K	-19db/deg.K	-19db/deg.K
MAX.EIRP	24dBW peak	24 dbW peak	24 dbW peak
C-BAND EIRP for RECEIVE FLUX DENSITY	2.0dBW for – 146 dBW/m ²	2.0 dbW for – 146 dbW/m ²	2.0 dbW for – 146 dbW/m ²
REC.POLARIZATION	RHCP	LHCP	LHCP
TRANSMIT POL	LINEAR	LINEAR	LINEAR
FREQ.TRANSLOCATION ERROR	± 40Khz over life ± 6Khz over 1 month	± 40Khz over life ± 6Khz over 1 month	± 40Khz over life ± 6Khz over 1 month

Data Relay Transponder (DRT) onboard INSAT 3D will have a receiving frequency band of 402.3 MHz ± 200 KHz.

5.5 Channel Specifications for TDMA transmission format

Table below gives the present AWS parameters and their identification code used in the TDMA transmission format.

Sl.No.	Channel No.	Identification Code	Parameter
1.	1	0000 (:0)	Instantaneous sampled value of air temperature in deg C at the end of every full hour UTC.
2.	2.	0001(:1)	Water level sampled at end of every full hour IST
3.	4	0100(:4)	Wind speed in knots (3 minute vector averaging)

			prior to full hour UTC).
4.	5	0101(:5)	Wind direction in degrees (3 minute vector averaging prior to full hour UTC).
5.	7	0111(:7)	Instantaneous value of RH at the end of every full hour UTC.
6.	10	1110(:14)	Duration of bright sunshine since last 20 UTC. Reset to zero at 20 UTC. (Global radiation will be transmitted in this slot instead of duration of sunshine.
7.	Cal1	:C1	Battery voltage (volts)
8.	Cal2	:C2	Hourly rainfall (rounded off to next higher integer).

5.6 Lightning Protection

The entire unit has to be adequately protected against lightning and build of static charges. The lightning rod should protrude 1 m above the highest point (Antenna) and should be placed in the centre of the pole. The mast should be electrically grounded by following as per CPWD earthing procedures. As a part of the maintenance, the earthing equipment shall be inspected on a yearly basis for its conductivity and effectiveness. Such inspection shall be carried out in the pre-monsoon period and any faults noticed shall be rectified.

5.7 Earthing For Equipment

The electrical grounding for all other electronic and electrical equipment should be done by following standard CPWD procedure. The earthing for the equipments should be done separately and should have a minimum distance of 2.5 metre from the earthing done for lightning rod. In no case both the earths should be done in the same earthing rod.

As a part of the maintenance, the earthing equipment shall be inspected on a yearly basis for its conductivity and effectiveness. Such inspection shall be carried out in the pre-monsoon period and any faults noticed shall be rectified.

6.0 SOLAR POWER SUPPLY WITH BATTERY BACKUP

6.1 Solar Power Supply

Solar Panel mounting hardware designed to allow a great variety of attachment methods and accommodate a variety of mounting surfaces. They may be used to mount a module on a horizontal or vertical surface, on surfaces at angles between horizontal and vertical and on metal or wooden poles. Attachment methods include bolts, lag bolts, u – bolt brackets and stainless steel hose clamps.

The Solar power supply shall be mounted on the roof of site buildings where existing. The Contractor shall optionally 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 of each DCU.

In order to guard against frequent theft of solar panels the mounting device shall be so designed as to make the solar panel detachable as and when required. It is intended to store the solar panel during the night hours as well for longer durations in the non-monsoon period and the arrangement should be designed in such a way that the arrangement is sturdy and capable of handling frequent disconnecting and re connections.

The power supply shall primarily function through a set of sealed maintenance free rechargeable batteries capable of preventing deep discharge.

The following features shall be supplied by the Contractor in addition to the technical information being provided by him as part of the bid. Any options available in respect of any of the features shall be clearly brought out with recommendations for a specific option selection.

- Typical Peak power
- Voltage at Peak power
- Current at Peak power
- Minimum at Peak power
- Short-Circuit current
- Open-circuit current
- Wind load
- Impact reliability

6.2 Batteries

The batteries required for the equipment above shall be maintenance free, rechargeable sealed batteries with the following features:

- Overcharge and deep discharge protection
- Leak-proof
- Easy handling – no special shipping container required
- Long service life
- Excellent recharge ability

One battery pack shall be provided for each DCU. The batteries pack provided shall have adequate capacity to sustain the maximum sized DCU configuration of sensors and telemetry equipment for a period of 60 days of continuous operation at the frequency of one observation per hour per sensor and one transmission per hour on a 24-hourly basis. This capacity shall be available at the end of second year of continuous operation.

The necessary housing and configuration of the batteries shall be furnished in detail by the bidder/Contractor.

The battery pack shall also include arrangements of charging through a standard 220 V AC domestic power supply outlet and also from solar panels established as above. The normal supply to the DCU equipment shall be from battery pack only.

The battery pack shall have audio and visual alarms for overcharging and deep discharging conditions. The charge level shall also be indicated on the front panel of the pack.

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.

7.0 SPECIFICATIONS OF EXISTING EARTH RECEIVING STATION EQUIPMENT

All components of the earth receiving station equipment compatible with TDMA transmission techniques. Accordingly equipment required for reception and processing the data may be provided. The whole system shall have complete redundancy.

Detailed specifications of the equipment required like down converter, demodulator, processing software will be discussed at the time of Design Review Meeting with the successful bidder.

A general overview of the ERS is given below:

7.1 General Features

7.2 Details of Earth Receiving Station Antenna

Antenna size : 3.8 metres or less diameter.

7.3 Features of LNA

Frequency range : 4500 – 4800 MHz

7.4 Features of Synthesized Down Converter

As per SFC4200A C-Band Synthesized Frequency Downconverter.

7.5 Features of Digital Receiver / BPSK Demodulator

As per PSM-500 IF Satellite Modem.

8.0 TELEMETRY LINK CALCULATIONS

The bidders shall submit the detailed telemetry link calculations for the system proposed in the offer. The calculations shall show the end quality objectives proposed to be fulfilled. The following information shall be mandatorily supplied.

(The values have been incorporated for 4504.2 MHz downlink and 402.75 MHz uplink frequencies. Need to be modified for the present downlink frequency 4506.05 MHz and uplink carrier frequency to be allotted, for Kalpana-1, INSAT 3A/ 3D....G/T etc....)

Sl.No	Link Budget with INSAT	TDMA
1	Bit rate (R)	2.4 Kbps (33.8 dB-Hz)
2	Transmission rate	4.8 Kbps (with half rate coding)
3	Required BW for PCM/PSK (1.2R)	5.7 KHz (37.6 dB-Hz)
	Downlink	
4	Frequency	4504.2 MHz
5	EIRP(S/C) for single AWS at BOL	2.4 dBW
6	Slant range	36,000 km
7	Free Space Loss	-195.8 dB
8	G/T of Ground Receive System	22.5 dB/°K (3.8 m HUB)
9	Boltzmann's Constant	-228.6 dBW / °K/Hz
10	C/No downlink	58.3 dB Hz
	Quality Objective	

11	Bit Error Probability	10^{-5}
12	Energy per bit to Noise density ratio (Eb/No)	7.0 dB for BPSK (Taking Viterbi decoding gain)
13	Implementation margin	2.0 dB
14	Effective Eb/No	9.0 dB
15	Effective C/No	42.8 dB
16	Degradation due to downlink	0.2 dB
17	Link margin	2 dB
18	C/No uplink	45 dB
	Uplink	
19	Uplink carrier frequency	402.75 MHz
20	Free space loss	-177 dB
21	G/T space craft	-19 dB / °K (min)
22	Boltzmann's constant	-228.6 dBW / °K/Hz
23	C/No uplink	45 dB
24	AWS EIRP	12.4 dBW
25	AWS Transmit power	1.4 dBW with 11 dB antenna gain
26	Data bit rate	2.4 Kbps (half rate)
27	Carrier modulation	PCM-BPSK (0° and 180°)
28	Data coding	PCM (NRZ-L)
30	Frequency stability	(+/- 1 ppm/year (0°C to +50°C))
31	Transmit signal bandwidth	6 KHz minimal
32	AWS EIRP	12.4 dBW min.
33	Transmission duration	186 msec
34	Transmit power	5 W (Max.)
35	Antenna gain	11.0 dB (min)
36	Antenna polarisation	Left / Right hand circular polarization (field selectable)

9.0 Other Equipment

9.1 Data downloading machine (Laptop) specifications:

Specifications		
1.	Configuration	Computer Note Book Intel Core 2 Duo configuration with T8300 chipset
2.	Processor	Mobile Intel Core 2 Duo Processor T8300, 2.4 GHz with 3 MB L2 Cache 800 MHz FSB or better

3.	Chipset & Motherboard	Mobile Intel GM 965 or GM 45 or higher chipset on OEM motherboard
4.	Memory	2 GB DDR 2 RAM Expandable to 4GB
5.	HDD	250GB 5400 rpm (min.) SATA
6.	Display	39.1 cm (15.4" TFT) or 35.5 cm (14.1") Active Matrix wide Screen Display
7.	Resolution	1280x800 WXGA
8.	Video Controller	Integrated GMA 900 series with 128 MB Shares Memory
9.	Modem /Ethernet	Integrated 56 KBPS Modem (FAX/DATA) and 10/100 IEEE8023 Ethernet card.
10.	Wireless Connectivity	Integrated wireless Intel 802.11a/b/g, Integrated Bluetooth
11.	DVD Writer speaker	Integrated DVD writer 8x and Integrated Stereo
12.	Key Board	Key Board with Touch pad
13.	Expansion Port	2 USB, 10/100 Ethernet card, RGB or video or VGA, PCMCIA/PCI Express slot, Microphone, Stereo Headphone & other standard fratures.
14.	Operating System & Software	Microsoft Windows Vista Professional, MS Office 2007 and Norton/McAfee/e- Antivirus Software latest version & other software. All software with media and with licensed updaton equal to the warranty period of the entire network
15.	Power Supply	230V, 50 Hz AC Supply with rechargeable Battery Pack comprising of Li-ION battery Suitable for approx. 4 hrs. Operation complete with battery charger/adaptor.
16.	Carrycase	To be provided
Note: Data downloading machines (Lap tops) shall be of branded make.		

9.2 Inverter 3 KVA

		Specifications
1.	Model	Sine wave
2.	Input Voltage	100V-300V (wide input voltage range) 180V-260V (Normal input voltage range)(optional)
3.	Output Voltage on Mains Mode	Same as input
4.	Output Voltage on inverter Mode	220 V+5%-10%
5.	Out put frequency on Inverter Mode	50Hz \pm 1 Hz
6.	Switching from Mains to Inverter and from Inverter to mains	Automatic
7.	Out put waveform on mains mode	Same as input
8.	Out put waveform on Inverter mode	Pure Sine Wave
9.	Battery Charging Current	Constant Charging approx 10% of the rated battery current in AH
10.	Charger	Power Factor controlled Boost Technology
11.	Efficiency	3KVA ;> 82% at 2100W Bulb Load / 48 VDC
12.	Inverter Over load / short	\geq 110% / 250%

	Circuit	
13.	Browns out mains voltage	100 V \pm 40V
14.	Technology	MICRO CONTROLLER / DSP BASED DESIGN
15.	Auto Reset Feature	Yes
Max.Load Condition set at 230 V / 50 Hz AC Input : 3KVA / 2100 Watt / RL Load		
Total Maintenance free battery with trolley.		
Note: Inverter shall be of branded make.		

10.0 Civil Works For Housing DCU and Associated Instrumentation

All civil and accommodation works shall be provided including safe, secure (as required at each location), weatherproof enclosures for equipment (NEMAIV enclosure), bases and foundations, all fixings and supports (above and below river water level) (all fixings to be non-corrodible), the masts shall be of at least 9.0 mts, suitable animal proof security fencing and lockable gateway to sites, security fittings and fixtures at all DCU sites and any necessary cable / wireless data transmission links.

11.0 VSAT terminal at Modeling Centre at Shimla and at Kol Dam site.

Antenna	
Antenna size	1.2m/1.8m
Mount type	Non-penetrating mount, elevation over azimuth
Type of feed	Prime focus feed/offset feed
Operating frequency	XC-Band (Extended C-Band)
Tx Gain (Mid band)	39.5 dBi \pm 0.5
Rx Gain(Mid band)	39.5 dBi \pm 0.5
Receive G/T at mid band	Better than 25dB ⁰ /k
Antenna noise temp @ 20 ⁰ elevation	Less than 35 ⁰ k
Off –axis radiation pattern antenna	As per ITU-R S.580-5
Cross polarization isolation of antenna	Better than 30dB As per ITU-R S.731
Off-axis EIRP (max. Permissible polarization)	As per ITU-R S. 728-1
Feed polarization	Linear
VSWR	1.3:1 or better
Antenna adjustment range	In azimuth – 0 ⁰ to 360 ⁰ continuous fine In elevation – 5 ⁰ to 90 ⁰ continuous
Wind loading	Unsusceptible to harsh weather conditions a) Operational – 80 kmph b) Survival – 200 kmph c) Lightening protection
Reflector material	SMC GFRP
Transceiver	
Type	XC band and full duplex operation
Radio Frequency Unit – transmit	
Transmit (output) Frequency	6.725 – 7.025 GHz
Receive (input) Frequency	L band
Carrier tuning	Step 100Hz
Output power	2.0 watt, adjustable in steps by remote control
Transmit (Tx) Gain	Fixed power output
Transmit spurious	Comply to ITU_R Rec S.726-1

Radio Frequency Unit – receive	
Input Frequency range	4.5 – 4.8 GHz
Output Frequency	L band
Low Noise temperature	90 degree K or better to meet overall G/T at site
In-Door Unit (IDU)	
In Route	
In Route Throughput	128 kbps
Modulation	QPSK or better
Carrier Frequency Stability	1×10^{-7} (over six months)
Bit Error Rate (BER)	Better than 1×10^{-7}
Out Route	
Out Route throughput	8 Mbps to 34 Mbps or more
In route access	TDMA/FDMA/DVB-RCS Multicast
EFC coding rate	$\frac{1}{2}$ $\frac{3}{4}$ rate
Modulation	QPSK or better
Carrier Frequency Stability	1×10^{-7} (over six months)
Bit Error Rate (BER)	Better than 1×10^{-7}
IDU shall support	(i) Quality or service (QoS) based on diffservy (ii) TCP spoofing (iii) Packet filtering
Ethernet LAN port	
Number of 10/100 base T	One
Physical interface	Conforming to IEEE 802.3(RJ-45 type)
Data rates	10/100 Mbps
Protocol supported	TCP/IP, UDP, IGMP from HUB and VSAT, TCP acceleration
feature	SNMP compliant, NAT support, IDU should support packet filtering and other network

The VSAT link between Modeling Centre, Shimla and Kol Dam (NTPC) shall work independently.

12.0 FIELD TROUBLESHOOTING EQUIPMENT

The contractor shall supply adequate field trouble shooting equipments alongwith a description of utility of each of the equipment proposed. The equipment supplied shall be of such nature that the purchaser can setup own trouble shooting team.

13.0 TESTING AND ACCEPTANCE

13.1 Factory Acceptance Testing

The contractor shall specify factory acceptance tests in respect of each component of the system namely Sensors, DCUs, VSAT and its major sub-assemblies wherever relevant as a part of the technical bid. The contractor shall also mention the acceptability ranges of the test parameters for acceptance at factory level. The programme for factory acceptance testing shall also be intimated in advance.

The Department or its representative shall have the right to inspect and/or to test the Goods to confirm their conformity to the Contract specifications at no extra cost to the Purchaser. The Department shall notify the Supplier in writing in a timely manner of the identity of the representatives retained for these purposes.

Factory Acceptance Test results shall be retained as part of the project QA record and the same shall be supplied to the purchaser.

After successful completion of Factory Acceptance Tests for any section of the Works, the Purchaser shall approve that section of the Works for delivery to site. Any such approval shall in no way relieve the Supplier of any of his obligations under the Contract.

The factory acceptance testing shall include the complete system being fully tested using simulation techniques where applicable to demonstrate its compliance with the Specification. The test shall allow for the connection of analogue inputs, digital inputs etc. to enable the overall performance and suitability of the software to be tested.

The purchaser, at its discretion may waive off the witnessing of the tests but the records of the tests shall be provided duly authenticated by the contractor.

13.2 System Integration Testing

The contractor shall specify System integration tests proposed to be carried out as a part of the technical bid. The tests shall be such that the performance of the system as a whole commencing from the sensors and extending to the real time data receipt at the existing CWC's modeling centre at Shimla gets involved in the test plan. The System integration tests may 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.

If any software errors are found, they shall be recoded and the code shall be amended. The test shall then be repeated.

System Integration Test results shall be retained as part of the project QA record and shall be made available to the Purchaser for his inspection if he so requires. If any errors are found in the Test Procedure or Result Sheets, they shall be corrected and resubmitted to the Purchaser for approval.

13.3 Site Acceptance Protocol

In order to facilitate the site acceptance of the system by the site – in – charges, the Contractor should give a list of deliverables for each site to the respective sites as well as to the headquarters. The list shall be verified by the site – in – charge and accordingly will give a verification report whether all deliverables have been delivered properly at the site.

For site acceptance test, the supplier should give a check – list of all components and their functions. This check list shall be decided in consultation with the department (Purchaser). This check list shall indicate the tests to be conducted at the site and the results that are expected for each and every component that are to be installed at the site. This check list will have to be provided to each and every site one month before the installation begins.

13.4 Site Acceptance Tests (SAT) for Remote Stations

The site acceptance test will be conducted by the purchaser or any other person nominated by the purchaser, at its option. Site acceptance test shall be carried out in two stages. The first stage of acceptance will be based on preliminary inspection of the equipment supplied with respect to the required and supplied components such as sensors, DCU with the weatherproof enclosures, batteries (charger/regulator), gauge apparatus with enclosures and sensors, INSAT transmitter, INSAT satellite antennae, solar panel and mounting hardware, including all associated accessories.

Second stage of site testing shall be undertaken for a period of 30 days following successful completion of witnessed commissioning to prove the equipment and the interconnecting cable

installation and ensure that all operators are fully conversant with the equipment and calibration procedures, methods of operation and all facilities provided by software. During the period of 30 days, there shall be no occurrence of any malfunction in any component necessitating replacement or repairs. No malfunction, partial or complete failure of any part of hardware or excessive heating of motors or other electro-mechanical equipment or bugs in the software should occur. All the software should be complete and no missing modules/sections will be allowed. The supplier shall maintain necessary log in respect of the results of the tests to establish to the entire satisfaction of the purchaser, the successful completion of the test specified. An average data acquisition efficiency of 99.5% for the duration of test period shall be considered as satisfactory. The testing schedule will be agreed to by both the parties during performance of contract. In this stage a regular comprehensive check of functioning of all the components will be made. On conclusion of site acceptance, all relevant documentation pertaining to the site shall be handed over by the supplier to the representative of the purchaser.

13.5 Complete Acceptance Test

The test shall involve testing of all equipments installed at the remote stations with the existing CWC's modeling centre at Shimla like server (hardware and software), data dissemination software, RDBMS and database for trouble free data transmission. This shall involve demonstration of non-interference with existing software packages already installed at the modeling station, if any. The testing shall also involve checking and demonstration of integration of all computers & peripherals supplied, local and wide area networks existing at the modeling centre.

After establishing above, the whole system shall be tested for completeness by demonstrating trouble free real time receipt of data from all the remote stations for a sustained period of 30 days operating on 24 X 7 basis and incorporation of the data into the data base set up at the existing modeling centre at shimla.

14 Documentation

Detailed Operating and Maintenance manuals for the control system and other equipment supplied under the contract shall be provided. Four copies of draft manuals are to be provided prior to factory acceptance testing for approval and 2 copies each of the final manuals have to be given to each modelling centres prior to final hand over.

The manuals shall detail in full the equipment supplied under this contract, including test certificates, and the software section shall be comprehensive and in sufficient detail to allow personnel to easily modify any setting or operational parameter.

The provision of all documentation is essential and shall be specific to this project.

15 Maintenance

All systems and equipment along with civil works and associated cables and accessories are to be supplied with a minimum of two years on site warranty. After this time, annual maintenance and repairs of the entire system including supply of spares, etc., for the next eightx years will be done by the Supplier. Purchaser at his will have the option to extend the Annual Maintenance contract (AMC) on same terms and conditions after the end of eighth year Annual Maintenance Contract entered into at the time of tendering excluding the two years of warranty. Maintenance manuals and appropriate staff training will be required from the equipment suppliers.

The maintenance efforts should be oriented towards minimization of the site downtime and minimizing the loss of real time data observations. The maintenance philosophy, which shall be adopted, shall generally be for fault-finding to card level and module replacement, with the faulty modules being either scrapped, if damaged beyond repair, or returned to the Supplier for repair, as appropriate. The Supplier shall operate a module repair and replacement scheme.

The Supplier shall include details of how he proposes to meet the maintenance strategy with his tender.

16 Spare parts

Manufacturer shall provide a list of recommended spares. Spare should be such which cover most common fault and does not require replacement of complete assembly.

The number of spare parts is fixed on the basis of ensuring a minimum availability at CWC, Shimla for rapid swapping in case of a major malfunction which can not be rectified at the site.

The following mandatory spare parts for the equipment that are essential and critical to the operation of the system with low downtime shall be supplied. For computing the numbers, the fractions are to be always rounded off to the next higher integer value.

Spare	No.
Data recorder with INSAT transmitter	1
INSAT Transmitter	4
Satellite Antenna	4
Solar panel assembly	4
Complete bubbler apparatus for river gauges	1
Rain gauges with its accessories	4
Mother Board for DCU	4
Sensor for water level	1
Snow sensors: depth, precipitation, SWE	4

Procurement of these mandatory spare parts by the purchaser does not waive of the warranty/maintenance responsibilities of the Supplier. The supplier has to ensure the availability of spares in order to run the system for 15 years. However, the supplier is required to maintain inventory in India covering the warranty period as well as AMC period.

The spare parts supplied by the Supplier shall be identical functionally, electrically and mechanically, to the corresponding parts in the equipment supplied under the Contract and shall be suitably packed and clearly marked, ready for reception at the Purchaser's stores. Any special handling instructions shall be clearly marked on the packages.

All components within equipment shall be of a type where replacements are readily available if required.

17 Specification for Cabling and connecting

- i. The term cable shall always include necessary type of connectors at both the ends for connecting between two equipments. 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 connecting various components and embedding them or protecting them with necessary conduits.

- iv. Wherever the cables are to be laid indoors and the length of the individual cable run exceeds 1 metre, 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 metre above the floor surface. Whenever the indoor cable is required to cross the floor, it shall be housed in a Galvanised Iron pipe of 12.5 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 upto 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 12.5 mm Galvanised Iron pipe embedded at a depth of not less than 1.5 metre 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 purchaser 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 purchaser 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.

18 CONSTRUCTION REQUIREMENTS AND WORKMANSHIP

18.4 Materials

18.4.1 Storage handling and use of materials

Materials and components shall be handled in such a manner as to avoid any damage or contamination, and in accordance with all applicable recommendations of the manufacturers.

18.4.2 Bricks

Bricks, blocks and tiles shall be regular and uniform in shape and colour, and all of a similar size to the respective type.

18.4.3 Cement

Cement shall be factory produced by a reputable manufacturer, and stored in dry conditions until required.

18.4.4 Mortar

- i. Mortar shall be mixed only as and when required in the proportions of 1 part cement to 3 parts sand, with fresh, clean and clear water, until its colour and consistency are uniform. It shall be conveyed fresh as required for use, and used within 20 minutes of mixing.
- ii. Fine aggregates for mortar shall be washed natural sand or crushed natural stone, of a diameter of between 1 mm and 3 mm.

18.4.5 Timber

All timber used in the permanent works shall be well seasoned and free from bows or warps or significant knots.

18.4.6 Ferrous metalwork

Ferrous metalwork exposed to the outside shall be treated with a continuous coating of bituminous primer over the whole exposed area. Where the metalwork is of a decorative nature, it shall be primed and painted with paint suitable for external use.

18.4.7 Nut and bolts

- i. Bolt lengths shall be sufficient to ensure that nuts are full-threaded when tightened in their final position, with two threads showing.
- ii. Where bolting is incompatible with the material being fixed, suitable isolation washers and sleeves shall be used.
- iii. Washers shall be provided under the head of the bolt and under the nut.

18.4.8 Natural stone

Natural stone shall be of durable quality, uniform in texture, and free from iron bands, spots, sandholes, flaws, shakes and other imperfections which would adversely affect its strength or appearance. The dimensions of stones shall be adequate for proper coursing and bonding.

18.5 Excavation, Backfilling and Reinstatement

18.5.1 Excavation

- i. The Supplier shall carry out his operations in such a manner as to avoid damage to, or deterioration of, the formation of excavations.
- ii. The sides of excavations shall be adequately supported at all times.
- iii. The Supplier shall be responsible for the disposal off site of all surplus excavated material, but no excavated material suitable for re-use shall be removed from the site. No surplus material shall be disposed of on the site.
- iv. The Supplier shall not allow water to lie anywhere on the site. Where water is encountered in excavation operations, it shall be disposed of to a suitable area away from the works and so as not to inconvenience others. Any temporary sumps which are constructed for dewatering shall be backfilled at the end of operations, with material similar to that excavated

18.5.2 Trenches

- i. Trenches in rock for pipes up to 100 mm nominal bore shall be excavated to provide a minimum clearance of 100 mm around the outside of the pipe barrels and joints. For pipes with nominal bores exceeding 100 mm, the minimum clearance shall be 200 mm.
- ii. Trenches for pipes shall be excavated to a sufficient depth to ensure a minimum cover of 500 mm to the top of the pipes. For pipes carrying water under pressure, or for pipes laid with a water load above, this depth shall be increased to 900 mm.
- iii. Where trench excavations encounter obstructions in the ground conditions (eg hard rock or major tree roots), the obstruction shall be bypassed by a separate trench enabling a straight line, or minimum suitable radius, between the pipe source and destination locations. The original trench shall be backfilled in a similar manner to other excavations as per the specification below.

18.5.3 Backfilling

- i. Backfilling shall, where practicable, be undertaken immediately the specified operations preceding it have been completed. Backfilling shall not, however, be commenced until the works to be covered have achieved a strength sufficient to withstand all loading imposed thereon.

- ii. Backfilling shall be undertaken in such a manner as to avoid uneven loading or damage.
- iii. Filling material to the permanent works shall be of a granular type, without clay or siltatious material (a well assorted mixture of grain size between 2 mm and 40mm diameter), deposited in 300 mm layers and compacted at each layer.
- iv. Backfilling to a highway surface shall be compacted and completed such that the finished surface is of a level flush and comparable to the adjoining area, after any settlement has occurred. Where the surrounding surface is of a bituminous (tarmac) type, the backfilling shall be finished with similar.
- v. Where the excavations have been supported and the supports are to be removed, these, where practicable, shall be withdrawn progressively as backfilling proceeds, in such a manner as to minimise the danger of collapse, and all voids formed behind the supports shall be carefully filled and compacted.

18.5.4 Reinstatement

- i. Kerbs, channels and edgings disturbed by the works shall be re-laid with existing units, provided they are not damaged. Where existing units are not suitable for re-use, the Supplier shall provide replacement units of similar texture, colour, type and quality, consistent with those adjacent.
- ii. The frames of all manholes and surface boxes shall be reinstated by bedding and haunching in mortar as specified. Chamber or frame tops shall be flush with the existing surface on all sides.
- iii. On completion of work in unpaved land, the Supplier shall break up the surface of all land affected, to a depth of at least 300 mm, and clear stones and extraneous material greater than 50 mm in size before placing and raking topsoil of at least 300 mm in depth, to the finished surface level.
- iv. The utmost care shall be taken to protect trees, crops and significant shrubs in the vicinity of the site area. Any that are damaged or killed shall be replaced with a new plant, or plants, of a similar species and type, in the area of the original.
- v. Any existing services of pipes or cables shall be avoided if possible. Where temporary removal is required, the service shall be turned off, and an accurate location of the point or points of interception marked. The Supplier shall record these positions, depths, pipe and cable diameters and types of construction, and shall reinstate them to their previous standard, following construction of the new works. Backfill shall be to the standard specified above.
- vi. The Supplier shall ensure that all pipes, whether new or reinstated, shall be clear of debris upon completion of the works.
- vii. Embankments and other areas of fill shall be formed of suitable materials capable of normal compaction to form stable fill, deposited and compacted evenly as soon as practicable after excavation, in a maximum of 300 mm layers.

18.6 Concrete, formwork and reinforcement

18.6.1 Concrete

- i. The cementitious content of any concrete shall be between 350 kg/m³ and 400 kg/m³, with a maximum free water / cementitious content ratio of between 0.45 and 0.50. The mix and strength of such concrete shall not be inferior to M20.
- ii. Calcium chloride or admixtures containing calcium chloride shall not be used in the production of concrete.
- iii. The nominal size of concrete aggregate shall be from 6mm to 20 mm.
- iv. The Supplier shall not permit any cement to come into contact with water at a temperature above 60 degrees Celsius.
- v. The concrete shall be mixed only as and when required, to a uniform colour and consistency.
- vi. Workability of fresh concrete shall be such that the concrete can be handled and placed without segregation, and, after compaction, can completely fill the formwork and surround all reinforcement and ducts.
- vii. The quantity of water used shall not exceed that required to produce a concrete with appropriate workability to be placed and compacted in the required location. Water used in the concrete mix shall be fresh, clean and clear.

18.6.2 Formwork

- i. Formwork shall be sufficiently rigid and tight to prevent loss of mortar from the concrete and to maintain the correct position, shape and dimensions of the finished work. It shall be so constructed as to be removable from the cast concrete without shock or damage.
- ii. The forms shall be capable of producing a consistent quality of surface.
- iii. Where holes are required in forms to accommodate projecting reinforcement fixing devices or other built-in items, precautions shall be taken to prevent loss of mortar matrix.
- iv. Formwork shall give access for the preparation of joint surfaces before the concrete has hardened.
- v. Top formwork shall be provided to slopes 30 degrees or more from the horizontal.
- vi. The Supplier's method of constructing formwork shall allow for props to soffit forms to remain in position until the formwork is struck.
- vii. Formwork shall be removed without shock to, or disturbance of, the concrete.
- viii. Formwork to vertical or sloping surfaces shall not be removed until the concrete strength shall be sufficient to meet any wind loading upon the concrete likely to arise at the time when the formwork is removed. This shall be a period of least 2 days.
- ix. The formwork for elevated slabs and beams shall remain in place for a minimum of 7 days.
- x. All concrete surfaces shall have a fair finish, formed by formwork which is designed to produce a hard smooth surface with true, clean rises. Only minor surface blemishes shall be permitted and there shall be no staining or discolouration. Any projections shall be removed and the surfaces made good. For finishes to surfaces not formed by formwork, the concrete shall be levelled and screeded with a wooden trowel, following which a fair finish shall be formed with firm pressure from a steel trowel, to produce a dense, smooth, uniform surface free from trowel marks.
- xi. If any blemishes to the finished surface appear, they shall be made good with fresh, specially prepared cement and fine aggregate paste, whilst the concrete is still green where possible. After the concrete has been properly cured the faces shall be rubbed down to produce a smooth and even surface, making every effort possible to match the colour of the concrete.

18.6.3 Reinforcement and other built-in items

- i. Reinforcement and other built in items (such as pipes and sleeves) shall be firmly supported in position and of sufficient strength to secure against displacement during the concrete pour.
- ii. Non-structural connections for the positioning of reinforcement and other built in items shall be made with tying wire or other fixing device. Precautions shall be made to ensure that projecting end of tying wire or other fixing device or clips do not encroach into the concrete cover.
- iii. All reinforcement and other built items shall be clean and free of rust or other debris bonding.
- iv. Reinforcement shall be of HYSD/TMT variety manufactured by SAIL or its subsidiaries. Cover to all reinforcement shall be 50 mm.
- v. Tie bolts for formwork shall be of the high tensile variety and shall be cast directly into the concrete. Only tie bolts which avoid embedding any metal parts permanently within 50 mm of the concrete surface shall be permitted. Voids remaining after the removal of all, or part of each tie bolt shall be filled flush with the surrounding concrete using a freshly prepared cement and fine aggregate paste. All such voids shall be prepared by removing surface laitance prior to filling to ensure bond is achieved.

18.6.4 Placing of concrete

- i. The interiors of all formwork shall be thoroughly cleaned out before any concrete is placed. The faces of the forms in contact with the concrete shall be clean and treated with a suitable releasing agent, where possible.
- ii. Each batch of concrete shall be continuously and thoroughly compacted in its final position within 20 minutes of mixing. Sufficient compaction shall take place until the expulsion of air has virtually ceased, and in a manner which does not promote segregation of the ingredients, in order to avoid surface blemishes.
- iii. Concrete to each discrete section shall be placed in one pour, or in a continuous fashion such that fresh concrete shall not adjoin concrete which has been in place for more than 30 minutes. If this does occur,

- concreting to this section shall be stopped until the placed concrete has set, but not hardened, and a construction joint shall be formed.
- iv. The surface of any set concrete against which new concrete is to be cast, otherwise known as a construction joint, shall be free from water or loose debris and shall be roughened to the extent that the large aggregate is exposed but not disturbed. The joint surface shall be cleaned immediately before the fresh concrete is placed against it.
 - v. All measures shall be taken to keep the temperature of fresh concrete below 32 degrees Celsius, and to prevent excessive evaporation of surface water. This shall include placing, and constantly keeping moist with cold water, hessian (or similar coarse weave natural material) and spraying the surface with curing agents to aid temperature escape, as soon after the formwork had been removed as possible.
 - vi. Where a kicker is used, it shall be at least 70 mm high and shall be incorporated with the previous concrete.
 - vii. Concrete shall not be allowed to taper off to a thickness of less than 50 mm. Vertical joints shall be formed against a stop board suitably notched to accommodate the reinforcement. The top surface of each lift of concrete shall be straight and level, unless described otherwise in the contract.

18.6.5 Tolerance for concrete structures

Concrete structures in the final work shall have no abrupt irregularities which are, to an extent, observable by eye. Subject to retaining the required concrete cover to reinforcement, other deviations from the surfaces described in the contract shall not deviate from line, level, vertically, cross sectional dimension or length by more than 10 mm.

18.7 Construction of pipe work

The cable runs along the ground for connecting the sensors to the DCU shall be made through the pipes of HDPE. The material and manufacturing quality of the pipes shall be as per relevant Indian Standards.

18.7.1 General

- i. Suitable measures shall be taken to prevent extraneous material from entering pipes, and to anchor each pipe to prevent flotation or other movement before the Works are complete
- ii. Pipeline marker tape shall be laid between 100 mm and 300 mm above the pipe.

18.7.2 Pipe bedding and covering

- i. In case of laying pipes for carrying the air tubing for the bubbler gauge, care should be taken to embed the pipe at a depth below the general profile of the river bank slope such that the same shall not be exposed on account of rainfall/ drainage induced gully erosion in the monsoons. Such depths shall be determined by the site in charge and the representative of the contractor.
- ii. For making horizontal runs of embedded pipes, crossing open ground and/ or walk ways frequented by traffic or cattle, a layer of warning bricks shall be laid over the pipe before filling up the trench.
- iii. Bedding for pipes shall be constructed by spreading and compacting granular bedding material of at least 100 mm thick over the full width of the pipe trench. After the pipes have been laid, additional material shall be placed and compacted equally on each side of the pipe. Where practicable, this shall be done in sequence with the removal of the trench supports.
- iv. Bedding, haunching and fill material to pipe or cabling work shall be of a granular type, without clay or silty material (a well assorted mixture of grain size between 2 mm and 40 mm diameter).
- v. After completion of the relevant operations, fill material shall be placed and compacted over the full width of the trench in layers not exceeding 150 mm before compaction, to a finished thickness of 250 mm above the crown of the pipes. Thereafter, layers shall be filled and compacted in 300 mm thicknesses, to 300 mm from the surrounding ground surface level. Topsoil shall then be placed to a level flush with the surrounding ground surface.

18.7.3 Pipe jointing

- i. Pipe jointing surfaces and components shall be kept clean and free from extraneous matter until the joints have been made or assembled. Care shall be taken to ensure that there is no ingress of grout or other extraneous material into the joint annulus after the joint has been made.
- ii. Where pipes with flexible joints are required to be laid to curves, the deflection at any joint as laid shall not exceed three quarters of the maximum deflection recommended by the manufacturer.
- iii. Fusion welding joints in high density and medium density polythene shall be made only between pipes having the same physical characteristics. No fusion joints between pipes from dissimilar materials shall be made. When solvent welding HDPE pipes are jointed outside the trench, they shall not be lowered into place until the period recommended by the manufacturer for complete setting of the joints has elapsed. A pipe section containing a completed weld shall achieve the same strength characteristics as the parent pipe.
- iv. Flanged joints shall be properly aligned before any bolts are tightened.
- v. For weld jointing of steel pipes, the ends of the pipes shall be cut and prepared, and be free from fins, planar defects, tears and other surface defects, prior to welding. Cleaning to base metal shall extend for at least 25 mm from the end of the pipe on both internal and external faces.
- vi. For cement mortar joints, the spigot of the pipe shall be entered into the socket of the last pipe laid until it bears on the back face of the socket, and it shall be centered in the socket. Two turns of tarred yarn shall then be caulked into the back of the socket and cement mortar shall be pressed into the joint to fill the socket and shall be bevelled off at 45 degrees from the outside edge of the socket.

18.7.4 Pipe protection

- i. Where concrete surrounds are provided to pipes, they shall be supported on precast setting blocks, the top face of each block being covered with two layers of compressible packing.
- ii. Where pipes with flexible joints are used, any concrete protection shall be interrupted over its full cross section of each pipe by a shaped compressible filler.
- iii. Plastic pipes shall be wrapped with a layer of plastic sheeting before being surrounded by any concrete.
- iv. Ferrous pipes shall be protected by a continuous coating of bitumen primer over the whole area to be protected.

18.7.5 Pipe cutting

Pipes shall be cut by a method which provides a clean, square profile, without splitting or fracturing the pipe wall, and which causes minimal damage to any protective coating.

18.8 Manholes

Manholes shall be constructed with steps, ladders or slabs aligned correctly, and of sufficient size to permit unrestricted access to workers.

19.0 TRAINING AND DOCUMENTATION

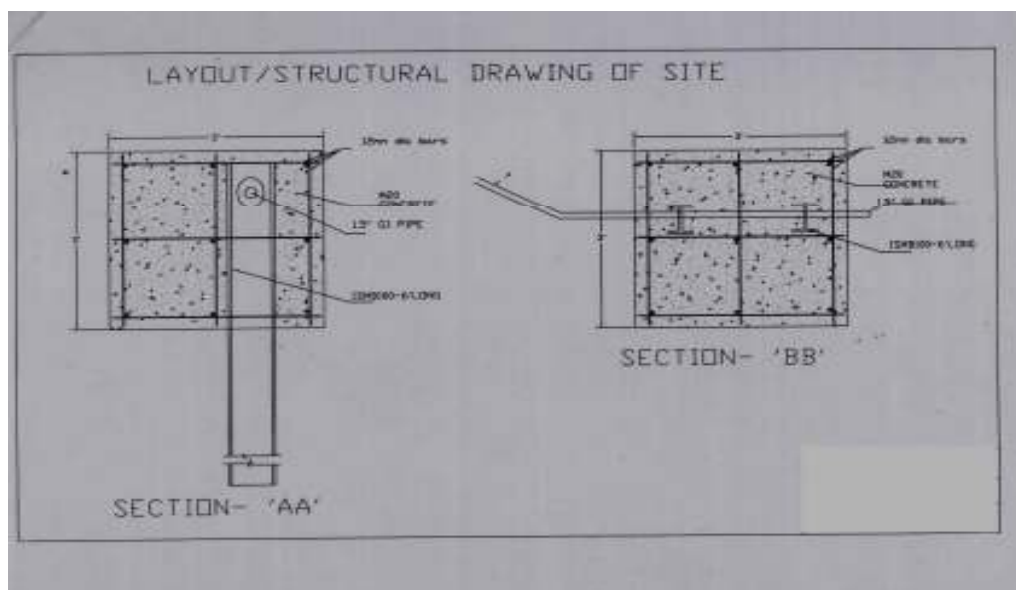
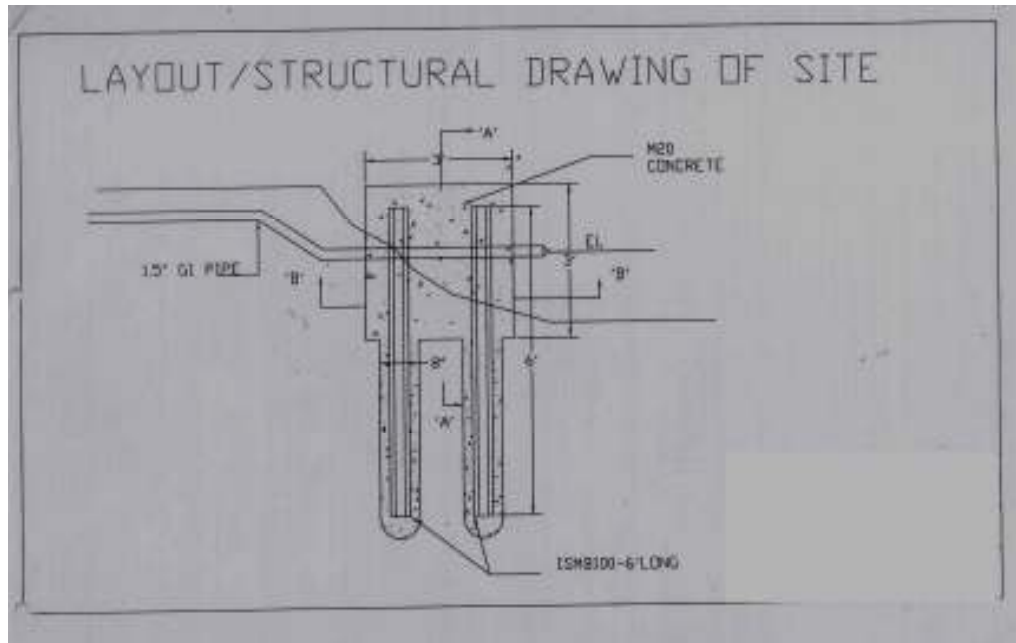
The contractor shall provide trainings as training modules as part of the tender given as under:

Training module for all remote stations:

S.No	Module Name	Target Group	Duration in days
1	Remote Station Management and Maintenance	All W/C staff located at Remote Stations	3
2	Trouble shooting of sensors at Site	JEs	3
3	Management of DCU through Laptop and Calibration of sensors	EE /SDE/JE	3

All aspects of the electrical, instrumentation and telemetry equipment being supplied shall be covered in the courses and full documentation shall be provided. The documentation and kits shall be got approved from purchaser in advance. The course shall provide detail documentation and shall ensure that the Purchasers personnel shall be able to modify settings/parameters without reference back to the Supplier. The places / sites where this training is to be given will be decided later by the Purchaser.

20.0 DRAWINGS OF TERMINATION BLOCK



21.0 DRAWINGS OF TRIPOD (MAST)

